



George Latimer, Westchester County Executive

General Requirements and Proposals
Information for Bidders
General and Special Clauses
Technical Specifications

PUMPING STATION REHABILITATION
CROTONVILLE PUMPING STATION
OSSINING SANITARY SEWER DISTRICT
OSSINING, NEW YORK

Contract No. 17-529

Bid Opening: October 27, 2021

By Bidder (Please Print) Firm/Business Name: _____ Address: _____ _____	For Official Use Only _____ _____
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DEPARTMENT OF PUBLIC WORKS AND TRANSPORTATION
Division of Engineering

SPECIAL NOTICE

County of Westchester
New York

ADDENDA TO THE BID DOCUMENTS

Addenda to the Bid Documents will be published on the Empire State Purchasing Group website at (<http://www.bidnetdirect.com/new-york>) **It is the responsibility of each potential bidder to check the website on a regular basis for further information relative to the bid documents including information relating to any and all addenda** prior to submitting its bid. All Bidders are deemed to have reviewed and considered all addendums in their Bid.

SUBMISSION OF BIDS

Bidders should not submit the entire bid document with its bid submission. Instead, each bidder is required to submit the full set of designated Proposal Pages. The Proposal Pages are denoted by a border and are titled on the bottom as “Proposal Page ____”. The Proposal Pages must be accompanied by the “Bid Bond and Consent of Surety” (as set forth in the Proposal Pages) attached to the outside of the sealed bid. A Bid Bond is NOT required for contracts of \$100,000 or less. Failure to submit in this manner may cause the bid to be rejected.

The successful bidder will be required to furnish a Performance and Payment Bond.

SPECIAL NOTICE

County of Westchester
New York

**NOTICE: DUE TO THE COVID-19 PANDEMIC, TO PARTICIPATE IN THE
MANDATORY PRE-BID SITE INSPECTION YOU ARE REQUIRED TO:**

- 1. Be familiar with the attached Department of Environmental Facilities notice to Contractors and Site Visitors regarding COVID-19 PPE Protocol and Zero Tolerance dated April 7, 2020.**
- 2. Maintain a minimum distance of 6-feet between yourself and other people while at the facility**
- 3. Bring and wear a protective mask covering both the nose and mouth at all times while at the location.**
- 4. Note that, for the purpose of this site visit, gloves and protective eye-wear are optional.**

MANDATORY PRE-BID SITE INSPECTION

- A. Superseding the first paragraph of Article “3. PRE-BID SITE INSPECTION” of the Information for Bidders, Bidders are required to attend a Mandatory Pre-Bid Site Inspection at **10:00 a.m. Tuesday, October 5, 2021 at the 100 Croton River Road, Ossining, New York**, at which time they will examine the work site under escort by the County’s representative’

**BIDS FROM CONTRACTORS NOT IN ATTENDANCE AT THIS MEETING, OR
THOSE WHO FAIL TO SIGN THE ATTENDANCE SHEET-WILL BE *REJECTED***

- B. Bidders shall indicate their interest in the Mandatory Pre-Bid Site Inspection by contacting John Coelho, Department of Public Works and Transportation, Division of Engineering at (914) 995-5144.
- C. All other portions of Article “3. PRE-BID SITE INSPECTION” of the Information for Bidders shall remain in full force and effect.



Department Memorandum
Department of Environmental Facilities

Date: April 7, 2020

To: Westchester County DEF Contractors and Site Visitors

From: Nat J. Federici, P.E.
Deputy Commissioner

Re: COVID-19 PPE Protocol and Zero Tolerance

First and foremost, on behalf of the Department I would like to thank everyone for the work that you all do and the part that you play in helping the Department maintain continuous wastewater collection and treatment services to Westchester County and its nearly one million residents. Wastewater collection and treatment are deemed essential public health services. Equally as important during this time is to ensure the health and safety of our employees and on-site consultants, contractors, sub-contractors, and suppliers.

As a result, the following protocol are being established and enforced in order to address the current state of emergency due to the COVID-19 pandemic at all of our Wastewater Collection and Treatment Facilities.

- All non-County employees working at a DEF site, should be confined to their designated work area and use separate personnel, dining, and restroom facilities, wherever possible.
- All non-County employers and their personnel working on-site at a DEF facility should follow all recommended CDC practices and guidelines to prevent exposure and/or spread of the Corona-virus. These include using engineering and administrative controls, safe work practices, and personal protective equipment (PPE) normally required for work tasks at all DEF facilities. The required minimum PPE includes: protective masks covering both the nose and mouth; disposable, single use latex or similar material gloves; and protective eye-ware. **The required PPE will be strictly enforced with zero tolerance going forward.**
- All non-County employees working at a DEF site, should maintain safe work distancing and a minimum of six feet of separation at all other times when on-site.

Anyone not adhering to the protocol listed above will be asked to leave the facility and not return; zero tolerance and no exceptions.

In addition, for the duration of the COVID-19 Pandemic Emergency, we request that all contractors limit their permanent employees to working only on one site, to the extent possible, as this will also minimize the potential for cross-contaminating personnel across different sites. Any employer that has an employee or sub-contractor that has tested positive for the COVID-19 virus must notify the DEF Facility Superintendent of the positive test, without specifically identifying the employee's name, but notifying the Superintendent of the positive tested employee's day(s) and location worked. Lastly, all Contractors working on-site should amend their Health and Safety Plan (HASP) to include the COVID-19 Pandemic Protocol.

While the change and disruption is reflected in every aspect of our lives, we remain confident and determined that we will come out through this together and stronger than we were before this unprecedented crisis. As stated before, **the health and safety of all employees working at all of our Facilities is paramount**, and maintaining the safest work environment by implementing the protocol included above is the most effective way to ensure that all workers remain safe, while working at any and each DEF Facility.

NJF/njf

cc: Vincent F. Kopicki
Erin O'Shea
Anthony Della Valle
Jagdish Mistry
Joseph Gibney
Michael Facelle
Jeffrey Bryant
Warren Pierce
John Lennon
Dave Ciuffreda
Ed Pellegrino
Catherine D'Onofrio

SPECIAL NOTICE

County of Westchester
New York

MINORITY PARTICIPATION POLICY

Contractors must comply with the County's Minority Participation Policy, including, but not limited to, the requirement that contractors make a demonstrated good faith effort to utilize Minority Owned Businesses ("MOB") and Women Owned Businesses ("WOB") (see IFB Article 36). To assist contractors in this effort the County has made available a list of MOB and WOB at <http://mwbe.westchestergov.com/> Contractors are also encouraged to utilize other sources to identify potential MOB and WOB as subcontractors and suppliers.

All bidders must submit as part of their bid package the Minority/Women Owned Business Enterprise Questionnaire located in the Proposal Page section of the bid documents.

SPECIAL NOTICE

County of Westchester
New York

CHANGES IN THE WICKS LAW

Effective July 1, 2008, construction contracts of one million five hundred thousand dollars or less will not require the preparation of separate contracts for plumbing and gas fitting; steam heating, hot water heating, ventilation and air conditioning apparatus; and electric wiring and standard illuminating fixtures and general construction.

Each bidder on a public work contract, where the preparation of separate contracts is not required shall, to the full extent applicable, submit with its bid a separate sealed list that names each Subcontractor that the bidder will use to perform work on the contract and the agreed upon price to be paid to each for (a) plumbing and gas fitting, (b) steam heating, hot water heating, ventilating and air conditioning apparatus and (c) electric wiring and standard illuminating fixtures and (d) general construction. The submission (Proposal Page 6) that contains the agreed upon price shall be acknowledged by both Contractor and Subcontractor. For purposes of this paragraph, the acknowledgment from the Subcontractor may contain the facsimile signature of an officer of the Subcontractor.

After the low bid is announced, the sealed list of subcontractors submitted with the bid shall be opened and the names of such subcontractors shall be announced. Thereafter, any changes of subcontractors or agreed-upon amount to be paid to each shall require the approval of the County upon a showing of legitimate construction need for such change.

The Successful low bidder, before award of the contract, must procure and provide to the County, from each of the above denoted Subcontractors, a Contract Disclosure Statement and the Required Disclosure of Relationships to County forms.

The sealed lists of Subcontractors submitted by unsuccessful bidders shall be destroyed after the contract award.

THIS PROJECT IS NOT SUBJECT TO THE REQUIREMENTS OF THE “WICKS LAW”. ACCORDINGLY, EACH BIDDER IS REQUIRED TO SUBMIT SPECIFIC INFORMATION PERTAINING TO ITS PROPOSED SUBCONTRACTORS. PLEASE SEE THE “NOTICE TO CONTRACTORS” THAT FORMS A PART OF THESE BID DOCUMENTS.

SPECIAL NOTICE

County of Westchester
New York

COMPLETION OF GRANT FUNDING FORMS

The bidders are hereby notified that if this project, or any portion thereof, is funded by a grant then the contractor will be responsible to complete all appropriate forms as required by the grant agency in order to complete the application.

PROMPT EXECUTION AND RETURN OF CONTRACT

- A. The successful bidder is required to return the completed contract to the County within ten (10) days of receipt of the execution copy of the contract. The contract must be signed, notarized and returned to the County with all insurance certificates, bonds and supporting documentation, including all required Subcontractor information.
- B. The County reserves all of its rights, including, but not limited to, proceeding against the bid bond, if the successful bidder fails to submit the complete executed package within the above time frame.

SPECIAL NOTICE

County of
Westchester New
York

MANDATORY OSHA CERTIFICATION

When a public works contract is in excess of \$250,000.00, all employees are required to have successfully completed the OSHA 10 hours training class. All contractors and subcontractors must attach copies of proof of completion of the OSHA 10 hour course by all employees to the first certified payroll submitted to the County and on each succeeding payroll where any new or additional employee is first listed. Employees may be requested by the County's representative to verify compliance with the OSHA 10 hour course by showing their OSHA card.

When a public works contract is in excess of \$1,000,000.00, all employees are required to have successfully completed the OSHA 30 hours training class. All contractors and subcontractors must attach copies of proof of completion of the OSHA 30 hour course by all employees to the first certified payroll submitted to the County and on each succeeding payroll where any new or additional employee is first listed. Employees may be requested by the County's representative to verify compliance with the OSHA 30 hour course by showing their OSHA card.

In addition, on any contract that includes excavation of underground facilities, the excavator is required to be certified and have completed the training and education program provided by the one-call notification system (Dig Safely New York, Inc. Certified Excavator Program in Safe Digging Best Practices) or any other provider authorized by the public service commission to administer such training and education program.

SPECIAL NOTICE

County of Westchester
New York

BUILDERS RISK INSURANCE

In addition to the insurance requirements listed in Section 2 of the Information for Bidders, the Contractor, at their own cost and expense, shall provide and maintain a **Builder's Risk Form, All Risk Insurance Contract**. The coverage shall be written for **100% of the completed value**, with the County of Westchester named as loss payee as its interest may appear. In formulating its proposal, the Contractor shall include the costs for this coverage. In the event that claims, for which the County may be liable, in excess of the insured amounts provided herein are filed by reason of Contractor's negligent acts or omissions under the Agreement or by virtue of the provisions of the labor law or other statute or any other reason, the amount of excess of such claims or any portion thereof, may be withheld from payment due or to become due the Contractor until such time as the Contractor shall furnish such additional security covering such claims in form satisfactory to the County of Westchester.

SPECIAL NOTICE

County of Westchester
New York

PROJECT LABOR AGREEMENT (PLA)

- A. The County of Westchester has determined that a Project Labor Agreement will be used on this Project. The successful bidder will be required as a condition of this Contract to execute the PLA with the Building and Construction Trades Council of Westchester and Putnam Counties, New York, AFL-CIO ("Council"). The PLA will be substantially in the same form as the PLA included in this contract specification book. Bidders are urged to familiarize themselves with the terms and conditions of the PLA.
- B. It should be noted that Schedule A of the PLA contains a list of the local unions affiliated with the Council. Copies of the applicable Collective Bargaining Agreements of the local unions can be obtained by writing to the Building and Construction Trades Council of Westchester and Putnam Counties, New York, AFL-CIO at 258 Saw Mill River Road, Elmsford, New York 10523, Attn.: Carol A. Boccardi.

SPECIAL NOTICE

County of Westchester
New York

**PROOF OF PAYMENT BY CONTRACTOR TO SUBCONTRACTORS
AND MATERIALMEN.**

In addition to and without limiting any of the provisions set forth in Section 23 of the Information for Bidders, after the Contractor completes 50% of the work under the contract, the Contractor shall supplement each requisition submitted to the County with documentation that establishes that the Contractor has timely and properly paid its subcontractors and materialmen as required by Section 23 of the Information For Bidders. Such documentation shall include copies of both sides of cancelled check(s) paid to the order of the subcontractors and materialmen and such other documentation as may be reasonably requested by the Commissioner. If the Contractor fails to submit such documentation, the Commissioner may, in his sole discretion, withhold payment of the requisition until such time as the documentation is properly submitted. Nothing herein is intended or shall be construed to confer upon or give any subcontractor or materialman, or its successors and assigns, any third party beneficiary rights, remedies or basis for reliance upon, under or by reason of the contract or this Special Notice provision.

SPECIAL NOTICE

County of Westchester
New York

PREVAILING WAGE

All public works contracts are subject to the payment of the prevailing wage and supplements as set forth by the laws of the State of New York, including, but not limited to, Articles 8 and 9 of the New York Labor Law (the “Prevailing Wage Laws”). Westchester County has an active Prevailing Wage Enforcement Officer who enforces the Prevailing Wage Laws within the County for public works contracts, including reviewing certified payroll records, visiting job sites, interviewing the employer and employees (See IFB Article 12) and, if necessary, requesting copies of cancelled checks.

Any Contractor who fails to comply with the Prevailing Wage Laws, including, but not limited to, failing to pay the prevailing wage rates and supplements, failing to submit certified payroll records to the County or failing to post the prevailing wage rates and supplements at the work site, will be subject to enforcement as provided for in the Contract and laws of the State of New York through the Westchester County District Attorney’s office, the Commissioner of the New York State Department of Labor, the County and/or the employee who suffered the underpayment. This enforcement could include, but is not limited to, criminal penalties, civil penalties, debarment from future bid awards, the withholding of payment under the Contract to satisfy the unpaid wages and supplements, including interest and civil penalty. In addition, such a failure shall constitute grounds for cancellation of the Contract (IFB 8(C)). Moreover, a prime contractor is responsible for its subcontractor’s failure to comply with, or evasion of, the provisions of the Prevailing Wage Laws.

CONTRACTOR SPECIAL NOTICE

Department of Environmental Facilities
Environmental Management System Requirements

General

The Contractor is responsible for complying and ensuring that all the Contractor's subcontractors comply with all federal, state, and local environmental and health and safety legal requirements.

The Contractor recognizes that the Department of Environmental Facilities (DEF) has an Environmental Management System (EnvMS) that includes DEF's Wastewater Treatment Plants (WWTPs), Solid Waste facilities, water treatment facilities, and related facilities and shall conform to and ensure the conformance of all of the Contractor's subcontractors (subcontractors) to the DEF Environmental Policy (Policy), all EnvMS associated procedures and protocols, and the requirements of this Special Notice. This includes the requirement to participate in the corrective action process, including attendance at meetings should activities in which the Contractor is involved result in a deviation from the Policy or the requirements of the EnvMS. Depending on the seriousness of the deviation, this may include participation in full root cause analysis.

Training

Prior to performing work the project superintendent, project manager and all responsible foremen for the Contractor and subcontractors shall attend a required 45-minute training session on EnvMS requirements provided by DEF Personnel. The Contractor shall ensure the attendance of these staff. The training may occur at the facility or at another location. The Contractor shall ensure that a minimum of one person who has participated in the EnvMS training is available on-site at all times that the Contractor's personnel or subcontractors are on-site.

The Contractor shall ensure that all employees and subcontractor employees working at any DEF facility are trained on the requirements of the EnvMS relevant to their work and shall keep records of training on site. The initial training for superintendents, project managers and foremen may be video taped by the Contractor for subsequent training of all Contractor's employees and subcontractor employees.

Records of training shall be kept by the contractor and made available to DEF, upon request.

Competency

The Contractor shall ensure employees and subcontractors are capable, based on training, education, licensing, and/or experience, to perform tasks that can impact the

CONTRACT NO. 17-529

environment. The Contractor shall maintain records of competency and make these records available to DEF upon request.

Project Coordination

The Contractor shall designate a staff member who will be responsible for the oversight of EnvMS project requirements and to work as a liaison with the plant Superintendent or facility operator. This person, or their properly qualified designee, must be available anytime the Contractor's personnel or subcontractors are on-site performing work.

Working Environment

In addition to the hazards typically found on construction and industrial sites, the following specific hazards are present at the WWTPs and water treatment facilities.

Hazards	Yonkers	Port Chester	Peekskill	Ossining	New Rochelle	Mamaroneck	Blind Brook	Shaft 22	Kensico Dam	Gate of Heaven
Digester Gas (consists mostly of methane – the primary component of natural gas)	X		X							
Natural Gas	X	X		X	X					
Propane		X	X		X					
Oxygen					X					
Class 1, Division 1 Explosion Proof Areas	X	X	X	X	X	X	X			
Confined Spaces	X	X	X	X	X	X	X			
Chemical Storage/Hazardous Materials	X	X	X	X	X	X	X	X	X	X
Hydrogen Sulfide	X	X	X	X	X	X	X			
High Pressure Lines	X	X	X	X	X	X	X			
Open Tanks / Drowning Hazards	X	X	X	X	X	X	X			
Ladders, Platforms & Slippery Surfaces	X	X	X	X	X	X	X	X	X	X
High Voltage Electrical Systems	X	X	X	X	X	X	X			
Potential Exposure to Blood Borne Pathogens	X	X	X	X	X	X	X			
Automatic Equipment	X	X	X	X	X	X	X			
Chlorine Gas								X		

CONTRACT NO. 17-529

Other DEF facilities (transfer stations, pump stations) may have these same or similar hazards.

The Contractor and subcontractors shall plan work appropriately for this environment and the specific location(s) where work is anticipated and implement the necessary health and safety precautions including, but not limited to, the use of proper equipment, including non-sparking tools, proper personal protective equipment (PPE) and monitoring equipment, and compliance with contractor Confined Space Entry and Lock-out / Tag-out programs.

Health and Safety Plan

The contractor shall develop a health and safety plan (plan) specific to the facility and the work planned and shall ensure that all work is performed in conformance with the plan. The contractor shall ensure that the plan addresses all relevant hazards including, but not limited to, the aforementioned hazards. The plan must be kept on site at the facility when work is being performed and must be made available to DEF personnel upon request.

Health and Safety Compliance Monitoring

An expert provided by the Contractor will monitor the Contractor and subcontractor compliance with all applicable health and safety regulations and the health and safety plan on an ongoing basis while the Contractor and subcontractors are performing work at any DEF facility. Monitoring shall be performed in accordance with the health and safety requirements in the project specifications. The Contractor shall ensure that all employees and subcontractors cooperate with the expert. The expert will document results of the monitoring and provide the results to the Contractor on an ongoing basis. The Contractor shall correct all health and safety non-compliances identified by the independent expert in a timely fashion. The monitoring results and any corrective actions taken shall be provided to DEF's representative on site.

Plant Equipment and Control of Hazardous Energy

All DEF sites are working facilities that must function at all times so as to meet regulatory obligations. The Contractor shall receive prior authorization from the WWTP Superintendent, the Supervisor of Operations, Chief Operator (water districts) facility manager (solid waste) if any planned activities of the Contractor or Contractor's subcontractor could interfere with the operation of the DEF facility, involve the use of plant or facility equipment, or require taking plant or facility equipment on or off line. The contractor shall not proceed without expressed authorization by same. DEF reserves the right to rescind authorization for the Contractor to use, work on, or otherwise render inoperable, any piece of equipment if needed for the operation of the plant or facility.

CONTRACT NO. 17-529

The Contractor shall be responsible for ensuring control of hazardous energy (lock-out/tag-out) for all contractor and subcontractor activities. Contractor shall coordinate taking plant equipment off line and putting it back on line with the Plant Superintendent or the Supervisor of Operations, Chief Operator (water districts) or facility manager (solid waste). Only authorized DEF personnel shall take plant equipment off line or place it back on line. Plant equipment includes, but is not limited to, all gates, valves, pumps, electrical panels, solid waste facilities, water and wastewater treatment, and associated equipment.

Odor Notification

The Contractor shall notify the WWTP Superintendent, Supervisor of Operations, Chief Operator (water districts) facility manager (solid waste) or ISO Coordinator 24 hrs prior to the initiation of activities that have the potential to cause odors in excess of those associated with normal operations.

Odor Control

The Contractor and subcontractors shall comply with all EnvMS odor control requirements. WWTP doors must be kept closed at all times except for entry or exit of personnel and equipment. Open periods shall be minimized to the greatest extent possible. Doors shall not be propped open or held open without the expressed approval of the WWTP Superintendent or the Supervisor of Operations.

For activities with the potential to cause odors in excess of those associated with normal operations, the contractor shall plan and implement appropriate odor abatement controls.

Demolition

Contractor shall implement a methodology to tag or mark all equipment and piping prior to demolition. All contractor and subcontractor employees responsible for demolition activities shall be trained on the methodology. Prior to demolition, marked or tagged equipment scheduled for demolition shall be reviewed with DEF's representative on site.

Stormwater Management, Soil Erosion and Sediment Control Activities

The Contractor shall comply strictly with all Soil Erosion and Sediment Control project specifications; stormwater permit requirements, if a permit is required; and regulatory requirements including the ***New York Standards and Specifications for Erosion and Sediment Control and the County of Westchester Best Management Practices for Reducing Nitrogen and Other Stormwater Pollutants.***

Soil Erosion and Sediment Controls shall include, but are not limited to, the following:

- Proper installation and use of erosion and sediment capture devices, i.e. silt fences and hay bales
- Protection of storm drain inlets
- Proper and timely backfilling and stabilization of trench excavation
- Inspections of discharge points
- Proper maintenance of erosion and sediment capture devices
- Regular inspections of controls by qualified Contractor staff
- Use of phosphorus containing fertilizers only in conformance with County requirements.

The Contractor shall be subject to Erosion and Sediment Control Inspections by DEF personnel.

Spills Prevention, Control and Response Procedures

Contractor and subcontractors shall have written spill response procedures that conform to DEF requirements. The Contractor's and subcontractors' supervisory personnel will be trained in the facility's Spill Prevention, Control and Response Procedures Requirements during the 45-minute EnvMS training session. Contractors and subcontractors shall ensure that these requirements are complied with and that their on-site employees are properly trained in spill prevention, control and response, and conformance with their spill response procedures. Contractor and subcontractors shall have a copy of these procedures available on site. The Contractor shall have appropriate spill clean-up equipment on site at all times.

In the event of a spill, the Contractor and subcontractors shall immediately respond to the spill in conformance with their spill procedures and as soon as possible report the spill to the main office.

The Contractor is responsible for proper clean-up and disposal of waste materials generated by any spill resulting from their activities.

Vehicle and Equipment Control

The Contractor and subcontractors shall ensure all vehicles and equipment are properly maintained and free of leaks. Contractor and subcontractors shall not perform fueling or maintenance of vehicles and equipment onsite without the expressed approval of the WWTP Superintendent or Supervisor of Operations, Chief Operator (water districts), or facility manager (solid waste). Contractor and subcontractors shall ensure vehicles comply with Westchester County idling restrictions and do not idle unnecessarily. The Contractor and subcontractors shall ensure all fuel used is ultra low sulfur in content.

CONTRACT NO. 17-529

Good Housekeeping/Chemicals, Petroleum and Hazardous Materials Management

The Contractor and subcontractors shall demonstrate good housekeeping practices and perform daily site clean-ups at the work site. The work site shall be subject to inspections by DEF Personnel.

The Contractor and subcontractors shall properly store and use all petroleum, chemicals and hazardous materials. This shall include but is not limited to use of proper secondary containment and protection from precipitation. Storage locations shall be pre-approved by the WWTP Superintendent, Supervisor of Operations, Chief Operator (water districts) or facility manager (solid waste) or ISO Coordinator.

The Contractor shall provide all Material Safety Data Sheets (MSDS) for all petroleum, chemicals and hazardous materials used at the work site to DEF prior to bringing same on site and shall maintain all MSDS on site. DEF reserves the right to forbid any material from being brought on site.

At the completion of work, the Contractor shall remove any staged materials, petroleum, chemicals, and hazardous materials remaining from the project, whether a result of contractor or subcontractor activities. Staged materials, petroleum, chemicals, and hazardous materials may remain with the expressed written approval of the WWTP Superintendent or Supervisor of Operations, Chief operator (water districts) facility manager (solid waste).

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Waste Management and Minimization

The Contractor and subcontractors shall dispose of waste in a manner that meets all applicable laws and regulations including Westchester County Source Separation Law (Chapter 825). Contractors shall make every effort to minimize waste production during construction operations. Contractors and subcontractors shall not bring waste onsite and may not dispose of waste onsite or in DEF receptacles without the expressed approval of DEF

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Mercury Containing Devices

The Contractor shall ensure no mercury containing devices are installed. Any mercury devices removed by the Contractor or subcontractors shall be disposed of legally by the Contractor and records of disposal shall be provided to the facility.

Energy Efficiency and Environmentally Preferable Products

With the exception of exterior lighting and historic lighting at the South Yonkers CSO and the Mamaroneck WWTP, the Contractor shall ensure incandescent bulbs are not installed or used.

CONTRACT NO. 17-529

The contractor shall:

- select energy star equipment or equipment within the upper 25 percent of energy efficiency as designated by the United States Federal Energy Management Program
- select environmentally preferable products
- utilize environmentally preferable cleaning products

if the prices of the equipment and products are reasonably competitive and the quality is adequate for the purpose intended.

The contractor shall ensure Styrofoam products are not utilized and shall request non-Styrofoam packaging for equipment and products.

Landscaping

When selecting plantings, the Contractor shall ensure plantings native to Westchester County are utilized. If no native species are appropriate, the Contractor shall ensure the planting of noninvasive species.

Pesticide Ban

The Contractor shall ensure pesticides that are banned under Westchester County Law (Chapter 690) are not utilized at the work site.

Change to Environmental Project Design Specification

The Contractor shall receive approval from an authorized County representative prior to making any modifications that affect environmental project specifications due to field conditions.

Third Party Audit

The EnvMS is certified to ISO 14001. The certification requires that a yearly third party audit be performed. The Contractor shall ensure that all employees cooperate with the third party auditor, answer questions put to them by the auditor, and make records required as part of this special notice available to the auditor, as requested.



**WESTCHESTER COUNTY
DEPARTMENT OF ENVIRONMENTAL FACILITIES**

ENVIRONMENTAL POLICY

It is the mission of the Westchester County Department of Environmental Facilities to protect, preserve and conserve the water supply and quality of watercourses within or on the borders of Westchester County; to provide proper solid waste stream reduction and recycling; and to protect the health, safety and welfare of the public. The Department is responsible for planning, operating and maintaining: water resource recovery facilities, sanitary collection systems, drinking water treatment and distribution facilities, and solid waste facilities in compliance with local, state and federal laws.

To achieve this mission and thereby contribute to a more sustainable society, DEF is committed to:

- meet, and where practical, exceed its environmental legal and regulatory requirements, and other commitments;
- prevent pollution, protect the environment; and,
- continually improve.

A handwritten signature in blue ink, appearing to read "V. F. Kopicki", written over a horizontal line.

Vincent F. Kopicki, P.E.
Commissioner, DEF

NOTICE TO CONTRACTORS

County of Westchester
New York

Sealed proposals for the following construction work:

CONTRACT NO: 17-529

ADVERTISING: September 24, 2021

MANDATORY PRE-BID INSPECTION: October 5, 2021

PUMPING STATION REHABILITATION CROTONVILLE PUMPING STATION OSSINING SANITARY SEWER DISTRICT OSSINING, NEW YORK

will be received by the Board of Acquisition and Contract in Room 528, Michaelian Office Building, 148 Martine Ave., White Plains, New York until 11:00 a.m., Wednesday, October 27, 2021, and immediately thereafter, the bids will be publicly opened and read aloud in Room 527 of the said building. The bid opening also will be made accessible to the public via the livestreaming service WebEx. The livestreaming of the bid opening via WebEx is in addition to and not in place of the publicly bid opening to be held in Room 527 of the Michaelian Office Building. For additional bidding information or questions call (914) 995-2274.

Instructions for livestreaming via WebEx. Attendees may join by computer browser at <https://westchestergov.webex.com/meet/bac-bidopening> or by phone 1-415-655-0001 US Toll or 1-844-621-3956 US Toll Free. The Access Code is 614 981 028.

The Bid Documents (General Requirements, Information for Bidders, Technical Specifications, etc. with Authorized Proposal Pages) **MUST BE OBTAINED** from the Empire State Purchasing Group website at the following web address:

<http://www.bidnetdirect.com/new-york>.

There is no cost to the bidder for this service. Bid documents will be available after 1:00 p.m. on the advertising date.

PLEASE TAKE NOTICE: IN ORDER TO SUBMIT A BID, BIDDERS MUST REGISTER AND DOWNLOAD THE BID DOCUMENTS FROM THE EMPIRE STATE PURCHASING GROUP WEBSITE AND MUST REGISTER USING THE NAME OF THE PERSON OR BUSINESS ENTITY THAT WILL BE SUBMITTING THE BID. IN ORDER TO ENSURE THAT COUNTY BID DOCUMENTS HAVE NOT BEEN ALTERED IN ANY WAY, THE COUNTY WILL NOT ACCEPT BIDS FROM PERSONS OR BUSINESS ENTITIES THAT HAVE NOT FOLLOWED THIS REQUIREMENT.

The Bid Documents include Contract Drawings which **MAY BE OBTAINED** at no cost on the Empire State Purchasing Group website at the following web address: <http://www.bidnetdirect.com/new-york>, after 1:00 p.m. on the advertising date.

If the bidder is unable to utilize the electronic version of the Contract Drawings that are available on the Empire State Purchasing Group Website, the bidder may purchase copies of the Contract Drawings. Contract Drawings may be obtained from the Office of the Board of Acquisition and Contract at the above address after 1:00 p.m. on the advertising date and between the hours of 9:00 a.m. to 4:00 p.m. Monday thru Friday. Copies of the Contract Drawings shall be made available upon payment of a personal check, company check or money order made payable to the County of Westchester, in the amount of **\$100.00** per set. For bidders, the deposit for each set of drawings will be refunded in full if returned in good condition within thirty days after award or rejection of bids. For non-bidders, only fifty percent of the deposit will be refunded. No refunds will be made to the successful bidder.

Each bidder is required to submit the full set of authorized Proposal Pages and all bids over **\$100,000.00** must also be accompanied by the "Bid Bond and Consent of Surety" (as set forth in the Proposal Pages) attached to the outside of the sealed bid. Failure to submit in this manner may cause the bid to be rejected. **The successful bidder, no matter the amount of its bid, will be required to furnish a Performance and Payment Bond with its signed contract.**

To the full extent applicable, each bidder shall submit with its bid a separate sealed list that names each Subcontractor that the bidder will use to perform work on the contract and the agreed upon price to be paid to each for: (a) plumbing and gas fitting, (b) steam heating, hot water heating, ventilating and air conditioning apparatus and (c) electric wiring and standard illuminating fixtures and (d) general construction. The submission (Proposal Page 41) that contains the agreed upon price shall be acknowledged by both Contractor and Subcontractor. For purposes of this paragraph, the acknowledgment from the Subcontractor may contain the facsimile signature of an officer of the Subcontractor.

The Successful low bidder, before award of the contract, must obtain and provide to the County, from each of the above denoted Subcontractors, fully completed and signed Contract Disclosure Statement (Proposal Pages 24-32) and Required Disclosure of Relationships to County (Proposal Pages 33) forms.

The sealed lists of Subcontractors submitted by unsuccessful bidders shall be destroyed, unless you request that it be returned by checking the applicable box on Proposal Page 5.

The County of Westchester reserves the right to waive any informalities in the bids, or to reject any or all bids. No bidder may withdraw its bid within forty-five (45) days after the date of the bid opening.

Pursuant to Chapter 308 of the Laws of the County of Westchester, it is the goal of the County to use its best efforts to encourage, promote, and increase the participation of business enterprises owned and controlled by persons of color or women - Minority Business Enterprise (MBE) and Women Business Enterprise (WBE).

REMINDER: All required licenses should be submitted with the Bid.

COUNTY OF WESTCHESTER, NEW YORK
DEPARTMENT OF PUBLIC WORKS AND TRANSPORTATION

BY: Hugh J. Greechan, Jr., P.E., Commissioner

TABLE OF CONTENTS

SECTION 1: GENERAL REQUIREMENTS AND PROPOSALS

General Requirements

1.	Description Of The Work	1.1
2.	Subcontracting & Direct Employment Of Labor	1.2
3.	Required Time For Completion Of The Work	1.2
4.	Security Regulations	1.3
5.	Payment for Bonds and Insurance	1.5

Contract Drawings

Contract Drawings	Contract Drawings 1
-------------------------	---------------------

Proposal Forms

Bidder's Identification	Proposal Page 1
Proposal Requirements and Addendum Receipt	Proposal Page 2
Non-Collusive Bidding Certification	Proposal Page 4
Bid Page(s)	Proposal Page 6
Contractor's Acknowledgement	Proposal Page 7
Contractor's Acknowledgement (Corporation/Sole Officer)	Proposal Page 8
Limited Liability Company Acknowledgement	Proposal Page 9
Certificate of Authority	Proposal Page 10
Certificate of Authority-Limited Liability Company	Proposal Page 11
Bid Bond and Consent of Surety	Proposal Page 12
Affirmative Action Program Requirement (Contractors)	Proposal Page 13
Apprenticeship Training Program Requirement	Proposal Page 14
Certificate of License (Electrical)	Proposal Page 15
Certificate of License (Plumbing)	Proposal Page 17
Certificate of License (Hauler)	Proposal Page 19
Stormwater Pollution Prevention Certification	Proposal Page 20
Prevailing Wage Rates and Supplement	Proposal Page 21
MBE/WBE Program Questionnaire	Proposal Page 22
Contractor Disclosure Statement	Proposal Page 23
Required Disclosure of Relationships to County	Proposal Page 32
VOID	Proposal Page 34
Schedule "F" Criminal Background Disclosure	Proposal Page 35
Subcontractors Sealed Bid Submission	Proposal Page 41

TABLE OF CONTENTS

SECTION 2: INFORMATION FOR BIDDERS

1.	Addenda And Interpretation	2.1
2.	Voided Clauses	2.1
3.	Pre-Bid Site Inspection	2.1
4.	Bid Security	2.1
5.	Performance And Payment Bond.....	2.2
6.	Indemnification Agreement	2.3
7.	Insurance Requirements.....	2.3
8.	Prevailing Wage Rates And Supplements	2.6
9.	Labor And Compliance With Labor Law	2.9
10.	Contractor's Report Of Employment And Weekly Affidavit	2.13
11.	Laws/Regulations And Appropriations.....	2.13
12.	Refusal To Answer Questions	2.13
13.	Bid Requirements.....	2.14
14.	Miscellaneous Additional Work (Item W-800)	2.14
15.	Correction Of Errors	2.15
16.	Shown Quantities	2.15
17.	Qualification Of Bidders.....	2.15
18.	Required Experience.....	2.16
19.	Increase Or Decrease Of Quantities: Elimination Of Items.....	2.16
20.	Breakdown Cost Of Lump Sum Items And Contracts.....	2.16
21.	Engineering Charges.....	2.17
22.	Estimates And Payments.....	2.17
23.	Payments To Subcontractors And Materialmen By Contractor	2.21
24.	Time Of Starting	2.22
25.	Safety And Health Regulations For Construction And Demolition Work	2.22
26.	Accident Prevention And First Aid Facilities	2.23
27.	Fire Prevention And Control.....	2.23
28.	State And Local Sales Tax Exemption	2.24
29.	Apprentices	2.24
30.	Affirmative Action Provision	2.24
31.	Affirmative Action Program Requirement	2.24
32.	Authority To Do Business In New York	2.25
33.	License Requirements (Electrical).....	2.25
34.	License Requirements (Plumbing).....	2.26
35.	License Requirements (Haulers).....	2.27
36.	Minority Participation Policy.....	2.30
37.	Sexual Harassment Policy.....	2.32
38.	Smoke-Free Workplace Policy	2.33
39.	County Energy Efficient Purchasing Policy	2.33
40.	Restriction On Use Of Tropical Hardwoods.....	2.33
41.	Disclosure Of Relationships To County	2.34
42.	Contractor Disclosure Statement	2.34
43.	Criminal Background Information.....	2.34
44.	Mandatory OSHA Construction Safety And Health Training.....	2.36

TABLE OF CONTENTS

SECTION 3: GENERAL CLAUSES

1.	Material And Workmanship	3.1
2.	Definitions.....	3.1
3.	Boundaries Of Work	3.2
4.	Overlapping Work	3.2
5.	Proper Method Of Work And Proper Materials	3.4
6.	Control Of Area	3.5
7.	Permits, Fees, Etc.....	3.5
8.	Traffic	3.5
9.	Inspection.....	3.5
10.	Stopping Work.....	3.5
11.	Dimensions	3.6
12.	Payments To County.....	3.6
13.	Protection Of Utilities And Structures.....	3.6
14.	Protection Of Water Resources & The Environment	3.6
15.	Sanitary Regulations	3.8
16.	Cleaning Up	3.8
17.	Prevention Of Dust Hazard.....	3.8
18.	Representative Always Present.....	3.9
19.	Work In Bad Weather	3.9
20.	Protection Of Work Until Completion.....	3.9
21.	Removal Of Temporary Structures And Cleaning Up.....	3.9
22.	Gross Loads Hauled On Highway	3.9
23.	Concrete Batch Proportions - Yield.....	3.9
24.	Damage Due To Contractor's Operations	3.10
25.	Property Damage	3.10
26.	Claims For Damages.....	3.10
27.	Extensions Of Time	3.11
28.	Request For Approval Of Equal	3.12
29.	Substitution	3.15
30.	Extra Work: Increased Compensation/Decreased Work: Credit To The Owner.....	3.18
31.	Disputed Work - Notice Of Claims For Damages	3.20
32.	Contractor's Subcontracts And Material Lists	3.21
33.	Assignment Of Contract	3.22
34.	Payment For General Provisions	3.22
35.	Costs Incurred By County.....	3.22
36.	Guarantee Of Work.....	3.23
37.	Separate Contracts	3.23
38.	Cooperation With Owner.....	3.24
39.	Job Meetings & Project Superintendant	3.24

TABLE OF CONTENTS

SECTION 3: GENERAL CLAUSES

40.	Patent Warranty	3.25
41.	Materials	3.26
42.	Standard Of Quality	3.29
43.	Proprietary Item	3.29
44.	Shop Drawings.....	3.30
45.	Sequence Of Construction Operations.....	3.34
46.	Protection	3.36
47.	Cleanup And Removal Of Debris	3.36
48.	Temporary Service.....	3.36
49.	Operating Tests	3.37
50.	Operating Instructions And Parts Lists	3.37
51.	Cutting And Patching.....	3.37
52.	Conflicts Among Contract Documents.....	3.39
53.	Record Drawings	3.39
54.	Time	3.40
55.	Acceleration Of The Work.....	3.40
56.	Ultra Low Sulfur Diesel Fuel.....	3.40
57.	Qualified Transportation Fringe Program.....	3.42
58.	Use of Fluorescent Light Bulbs & Energy Efficient Bulbs	3.42
59.	County of Westchester Phosphorus-Free Lawn Fertilizer Policy.....	3.42

TABLE OF CONTENTS

SAMPLE FORMS AND ATTACHMENTS

Sample Forms

Affirmative Action Program Requirement – Subcontractor(s).....	Forms Page 1
Contractor’s Report Of Employment And Weekly Affidavit.....	Forms Page 2
Monthly Employment Utilization Report	Forms Page 4
Shop Drawing Schedule.....	Forms Page 5
Shop Drawing ID	Forms Page 6
Request For Approval Of Equal	Forms Page 7
Request For Approval Of Substitutions.....	Forms Page 8
Contractor’s Ultra Low Sulfur Diesel Fuel Affidavit.....	Forms Page 9
Contractor’s Ultra Low Sulfur Diesel Fuel-LOG	Forms Page 10
Electronic Funds Transfer (EFT)-Vendor Direct Payment Authorization Form.....	Forms Page 11

Sample Contract And Bond

Sample Contract And Bond For Construction	A-1
---	-----

Schedule Of Hourly Rates And Supplements

Schedule Of Hourly Rates And Supplements	B-1
--	-----

TABLE OF CONTENTS

TECHNICAL SPECIFICATIONS

CONTRACT NO. 17-529

DIVISION 1 – GENERAL REQUIREMENTS

Section 01 10 00	Summary	01 10 00-1 to 6
Section 01 31 00	Project Coordination	01 31 00-1 to 8
Section 01 32 00	Construction Progress Documentation	01 32 00-1 to 7
Section 01 33 00	Submittal Procedures	01 33 00-1 to 10
Section 01 42 00	References	01 42 00-1 to 11
Section 01 45 00	Quality Requirements	01 45 00-1 to 8
Section 01 51 00	Temporary Facilities and Controls	01 51 00-1 to 6
Section 01 52 00	Environmental Requirements for Construction	01 52 00-1 to 3
Section 01 60 00	Product Requirements	01 60 00-1 to 2
Section 01 73 00	Execution	01 73 00-1 to 10
Section 01 77 00	Closeout Procedures	01 77 00-1 to 4
Section 01 78 23	Operation and Maintenance Data	01 78 23-1 to 6
Section 01 78 40	Project Record Documents	01 78 40-1 to 3
Section 01 79 00	Demonstration and Training	01 79 00-1 to 4

DIVISION 2 – EXISTING CONDITIONS

Section 02 41 13	Selective Demolition	02 41 13-1 to 6
------------------	----------------------	-----------------

DIVISION 3 – CONCRETE

Section 03 30 00	Cast-in-Place Concrete	03 30 00-1 to 15
------------------	------------------------	------------------

DIVISION 5 – METALS

Section 05 50 00	Metal Fabrications	05 50 00-1 to 4
Section 05 52 13	Pipe and Tube Railings	05 52 13-1 to 8
Section 05 53 00	Metal Grating	05 53 00-1 to 6

DIVISION 6 – WOOD, PLASTICS, AND COMPOSITES

Section 06 10 00	Rough Carpentry	06 10 00-1 to 6
------------------	-----------------	-----------------

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

Section 07 01 50	Preparation for Re-Roofing	07 01 50-1 to 4
Section 07 21 00	Thermal Insulation	07 21 00-1 to 4
Section 07 27 26	Fluid Applied Weather Barrier	07 27 26-1 to 7
Section 07 53 23	EPDM Roofing	07 53 23-1 to 13
Section 07 72 00	Roof Accessories	07 72 00-1 to 7
Section 07 92 00	Joint Sealants	07 92 00-1 to 6

TABLE OF CONTENTS

DIVISION 8 – OPENINGS

Section 08 45 00	Insulated Translucent Panels	08 45 00-1 to 6
Section 08 90 00	Louvers and Vents	08 90 00-1 to 5

DIVISION 9 – FINISHES

Section 09 90 00	Field Painting	09 90 00-1 to 22
------------------	----------------	------------------

DIVISION 10 – SPECIALTIES

Section 10 28 13	Toilet Accessories	10 28 13-1 to 2
------------------	--------------------	-----------------

DIVISION 22 – PLUMBING

Section 22 05 00	Common Work Results for Plumbing	22 05 00-1 to 12
Section 22 05 23	General Duty Valves for Plumbing	22 05 23-1 to 11
Section 22 05 29	Hangers & Supports for Plumbing Piping and Equipment	22 05 29-1 to 6
Section 22 05 53	Identification for Plumbing Piping and Equipment	22 05 53-1 to 5
Section 22 05 93.50	Pipe Pressure Tests for Plumbing	22 05 93-1 to 5
Section 22 07 19	Plumbing Insulation	22 07 19-1 to 8
Section 22 11 16	Domestic Water Piping	22 11 16-1 to 5
Section 22 11 19	Domestic Water Piping Specialties	22 11 19-1 to 5
Section 22 11 23	Domestic Water Pumps	22 13 16-1 to 5
Section 22 11 30	Non-potable Water Piping	22 11 30-1 to 4
Section 22 13 16	Sanitary Waste and Vent Piping	22 13 16-1 to 5
Section 22 13 19	Sanitary Waste Piping Specialties	22 13 19-1 to 5
Section 22 33 00	Electric Domestic Water Heaters	22 33 00-1 to 3
Section 22 40 00	Plumbing Fixtures	22 40 00-1 to 3

DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING

Section 23 05 00	Common Work Results for HVAC	23 05 00-1 to 13
Section 23 05 29	Hangers and Supports for HVAC Systems	23 05 29-1 to 5
Section 23 05 53	Identification for HVAC Systems	23 05 53-1 to 4
Section 23 05 93	Testing Adjusting and Balancing for HVAC	23 05 93-1 to 12
Section 23 07 00	HVAC Insulation	23 07 00-1 to 10
Section 23 09 13	Instrumentation and Control Devices for HVAC	23 09 13-1 to 5
Section 23 31 00	HVAC Ducts and Casings	23 31 00-1 to 5
Section 23 33 00	Air Duct Accessories	23 33 00-1 to 5
Section 23 34 00	HVAC Fans	23 34 00-1 to 7
Section 23 37 00	Air Outlets and Inlets	23 37 00-1 to 6
Section 23 73 13	Heat Recovery Unit	23 73 13-1 to 8
Section 23 82 00	Electric Terminal Units	23 82 00-1 to 5

DIVISION 26 – ELECTRICAL

Section 26 00 00	Electrical	26 00 00-1 to 13
Section 26 00 20	Common Motor Requirements	26 00 20-1 to 6
Section 26 05 15	Medium Voltage Conductors	26 05 15-1 to 8
Section 26 05 19	Low-Voltage Electrical Power Conductors and Cables	26 05 19-1 to 7
Section 26 05 26	Grounding and Bonding for Electrical Systems	26 05 26-1 to 6

TABLE OF CONTENTS

Section 26 05 33	Raceways and Boxes for Electrical Systems	26 05 33-1 to 11
Section 26 05 53	Identification for Electrical Systems	26 05 53-1 to 4
Section 26 05 73	Overcurrent Protective Device Coordination Study	26 05 73-1 to 7
Section 26 09 16	Electrical Controls	26 09 16-1 to 4
Section 26 21 00	Electrical Service Entrance	26 21 00-1 to 3
Section 26 22 13	Low-Voltage Distribution Transformers	26 22 13-1 to 4
Section 26 24 13	Switchboard	26 24 13-1 to 5
Section 26 24 16	Panelboards	26 24 16-1 to 5
Section 26 24 19	Motor Control Centers	26 24 19-1 to 8
Section 26 27 26	Wiring Devices	26 27 27-1 to 5
Section 26 28 16	Enclosed Switches	26 28 16-1 to 8
Section 26 32 13	Diesel-Engine-Driven Generator Sets	26 32 13-1 to 16
Section 26 41 13	Lightning Protection for Structures	26 41 13-1 to 5
Section 26 43 00	Surge Protective Devices	26 43 00-1 to 3
Section 26 50 00	Lighting	26 50 00-1 to 3
DIVISION 27 – COMMUNICATIONS		
Section 27 00 00	Communications	27 00 00-1 to 3
DIVISION 31 – EARTHWORK		
Section 31 01 01	Earthwork	31 01 01-1 to 9
Section 31 05 14	Select Fill	31 05 14-1 to 3
Section 31 23 33	Trench Excavation and Backfill	31 23 33-1 to 3
DIVISION 32 – EXTERIOR IMPROVEMENTS		
Section 32 01 00	Restoration of Surfaces	32 01 00-1 to 5
Section 32 12 16	Asphalt Paving	32 12 16-1 to 3
Section 32 31 13	Chain Link Fences and Gates	32 31 13-1 to 5
Section 32 93 13	Topsoil and Seeding	32 93 13-1 to 3
DIVISION 33 – UTILITIES		
Section 33 29 60	Wastewater Temporary Bypass Pumping	33 29 60-1 to 4
DIVISION 40 – PROCESS INTERCONNECTIONS		
Section 40 05 07	Hangers and Supports for Process Piping	40 05 07-1 to 7
Section 40 05 13	Process Piping Systems	40 05 13-1 to 16
Section 40 05 25	Miscellaneous Valves and Appurtenances	40 05 25-1 to 5
Section 40 05 52	Identification for Process Piping and Equipment	40 05 52-1 to 6
Section 40 05 53	Process Valves Three Inches and Larger	40 05 53-1 to 6
Section 40 05 59	Stainless Steel Gates	40 05 59-1 to 8
Section 40 05 76	Line Stop Bypass System	40 05 76-1 to 6
Section 40 61 00	Process Control Systems	40 61 00-1 to 11
Section 40 61 13	Process Control System Integrator General Provisions	40 61 13-1 to 12
Section 40 63 43	Programmable Logic Controllers	40 63 43-1 to 11
Section 40 67 00	Control System Equipment Panels	40 67 00-1 to 14
Section 40 71 00	Instrumentation and Control for Process Piping	40 71 00-1 to 16

TABLE OF CONTENTS

Section 40 71 13.13	Inline Magnetic Flow Meter	40 71 13-1 to 9
Section 40 72 13	Ultrasonic Level Meters	40 72 13-1 to 7
Section 40 72 43	Pressure Type Level Meters	40 72 43-1 to 8
Section 40 72 46	Bubbler Systems	40 72 46-1 to 9
Section 40 72 76	Level Switches	40 72 76-1 to 8
Section 40 73 26	Gauge Pressure Transmitters	40 73 26-1 to 8
Section 40 73 36	Pressure and Differential Pressure Switches	40 73 36-1 to 8
Section 40 76 00	Gas Analysis System	40 76 00-1 to 11
Section 40 78 63	Alarm Dialer	40 78 63-1 to 11
DIVISION 43 – PROCESS GAS AND LIQUID HANDLING, PURIFICATION AND STORAGE EQUIPMENT		
Section 43 21 16	Tests on Pumping Equipment	43 21 16-1 to 5
Section 43 21 39	Dry Pit Submersible Pumps	43 21 39-1 to 11
Section 43 41 43	Polyethylene Chemical Storage Tanks	43 41 43-1 to 8
DIVISION 46 – WATER AND WASTEWATER EQUIPMENT		
Section 46 21 16	Flexible Rake Bar Screens	46 21 16-1 to 14
Section 46 33 44	Peristaltic Chemical Feed Pumps	46 33 44-1 to 7



1. GENERAL REQUIREMENTS AND PROPOSALS

DEPARTMENT OF PUBLIC WORKS AND TRANSPORTATION

Division of Engineering

GENERAL REQUIREMENTS

1. DESCRIPTION OF THE WORK

Work under this Contract includes all necessary labor, materials and equipment required to:

Construction of comprehensive improvements to the existing pumping station. Improvements include, but are not limited to, new dry-pit submersible pumps, mechanically cleaned bar screen and washer-compactor, all associated piping, valves and appurtenances, flood-mitigating improvements to the facility, electrical improvements, and an extensive bypass pumping operation.

It is not intended that this description of work mention each particular item required, but that it give information concerning the general scope and areas of work for the convenience of the bidders.

THIS PROJECT IS NOT SUBJECT TO THE REQUIREMENTS OF THE “WICKS LAW”. ACCORDINGLY, EACH BIDDER IS REQUIRED TO SUBMIT SPECIFIC INFORMATION PERTAINING TO ITS PROPOSED SUBCONTRACTORS. PLEASE SEE THE “NOTICE TO CONTRACTORS” THAT FORMS A PART OF THESE BID DOCUMENTS.

GENERAL REQUIREMENTS

2. SUBCONTRACTING & DIRECT EMPLOYMENT OF LABOR

The Contractor shall not subcontract more than ninety (90%) percent of its bid. The Contractor must directly employ at least ten (10%) percent of the personnel working on this contract as measured in man-days worked.

“Directly employ” shall be construed to include only workers employed and paid directly by the Contractor, usually for wages or salary.

The Contractor expressly acknowledges that any violation of this provision constitutes a default under this contract.

3. REQUIRED TIME FOR COMPLETION OF THE WORK

Notification to commence the work will require the mandatory submission of all the executed contracts and the Certificates of Insurance after receipt of authority to award.

The Contractor shall commence the work embraced in this contract within ten (10) days of the service of Notice by the County to do so and shall complete the said work within **720** consecutive calendar days computed from the date of such Notice to commence.

GENERAL REQUIREMENTS

4. SECURITY REGULATIONS

Security Regulations For all County Facilities except County Correctional Facilities:

- A. Contractor's attention is called to the fact that this work is to be performed on property which is the responsibility of the County; therefore, all personnel associated with this contract are subject to special conditions affecting security and control of the facilities operations. Every person required to enter the work site will be issued an ID card and be required to fill out appropriate applications. **There is a \$30.00 processing fee for each lost ID card**; remitted by check made payable to the County of Westchester. All ID processing will be scheduled by the Construction Administrator.
- B. The Contractor/Subcontractor shall issue a copy of the security regulations (Paragraph C) to all personnel engaged on this project.
- C. All Contractor/Subcontractor personnel shall be bound by the following security regulations for the duration of this contract.
 - 1) All personnel must conspicuously display the ID card and identify themselves upon request.
 - 2) If an ID card is misplaced or lost, report this immediately to the Inspector.
 - 3) All Contractor/Subcontractor personnel are responsible for all tools and equipment and you must report any loss immediately to the Construction Administrator.
 - 4) All personnel must observe all orders of the Owner.
 - 5) All personnel are to report any unusual incidents or problems to the Construction Administrator immediately.
 - 6) All personnel shall not possess or consume any alcoholic beverage or illegal drug or medication while on the property, or report to work under the influence of alcohol or drugs.
 - 7) Any vehicle left on the property must be locked and the ignition keys must be removed. Vehicles will not be left overnight without prior approval.
 - 8) All personnel shall not enter any other areas of the premises (except the areas agreed to) without prior approval of the Construction Administrator.

Security Regulations For County Correctional Facilities:

- A. Contractor's attention is called to the fact that this work is to be performed on property adjacent and/or within the County's Correctional Facilities; therefore, all personnel associated with this project are subject to special conditions affecting security and control of the Correctional Facility Operations. Every person required to enter the work site will be fingerprinted, processed for a photo ID card and be required to fill out appropriate applications. **There is a \$100.00 processing fee for each person**, checks made payable to the Commissioner of Finance. All ID processing will be scheduled by the Construction Administrator.

GENERAL REQUIREMENTS

- B. All Contractors and Subcontractors shall issue a copy of the security regulations (Paragraph C) to all personnel to be engaged on this project.
- C. All Contractor's and Subcontractor's personnel shall be bound by the following security regulations for the duration of this project.
 - 1) All personnel entering the Penitentiary, Jail or Women's Unit must stop and identify themselves to the Control or Desk Officer who will issue the appropriate pass after ascertaining that they have been cleared to enter the facility. Only workers with valid ID will be permitted entry. **NO HELPERS.**
 - 2) All personnel must sign in the Visitor's Book, to include the following information: **PERSON'S NAME, COMPANY NAME, REASON FOR ENTRY, WORK LOCATION IN BUILDING.**
 - 3) All personnel must conspicuously display the ID card and identify themselves upon request.
 - 4) If ID card is misplaced or lost, report this loss immediately to the Shift Captain or Associate Warden.
 - 5) All tradesmen will be required to perform a tool inventory inspection of all tools in their possession to demonstrate to the admitting Correction Officer that the typed inventory list matches the tools each time they enter and leave the building. The tradesmen are responsible for keeping all tools and equipment locked when not in immediate use and they must report any loss of tools or equipment immediately to the Shift Captain or Associate Warden.
 - 6) All tradesmen and helpers shall carry all tools in a locked and secured tool box or tool cart. A typed inventory sheet shall be carried with the tool box/cart listing all hand and power tools. A manufacturer's MSD Sheet shall be carried with the tool box/cart for any chemical compound that the tradesman has in his/her possession.
 - 7) All debris (i.e. packaging, demolition, etc) shall be removed from the worksite at the end of each workday.
 - 8) All personnel are subject to search at all times.
 - 9) All personnel must observe all orders of Correctional Staff.
 - 10) All personnel are to report any unusual incidents or problems to a Correction Officer, Shift Captain or the Associate Warden immediately.
 - 11) All personnel shall not possess or consume any alcoholic beverage or illegal drug or medication while on County property, or report to work under the influence of alcohol or drugs.
 - 12) Any vehicle left on County property must be locked and the ignition keys must be removed. Vehicles will not be left over-night on County property without prior approval.
 - 13) All personnel shall not enter any other areas of the prison (except the areas agreed to) without prior approval of the Shift Captain or the Associate Warden.

GENERAL REQUIREMENTS

- 14) All personnel shall not bring anything in for any inmate/detainee or staff member or take out anything for any inmate/detainee or staff member.
- 15) All personnel shall not engage in any unnecessary conversations with any inmate/detainee.
- 16) Weapons, i.e., guns, knives, blackjacks, to include any tool activated by gunpowder or other explosive charge is prohibited in the building (i.e., stud gun). Violators of this rule are subject to arrest.
- 17) All personnel must sign out when leaving and must return the ID card to the Control/Desk Officer before leaving.
- 18) Failure of the contractor to follow these procedures will result in the contractor being denied access to the facility.

5. PAYMENT FOR BONDS AND INSURANCE

The amount bid for contract bonds and insurance shall not exceed 3% of the total contract price excluding the bid price for Miscellaneous Additional Work (Item W800) and Field Testing Equipment (W851), where applicable. Should the bidder exceed the foregoing three percent (3%), the Department will make the necessary adjustment to determine the total amount bid based on the arithmetically correct proposal.

The amount bid shall be payable with the first contract payment.

GENERAL REQUIREMENTS

CONTRACT DRAWINGS:

CONTRACT NUMBER 17-529

The Design Drawings, as listed on the Contract Drawing Index, herewith made a part of these Specifications, shows in general and/or in detail the work to be done under this Contract and/or the various Contracts forming the entire work for the Project, as described herein.

After sending the executed contract to the County and prior to the first job meeting, the Contractor is responsible for obtaining from Public Works, Division of Engineering, Michaelian Office Building, White Plains, a maximum of five gratis copies of the Contract Drawings and Specifications; for the Contractor's permanent possession. Additional sets, requested by the Contractor, beyond the permitted number and time limit, will be furnished by Public Works; but at the Contractor's expense.

<u>DRAWING NO.</u>	<u>TITLE</u>	<u>SHEET NO.</u>
T-001	TITLE SHEET	208-03-T-25-0
G-001	NOTES, SYMBOLS AND ABBREVIATIONS	208-03-G-26-0
C-101	EXISTING SITE AND DEMOLITION PLAN	208-03-G-27-0
C-102	SITE PLAN	208-03-G-28-0
C-501	DETAILS	208-03-G-29-0
C-502	DETAIL	208-03-G-30-0
S-001	GENERAL NOTES	208-03-S-31-0
S-101	MAIN FLOOR PLAN	208-03-S-32-0
S-102	ELECTRICAL SERVICE PLATFORM	208-03-S-33-0
S-103	PARTIAL EXISTING ROOF PLANS	208-03-S-34-0
S-104	ELECTRICAL SERVICE PLATFORMS	208-03-S-35-0
S-301	SECTIONS & DETAILS	208-03-S-36-0
S-302	SECTIONS & DETAILS	208-03-S-37-0
S-303	SECTIONS & DETAILS	208-03-S-38-0
S-501	TYPICAL DETAILS	208-03-S-39-0
A-01	ABBREVIATIONS & SYMBOLS	208-03-A-40-0
A-02	CODE ANALYSIS	208-03-A-41-0
A-101	PLANS	208-03-A-42-0
A-102	ROOF PLAN	208-03-A-43-0
A-201	ELEVATION	208-03-A-44-0
A-301	SECTIONS	208-03-A-45-0
A-302	SECTIONS AT FLOOD DOORS	208-03-A-46-0
A-501	TRANSLUCENT PANEL DETAILS	208-03-A-47-0
A-601	SCHEDULES AND DETAILS	208-03-A-48-0
M-101	LOWER & MIDDLE LEVEL DEMOLITION PLANS	208-03-M-49-0
M-102	MAIN LEVEL DEMOLITION PLAN & SECTION	208-03-M-50-0
M-103	LOWER & MIDDLE LEVEL PLANS	208-03-M-51-0

Contract Drawings 1

GENERAL REQUIREMENTS

M-104	MAIN LEVEL PLAN	208-03-M-52-0
M-301	SECTIONS	208-03-M-53-0
M-302	SECTIONS	208-03-M-54-0
M-501	TYPICAL DETAILS	208-03-M-55-0
M-502	TYPICAL DETAILS	208-03-M-56-0
I-001	PROCESS CONTROL AND INSTRUMENTATION SYMBOLS	208-03-E-57-0
I-002	P&ID PUMPING STATION	208-03-E-58-0
I-03	P&ID CHEMICAL SYSTEM	208-03-E-59-0
I-04	P&ID ANCILLARY	208-03-E-60-0
E-001	GENERAL NOTES, ABBREVIATIONS & SYMBOLS	208-03-E-61-0
E-101	DEMOLITION PLANS	208-03-E-62-0
E-102	DEMOLITION PLANS	208-03-E-63-0
E-103	POWER PLANS	208-03-E-64-0
E-104	POWER PLANS	208-03-E-65-0
E-105	LIGHTING PLANS	208-03-E-66-0
E-106	LIGHTING PLANS	208-03-E-67-0
E-501	ELECTRICAL DETAILS	208-03-E-68-0
E-502	ELECTRICAL DETAILS	208-03-E-69-0
E-601	ONE-LINE DIAGRAMS	208-03-E-70-0
E-602	ELEMENTARY DIAGRAMS	208-03-E-71-0
E-603	ELEMENTARY DIAGRAMS	208-03-E-72-0
E-604	SCHEDULES	208-03-E-73-0
E-605	CONDUIT SCHEDULE	208-03-E-74-0
H-101	MAIN LEVEL & ROOF PLANS	208-03-H-75-0
H-102	MIDDLE LEVEL & LOWER LEVEL PLANS	208-03-H-76-0
H-301	SECTIONS	208-03-H-77-0
H-302	SECTIONS	208-03-H-78-0
H-501	DETAILS	208-03-H-79-0
H-601	SCHEDULE	208-03-H-80-0
P-101	MAIN LEVEL PLUMBING DEMOLITION & INSTALLATION PLANS	208-03-P-81-0
P-102	MIDDLE LEVEL PLUMBING DEMOLITION & INSTALLATION PLANS	208-03-P-82-0
P-103	LOWER LEVEL PLUMBING DEMOLITION & INSTALLATION PLANS	208-03-P-83-0
P-701	ISOMETRIC, DETAIL & SCHEDULE	208-03-P-84-0

Submit all proposal pages in this section, including all executed and unexecuted pages and fasten with a clip at the upper left hand corner.



George Latimer, Westchester County Executive

PROPOSAL PAGES

**PUMPING STATION REHABILITATION
CROTONVILLE PUMPING STATION
OSSINING SANITARY SEWER DISTRICT
OSSINING, NEW YORK**

Contract No. 17-529

Bid Opening: October 27, 2021

By Bidder (Please Print)	For Official Use Only
Firm/Business Name: _____	
Address: _____	

DEPARTMENT OF PUBLIC WORKS AND TRANSPORTATION

Division of Engineering

PROPOSAL REQUIREMENTS

BIDDER'S IDENTIFICATION

CONTRACT NO. _____

To the Commissioner of Public Works, Westchester County, New York, acting for the party of the first part.

Proposal made by _____
as party of the second part.

Whose business address is _____

Whose telephone number is _____

Whose E-mail address is _____

Whose Federal ID number is _____

Is bidder an individual,
a partnership or a corporation? _____

If a partnership or corporation,
give the names of all partners
or officers with their titles _____

If operating under a trade name or as partners, has the required Certificate been filed with a County Clerk in accordance with the General Business Law, Section 130?

Yes....[] No....[] N.A....[]

If the answer is NO, Certificate must be filed before the contract can be executed.

NOTE: the bid must be submitted using the Contractor's legal name, not just the "doing business as" (i.e. DBA) name.

COMPLETE THIS FORM USING BLACK INK ONLY

PROPOSAL REQUIREMENTS

1. The undersigned, the bidder, does hereby declare that it has carefully read the contract specifications and has carefully studied the relevant plans, profiles and other drawings (as defined in Article "Contract Drawings" of the General Requirements) relating to the contract work, and has inspected the site(s) of the work..
2. The undersigned does hereby declare that it is the only one interested in its indicated bid; that the bid is in all respects without fraud or reservations; and that no official of the County or of the participating municipalities (if any), or any person in the employ of the County of participating municipalities (if any) is directly interested in the contract bid or in the supplies, equipment or works to which it relates, or in any part of the profits resulting there-from.
3. The undersigned does hereby offer and agree to furnish all materials, to fully and faithfully construct, perform and execute all work under the contract in accordance with the plans, profiles, other drawings and specifications relating thereto, and to furnish all labor, tools, implements, machinery, forms, transportation and materials necessary and proper for said purpose at the following indicated lump sum price for the total work and/or the following indicated unit prices for the various items of the work.
4. The undersigned does hereby declare that the indicated price(s) cover all expenses of every kind incidental to the completion of the contract work, including all claims affecting the work, labor and materials, which may arise through any cause whatsoever, excepting as provided for in Article "Disputed Work-Notice Of Claims For Damages: of the General Clauses.
5. The undersigned hereby agrees that in the event that the quantities of contract work actually performed by the undersigned are less than the approximate quantities indicated in the specifications it will make no claim(s) for loss of anticipated profits.
6. The undersigned does hereby agree that it will execute a contract containing all the terms, conditions, provisions and covenants necessary to complete the work according to the appropriate plans and specifications, within ten working days after receipt by the undersigned of the contract from the County, and that if it fails to execute said contract within said period of time the County may rescind the contract award and may retain as liquidated damages and not as a penalty, any amounts submitted as the bid security accompanying the undersigned's proposal, and/or demand from the Bidder's Surety Company that executed the required Bid Bond and Consent of Surety to pay to the County the difference between the amount bid and the amount for which such contract is thereafter awarded, together with the cost to the County of reletting said contract up to the maximum aggregate amount of 25% of the amount bid.
7. The undersigned does hereby agree to commence the work encompassed under the contract within ten days after notification in writing from the Commissioner of Public Works or his authorized designee, unless a definite earlier or later start has been specified, and will complete the work fully and in every respect on or before the specified completion date; and further agrees that the County has the right to employ such combination of labor, equipment

PROPOSAL REQUIREMENTS

and materials as may be required for the proper completion of the contract work and to deduct all costs from such monies as may be due the undersigned, in the event the contract work is not completed by the specified completion date.

8. The undersigned does hereby agree to comply with all relevant provisions of the Labor Laws of the State of New York, and agrees to adhere to the provisions relating to the eight-hour day and five-day week, the payments of minimum rates for labor, and the latest laws relative to payments for wages for labor on public contracts.
9. The undersigned does hereby agree to insure all persons connected with the contract work against accident, at its own expense, as prescribed by the Workmen's Compensation Law of the State of New York; and that it will be responsible for payments by itself, its subcontractors and vendors of all taxes applicable to the work, and all other payments as may be required by various laws and rules and regulations of the Federal Government, the State of New York and its political subdivisions and agencies, such payments including but not limited to the following:
 - A. Federal Social Security Taxes on employees' wages.
 - B. Applicable Federal Excise Taxes.
 - C. New York State Unemployment Insurance and Disability Payments, based on employees' wages.
10. The undersigned does hereby agree to accept their indicated lump sum price for the total work and/or their indicated unit prices for the various items of the work as the sole basis in the determination of the value of addition to, or deletions from the specified scope of the contract work.

11. ADDENDUM RECEIPT - CONTRACT NO. _____

(The undersigned shall fill in contract number above, and the required information below.)

The undersigned does hereby acknowledge receipt of the below listed addenda to the contract specifications:

Addendum No. _____ Dated _____

Addendum No. _____ Dated _____

Addendum No. _____ Dated _____

Addendum No. _____ Dated _____

Addendum No. _____ Dated _____

COMPLETE THIS FORM USING BLACK ONLY

PROPOSAL REQUIREMENTS

12. Bidders should not submit the entire Bid document with its bid submission. Instead, Bidders must submit ALL of the Proposal Pages. Proposal Pages are denoted by a border and are titled on the bottom as "Proposal Page ____".

Be sure that, where required, the forms have been completed and signed by a notary public.

Proposal Page 12 must be completed by a surety company and submitted with the bid if a Performance and Payment Bond is required in accordance with the "Notice to Contractors".

13. NON-COLLUSIVE BIDDING CERTIFICATION

Made pursuant to Section 103-d of the General Municipal Law of the State of New York as amended by the Laws of 1966.

- A. By submission of this bid, each bidder and each person signing on behalf of any bidder certifies, and in the case of a joint bid each party thereto certifies as to its own organization, under penalty of perjury, that to the best of his knowledge and belief:
- 1) The prices in this bid have been arrived at independently without collusion, consultation, communication, or agreement, for the purpose of restricting competition, as to any matter relating to such prices with any other bidder or with any competitor;
 - 2) Unless otherwise required by law, the prices which have been quoted in this bid have not been knowingly disclosed by the bidder and will not knowingly be disclosed by the bidder prior to opening, directly or indirectly, to any other bidder or to any competitor; and
 - 3) No attempt has been made or will be made by the bidder to induce any other person, partnership or corporation to submit or not to submit a bid for the purpose of restricting competition.
- B. A bid shall not be considered for award nor shall any award be made where a. (1), (2) and (3), above, have not been complied with; provided however, that if any case the bidder cannot make the foregoing certification, the bidder shall so state and shall furnish with the bid a signed statement which sets forth in detail the reasons therefore. Where a. (1), (2) and (3), above, have not been complied with, the bid shall not be considered for award nor shall any award be made unless the head of the purchasing unit of the political subdivision, public department, agency or official thereof to which the bid is made, or his designee, determines that such disclosure was not added for the purpose of restricting competition."
14. The undersigned and each person signing in behalf of the undersigned hereby executes the foregoing Affirmative Action Questionnaire, Proposal, Addendum Receipt and Non-Collusive Bidding Certification.
15. The undersigned and each person signing on behalf of the undersigned hereby certifies that

PROPOSAL REQUIREMENTS

the person, firm or corporation submitting this proposal as the bidder has not been found guilty of a willful violation of the New York State Labor Law for failure to pay prevailing wages and supplements, as those terms are defined by the New York State Labor Law, within the twelve (12) months immediately preceding the submission of this bid.

16. The undersigned, by submitting the Proposal Pages, acknowledges that it has read the complete bid package including any and all addenda thereto and its bid includes all of the terms and conditions set forth in the bid documents, including, but not limited to, the Notice to Contractors, General Requirements and Proposals, Contract plans/drawings (if any), Proposal Forms, Information for Bidders, General Clauses, Sample Forms and Attachments, Sample Contract and Bond, Schedule of Hourly Rates and Supplements, Technical Specifications, any Special Notices and all applicable laws, rules and regulations. The undersigned further acknowledges that by submitting this bid the above denoted items are incorporated by reference and constitute an integral part of its bid.
17. The undersigned agrees that, if it is not the Successful bidder, the Sealed List of Subcontractors submitted with its bid can be destroyed by the County. **Please check the following box if you want the Sealed List of Subcontractors returned to you.** ☐

Dated _____, 20__

Legal Name of Person, Firm or
Corporation

(Seal of Corporation)

Business Address of Person, Firm or Corporation

By _____
Signature

Title

COMPLETE THIS FORM USING BLACK INK ONLY

LUMP SUM PROPOSAL

ITEM NO.	DESCRIPTION	AMOUNT BID	
		DOLLARS	CENTS
A	For providing all labor, material and equipment necessary to complete all work as shown on the contract drawings and in accordance with the specifications for the Crotonville Pumping Station Rehabilitation, Ossining Sanitary Sewer District.	\$	
	Subtotal of All Items Above:	\$	
B	Contract Bonds and Insurance (Must not exceed 3.00% of Subtotal shown above)	\$	
W800	Necessary for Miscellaneous Additional Work per Article "Miscellaneous Additional Work (Item W-800)" of Information for Bidders, as directed	\$ 700,000	.00
	Gross Sum of Total Base Bid Written in Figures:	\$	

CONTRACTOR: _____

ADDRESS: _____

BY: _____

Signature/Title

COMPLETE THIS FORM USING BLACK INK ONLY

CONTRACTOR'S ACKNOWLEDGMENT

(If Corporate)

STATE OF NEW YORK)

COUNTY OF WESTCHESTER) ss.:

On this _____ day of _____, 20____, before me personally came _____
_____ to me known and known to me to be the _____
_____ of _____ the corporation described in and which
executed the within instrument, who being by me duly sworn did depose and say that he the said _____
_____ resides at _____
_____ and that he is _____ of said corporation and knows the corporate
seal of the said corporation; that the seal affixed to the within instrument is such corporate seal and
that it was so affixed by order of the Board of Directors of said corporation, and that he signed his
name thereto by like order.

Notary Public

CONTRACTOR'S ACKNOWLEDGMENT

(If Individual)

STATE OF NEW YORK)

COUNTY OF WESTCHESTER) ss.:

On this _____ day of _____, 20____, before me personally came _____
_____ to me known, and known to me to be the same person described in
and who executed the within instrument and he duly acknowledged to me that he executed the same
for the purpose herein mentioned and, if operating under the trade name, that the certificate required
by the New York State General Business Law Section 130 has been filed with the County Clerk of
Westchester County.

Notary Public

CONTRACTOR'S ACKNOWLEDGMENT

(If Co-Partnership)

STATE OF NEW YORK)

COUNTY OF WESTCHESTER) ss.:

On this _____ day of _____, 20____, before me personally came _____
_____ to me known, and known to me to be a member of the firm of _____
_____ and the person described in, and who executed the
within instrument in behalf of said firm, and he acknowledged to me that he executed the same in
behalf of, and as the act of said firm for the purposes herein mentioned and that the certificate
required by the New York State General Business Law Section 130 has been filed with the County
Clerk of Westchester County.

Notary Public

COMPLETE THIS FORM USING BLACK INK ONLY

CONTRACTOR'S ACKNOWLEDGMENT

(If Corporation/Sole Officer)

STATE OF NEW YORK)
) ss.:
COUNTY OF)

On this _____ day of _____, 20__, before me
personally came _____ to me known and
(Name)

known to me to be the _____
(Title)

of _____, the corporation described in and which
(Name of Corporation)

executed the within instrument, who being by me duly sworn did depose and say that he/she,
resides at _____

and that he/she signed the within instrument, on behalf of said corporation, in his/her capacity as the _____ and sole officer and director of said corporation
(Title)

and that he/she owns all the issued and outstanding capital stock of said corporation.

Notary Public

Notary Public

COMPLETE THIS FORM USING BLACK INK ONLY

LIMITED LIABILITY COMPANY ACKNOWLEDGMENT

STATE OF NEW YORK)
) ss.:
COUNTY OF)

On this _____ day of _____, 20__, before me

personally came _____ to me known to be the individual
(*Name of individual who signed agreement*)

who executed the foregoing instrument, and who, being duly sworn by me, did depose and say that

(s)he is (the)(a) _____ of _____,
(*member*)(*manager*) (*name of limited liability company*)

a _____ limited liability company, and that (s)he has authority
(*name of state*)

to sign the same, and acknowledged that (s)he executed the same as the act and deed of said limited liability company.

Sworn to before me this ____ day
of _____, 20__

Notary Public

My Commission Expires on: _____

COMPLETE THIS FORM USING BLACK INK ONLY

CERTIFICATE OF AUTHORITY

I, _____
(Officer other than officer executing proposed documents)

certify that I am _____ of the
(Title)

(Name of Contractor)

(the "Contractor"), a corporation duly organized and in good standing under the

(Law under which organized, e.g., the New York Business Corporation Law)

named in the foregoing agreement; that _____
(Person executing proposal documents)

who signed said agreement on behalf of the Contractor was, at the time of execution the

_____ of the Contractor; that said agreement was
(Title of such person)

duly signed for and in behalf of said Contractor by authority of its Board of Directors, thereunto

duly organized, and that such authority is in full force and effect at the date hereof.

(Signature)

(SEAL)

STATE OF NEW YORK)
) ss.:
COUNTY OF)

On this _____ day of _____, 20____, before me personally came
_____ to me known, and known to me to be
the _____ of _____, the
Corporation described in and which executed the above certificate, who being by me duly sworn did
depose and say that he, the said _____ resides at
_____ and that he is _____
_____ of said Corporation and knows the Corporate Seal of the said
Corporation; that the seal affixed to the above certificate is such Corporate Seal and that it was so
affixed by order of the Board of Directors of said Corporation, and that he signed his name thereto
by like order.

Notary Public

COMPLETE THIS FORM IN BLACK INK ONLY

CERTIFICATE OF AUTHORITY-LIMITED LIABILITY COMPANY

I, _____,
(member or manager other than person executing the agreement)

certify that I am a _____ of _____
(member/manager) (Name of Limited Liability Company)

(the “LLC”) duly organized under the Laws of the State of _____; that
(Name of State)

_____ who signed said agreement on behalf of the LLC.
(Person Executing Agreement)

was, at the time of execution, a manager of the LLC; that said Contract was duly signed for and on behalf of said LLC and as the act of said LLC for the purposes herein mentioned.

(Signature)

[illegible]

On this _____ day of _____, 20____, before me personally came
_____, to me known, and known to me to be the _____
(name of member/manager) (member/manager)
described in and who executed the above certificate, who being be me duly sworn did depose and say
that he resides at _____, and he is a
(member/manager) of said LLC; that he is duly authorized to execute said certificate on behalf of said
LLC, and that he signed his name thereto pursuant to such authority.

Notary Public

County

My Commission Expires on: _____

COMPLETE THIS FORM USING BLACK INK ONLY

***Required for all Bids over \$100,000 where a Performance & Payment Bond
is Required in accordance with the "Notice to Contractors"***

CONTRACT NO. _____

BID BOND AND CONSENT OF SURETY

KNOW ALL PERSONS BY THESE PRESENTS, That _____
(Name of Contractor)

(Address)
(hereinafter called the "Principal") and the _____ a
corporation created and existing under the laws of the State of _____, having its principal office
at _____ (hereinafter called the "Surety"),
(PRINT FULL ADDRESS OF SURETY)

are held and firmly bound unto the County of Westchester (hereinafter called the "Obligee"), in the full just
sum of *Twenty-Five (25%) Percent of the Attached Bid*, good and lawful money of the United States of
America, for the payment of which said sum of money, well and truly to be made and done, the said
Principal binds themselves (himself/herself, itself), their (his/her, its) heirs, executors and administrators,
successors and assigns, and the said Surety binds itself, its successors and assigns jointly and severally,
firmly by these presents:

WHEREAS, the said Principal has submitted to the County of Westchester, New York, a
proposal/bid for Contract Number: _____
Project Title: _____ and

WHEREAS, under the terms of the Laws of the State of New York as above indicated, the said
Principal has filed or intends to file this bond to guarantee that the Principal will execute all required contract
documents, furnish all required insurance and furnish such Performance and Payment Bonds or other bonds
as may be required in accordance with the terms of the Principal's said proposal/bid.

NOW, THEREFORE, the Surety agrees:

- (i) if the Contract for which the preceding estimate and proposal is made, is awarded to the Bidder by
the County, the Surety shall become bound as Surety and guarantor for the faithful performance of the
Contract and shall execute and deliver a Performance & Payment Bond, in a form acceptable to the County,
in the amount of 100% of the total Contract price, or such other amount as may be specified in the Bid
documents, and shall execute the Contract as party of the third part when required to do so by the Board of
Acquisition and Contract of the County; and
- (ii) if the Bidder shall, upon award of the Contract to the Bidder, fail or refuse to execute the Contract
and furnish the necessary bonds and insurance certificates, the Surety shall, on demand by the County, pay to
the County the difference between the amount bid and the amount for which such contract is thereafter
awarded, together with the cost to the County of reletting said Contract, up to the maximum aggregate
amount of this bond.
- (iii) the condition of the foregoing obligation is such, that if the said Principal shall promptly execute
and submit, and the County shall accept, all required contract documents including insurance and such
Performance and Payment Bond or other bonds, all as may be required in accordance with the terms of the
Principal's said bid/proposal, then this obligation shall be null and void, otherwise to remain in full force and
virtue.

The Surety, for value received, the receipt of which is hereby acknowledged by the Surety, hereby stipulates and agrees that the obligation of the Surety and of its bond shall remain absolute and shall be in no way impaired, affected or discharged by an extension of time, mutually agreed to by the County and the Bidder, within which the County may award said Contract, and the Surety hereby waives notice of any such extension.

IN TESTIMONY WHEREOF, the said Principal has hereunto set his/her (their, its) hand and the said Surety has caused this instrument to be signed by its duly authorized officer this _____ day of _____ 200__.

Signed and delivered this ____ day of _____ 20____ in the presence of:

(Print Name of Contractor)

(Signature) Principal

(Title of Authorized Officer)

(Print Name of Surety)

By _____ Surety
(Signature)

(Title of Authorized Officer)

(The Surety Company shall append a single copy of a statement of its financial condition, a copy of the resolution authorizing the execution of Bonds by officers of the Surety Company, Power of Attorney, Surety Acknowledgment.)

AFFIRMATIVE ACTION PROGRAM REQUIREMENT

Affirmative Action Program

An approved Affirmative Action Plan shall be required in all contracts for public work where the awarded contract amount exceeds \$50,000 or more than fourteen (14) persons are employed by the Contractor and/or his subcontractors.

Does the Contractor participate in an approved Affirmative Action Program? Yes [☐] No [☐]

If Yes, give name of Program: _____

If No, how many employees (total) does the Contractor employ. Please also include in your count the number of employees the Contractor and its Subcontractors expect to use on this project: _____

An approved Affirmative Action Program shall mean a plan approved or adopted by Westchester County including but not limited to, the Home-Town Plan, the Recruitment Training Program or any other program approved or meeting the requirements of the State or Federal government.

The "Monthly Employment Utilization Report" of the Sample Forms, shall be filled out by the Contractor and/or Subcontractor(s) who are required to have an Affirmative Action Program, prior to the start of the work.

Before any subcontractor is approved for use on this contract it will have to complete and submit the "Affirmative Action Program Requirement- Subcontractors" form of the Sample Forms.

COMPLETE THIS FORM USING BLACK INK ONLY

APPRENTICESHIP TRAINING PROGRAM REQUIREMENT

Apprenticeship Training Program

An approved Apprenticeship Training Program shall be required in all contracts for public work where the awarded contract amount exceeds \$50,000. and more than fourteen (14) persons are employed by the Contractor or Subcontractor(s).

Will the Contractor utilize apprentices for this
Contract? Yes [] No []

If Contractor Yes, do the apprentices participate in an approved Apprenticeship
Training Program? Yes [] No []

If Contractor Yes, give the name of the Program: _____

Will the Subcontractor(s) utilize apprentices for this
Contract? Yes [] No []

If Subcontractor(s) Yes, do the apprentices participate in an approved Apprenticeship
Training Program? Yes [] No []

If Subcontractor(s) Yes, give the name of the Program: _____

AN APPROVED APPRENTICESHIP TRAINING PROGRAM SHALL MEAN A NEW YORK
STATE REGISTERED APPRENTICESHIP TRAINING PROGRAM AS DEFINED UNDER
THE NEW YORK STATE LABOR LAW.

COMPLETE THIS FORM USING BLACK INK ONLY

CERTIFICATE OF LICENSE

(TO BE COMPLETED BY AN ELECTRICAL BIDDER ONLY)

_____, being duly sworn
(Name)

deposes and says that the following statements are true:

(1) I am the _____ of the
(Title)

_____, the bidder named on the
(Name of Contractor)

bid proposal, and I have read and am familiar with: a) the electrical license requirements contained in the Information for Bidders of the bid, b) Chapter 277 Article XVII of the Laws of Westchester County entitled Electrical Licensing Board and the Licensing of Master Electricians, and c) the Westchester County Electrical Licensing Board Rules and Regulations.

(2) I am familiar with, and this bid is being submitted in compliance with, the Westchester County Electrical Licensing Board Rules and Regulations, in particular No. 11, which states as follows:

No individual holding a Master Electrician's License shall lend such License to any person or allow any other person to carry on, engage in, or labor at the business as defined herein of installing, removing, altering, testing, replacing, or repairing electrical systems. A violation of this section by any person holding a License shall be sufficient cause for revocation of such License.

However, nothing herein shall be construed to prohibit the use of a License by the holder thereof for or on behalf of a partnership, corporation or other business association, provided that fifty-one (51) percent or more of the control of the voting capital stock of such partnership, corporation, or other business association is owned by one (1) or more holders of a Westchester County Master Electrical License and that all work performed by such partnership, corporation or other business association is performed by or under the direct supervision of such License holder or holders.

(3) That, as of this date, the bidder submitting the bid possesses the applicable valid Master/"Special" Electrician's license issued by the Westchester County Electrical Licensing Board; that this License is being used in compliance with the Laws of Westchester County and Westchester County Electrical Licensing Board Rules and Regulations; and **I have provided a copy of such license with the sealed bid proposal.**

COMPLETE THIS FORM USING BLACK INK ONLY

CERTIFICATE OF LICENSE (Continued)

(TO BE COMPLETED BY AN ELECTRICAL BIDDER ONLY)

(4) That all electrical work shall be performed in accordance with the requirements of Chapter 277 Article XVII of the Laws of Westchester County entitled Electrical Licensing Board and the Licensing of Master Electricians and the Westchester County Electrical Licensing Board Rules and Regulations.

(5) That I make this statement in connection with the submission of the bid as proof of the required electrical license, knowing that this statement will be relied upon by the County in the evaluation of that bid.

Signature

Sworn to before me
this _____ day of _____

License No.

Notary Public - State of New York

COMPLETE THIS FORM USING BLACK INK ONLY

CERTIFICATE OF LICENSE

(TO BE COMPLETED BY A PLUMBING BIDDER ONLY)

_____, being duly sworn
(Name)

deposes and says that the following statements are true:

(1) I am the _____ of the
(Title)

_____, the bidder named on the
(Name of Contractor)

bid proposal, and I have read and am familiar with: a) the plumbing license requirements contained in the Information for Bidders of the bid, b) Chapter 277 Article XV of the Laws of Westchester County entitled Westchester County Board of Plumbing Examiners and County-wide Plumbing License, and c) the Westchester County Board of Plumbing Examiners Rules and Regulations.

(2) I am familiar with, and this bid is being submitted in compliance with, Section 277.509A of Article XV of Chapter 277 of the Laws of Westchester County, which states as follows:

A. No holder of a license or certification issued under this article shall authorize, consent to or permit the use of his or her license or certification by or on behalf of any other person. No person who has not qualified or obtained a license or certification under this article shall represent himself or herself to the public as holder of a license or certification issued under this article, either directly, by means of signs, sign cards metal plates or stationery, or indirectly in any other manner whatsoever. However, nothing herein shall be construed to prohibit the use of a license by the holder thereof for or on behalf of a partnership, corporation or other business association, provided that 51 percent or more of the control of the voting capital stock of such partnership, corporation or other business association is owned by one or more holders of a Westchester County master plumbing license and that all work performed by such partnership, corporation or other business association is performed by or under the direct supervision of such license holder or holders.

(3) That, as of this date, the bidder submitting the bid possesses a valid Master Plumber's license issued by the Westchester County Board of Plumbing Examiners; that this License is being used in compliance with the Laws of Westchester County and the Westchester County Board of Plumbing Examiners Rules and Regulations; and **I have provided a copy of such license with the sealed bid proposal.**

COMPLETE THIS FORM USING BLACK INK ONLY

CERTIFICATE OF LICENSE (Continued)

(TO BE COMPLETED BY A PLUMBING BIDDER ONLY)

(4) That all plumbing work shall be performed in accordance with the requirements of Chapter 277, Article XV of the Laws of Westchester County entitled Westchester County Board of Plumbing Examiners and County-wide Plumbing License, and the Westchester County Board of Plumbing Examiners Rules and Regulations.

(5) That I make this statement in connection with the submission of the bid as proof of the required plumbing license, knowing that this statement will be relied upon by the County in the evaluation of that bid.

Signature

Sworn to before me
this _____ day of _____

License No.

Notary Public - State of New York

COMPLETE THIS FORM USING BLACK INK ONLY

CERTIFICATE OF LICENSE

(TO BE COMPLETED BY A HAULING BIDDER OR SUBCONTRACTOR ONLY)

_____, being duly sworn
(Name)

deposes and says that the following statements are true:

(1) I am the _____ of the
(Title)

_____, the bidder/subcontractor (circle one)
(Name of Contractor)

named on the foregoing bid proposal, and I have read and am familiar with the hauling license requirements contained in the Information for Bidders of the foregoing bid.

(2) That, as of this date, the bidder submitting the foregoing bid/subcontractor of the bidder submitting the foregoing bid (circle one) possesses a valid _____ license
(License type, i.e. Class "A")
issued by the Westchester County Solid Waste Commission.

(3) That all hauling work shall be performed in accordance with the requirements of Chapter 826-a of the Laws of Westchester County.

(4) That I make this statement in connection with the submission of the foregoing bid as proof of the required hauling license, knowing that this statement will be relied upon by the County in the evaluation of that bid.

Signature

Sworn to before me
this _____ day of _____

License No.

Notary Public - State of New York

COMPLETE THIS FORM USING BLACK INK ONLY

STORMWATER POLLUTION PREVENTION CERTIFICATION

I certify under penalty of law that I understand and agree to comply with the terms and conditions of the Stormwater Pollution Prevention Plan ("SPPP") for the construction site identified in such SPPP as a condition of authorization to discharge stormwater. I also understand the operator must comply with the terms and conditions of the New York State Pollutant Discharge Elimination System ("SPDES") general permit for stormwater discharges from construction activities and it is unlawful for any person to contribute to a violation of water quality standards.

Signature

Sworn to before me

This _____ day of _____, 200__.

Notary Public – State of New York, County of _____

My Commission Expires on _____.

This Certification will also have to be signed by your subcontractors. Additional copies of this form can be acquired from the Department of Public Works.

COMPLETE THIS FORM USING BLACK INK ONLY

PREVAILING WAGE RATES AND SUPPLEMENTS

Compliance with the New York State Construction (Article 1, Section 17) and the New York State Labor Law (Section 220)

Is your firm in full compliance with the New York State Labor Law?
(Please check one)

Yes _____

No _____

Are the wage supplements paid into a Federally approved program?
(Please check one)

Yes _____

No _____

If Yes, please indicate which program:

If No, please indicate how the supplements are being paid:

Yes, I have read and understand the terms of this Contract and the laws of this Agreement:

Signature

Date: _____

Notary Public

Date: _____

COMPLETE THIS FORM USING BLACK INK ONLY

MINORITY/WOMEN BUSINESS ENTERPRISE PROGRAM QUESTIONNAIRE
QUESTIONNAIRE REGARDING BUSINESS ENTERPRISES
OWNED AND CONTROLLED BY WOMEN OR PERSONS OF COLOR

As part of the County's program to encourage the meaningful and significant participation of business enterprises owned and controlled by persons of color or women in County contracts, and in furtherance of Section 308.01 of the Laws of Westchester County, completion of this form is required.

A "business enterprise owned and controlled by women or persons of color" means a business enterprise, including a sole proprietorship, limited liability partnership, partnership, limited liability corporation, or corporation, that either:

- 1.) meets the following requirements:
 - a. is at least 51% owned by one or more persons of color or women;
 - b. is an enterprise in which such ownership by persons of color or women is real, substantial and continuing;
 - c. is an enterprise in which such ownership interest by persons of color or women has and exercises the authority to control and operate, independently, the day-to-day business decisions of the enterprise; and
 - d. is an enterprise authorized to do business in this state which is independently owned and operated.
- 2.) is a business enterprise certified as a minority business enterprise ("MBE") or women business enterprise ("WBE") pursuant to Article 15-a of the New York State Executive Law and the implementing regulations, 9 New York Code of Rules and Regulations subtitle N Part 540 et seq., **OR**
- 3.) is a business enterprise certified as a small disadvantaged business concern pursuant to the Small Business Act, 15 U.S.C. 631 et seq., and the relevant provisions of the Code of Federal Regulations as amended.

Please note that the term "persons of color," as used in this form, means a United States citizen or permanent resident alien who is and can demonstrate membership of one of the following groups:

- (a) Black persons having origins in any of the Black African racial groups;
- (b) Hispanic persons of Mexican, Puerto Rican, Dominican, Cuban, Central or South American descent of either Indian or Hispanic origin regardless of race;
- (c) Native American or Alaskan native persons having origins in any of the original peoples of North America; or
- (d) Asian or Pacific Islander persons having origins in any of the Far East countries, South East Asia, the Indian subcontinent or the Pacific Islands.

1. Are you a business enterprise owned and controlled by women or persons of color in accordance with the standards listed above?

_____ No

_____ Yes

Please note: If you answered “yes” based upon certification by New York State and/or the Federal government, official documentation of the certification must be attached.

2. If you answered “Yes” above, please check off below whether your business enterprise is owned and controlled by women, persons of color, or both.

_____ Women

_____ Persons of Color (*please check off below all that apply*)

_____ Black persons having origins in any of the Black African racial groups

_____ Hispanic persons of Mexican, Puerto Rican, Dominican, Cuban, Central or South American descent of either Indian or Hispanic origin regardless of race

_____ Native American or Alaskan native persons having origins in any of the original peoples of North America

_____ Asian or Pacific Islander persons having origins in any of the Far East countries, South East Asia, the Indian sub-continent or the Pacific Islands

Name of Business Enterprise: _____

Address: _____

Name and Title of person completing questionnaire: _____

Signature: _____

Notary Public

Date

CONTRACTOR'S DISCLOSURE STATEMENT

Instructions:

The County of Westchester, in order to insure that it employs responsible contractors for its major construction projects, requires all bidders for construction contracts (which includes reconstruction and repair) with an estimated value of One Hundred Thousand (\$100,000.00) or more Dollars to answer completely and swear to the questions below. If a Contractor Disclosure Statement has been included with this bid specification, then the County has determined that it is applicable to this bid. All subcontractors whose contract has a value of One Hundred Thousand (\$100,000.00) or more Dollars must also submit a Contractor Disclosure Statement.

Please read the questions carefully and answer them completely. Before you answer these questions, please read the definitions of terms used in these questions. While you may contact the Department of Public Works if you have questions about this form, the County cannot provide you with any legal advice for which you must contact your own lawyer. **FAILURE TO COMPLETE THIS CONTRACTOR DISCLOSURE STATEMENT IN GOOD FAITH MAY RESULT IN THE REJECTION OF YOUR BID.**

If you have previously filled out a Contractor Disclosure Statement for another County bid and only some but not all of your responses have changed, attach a copy of the prior Contractor Disclosure Statement and check #2 below indicating changes only and only answer those questions which have changed since you last filled out the Contractor Disclosure Statement.

If you have previously completed a Contractor Disclosure Statement for another County bid and nothing has changed in your responses to the questions, then check #3 and fill out the attached No Change Affidavit. Attach a copy of the prior Contractor Disclosure Statement to the No Change Affidavit.

NOTE IF THE SPACES PROVIDED FOR ANSWERS ARE NOT SUFFICIENT FOR YOU TO COMPLETE YOUR ANSWER TO A PARTICULAR QUESTION, THEN ATTACH ADDITIONAL PAGES TO THIS CONTRACTOR DISCLOSURE STATEMENT WHICH INDICATE THE NUMBER OF THE QUESTION THAT YOU ARE COMPLETING THE ANSWER FOR.

ALSO DO NOT LEAVE ANY ANSWERS BLANK. IF A QUESTION IS NOT APPLICABLE, ANSWER - N/A – AND OFFER A BRIEF EXPLANATION AS TO WHY THE QUESTION DOES NOT APPLY.

Definitions:

Affiliate – is another Business Entity in which the Contractor or one or more of the Principals of the Contractor has an ownership interest of more than fifty (50%) percent. An Affiliate is also another Business Entity in which the Parent of the Contractor owns more than fifty (50%) percent of that other Business Entity.

Agency or Government Agency – is any Federal, State, City or other local agency including, but not limited to, departments, offices, quasi-public agencies, public authorities and

CONTRACTOR'S DISCLOSURE STATEMENT

corporations, boards of education and higher education, public development corporations and local development corporations.

Assignee – is a person or Business Entity to whom an assignment (e.g., a transfer to another of any property, real or personal, including a transfer of any rights in such property) is made.

Business Address – is the location of principal executive offices and is also the primary place of business in Westchester County, if different.

Business Entity – is any profit-seeking business including, but not limited to, corporations, limited and general partnerships, joint ventures and individual (sole) proprietorships.

Contract – is any binding agreement with any Government Agency or other Business Entity for the provision of goods, or services including, but not limited to, construction.

Contractor – is the Business Entity submitting this Contractor Disclosure Statement.

Contractor Disclosure Statement – is this document.

Control – A Business Entity controls another Business Entity when:

- The controlling Business Entity owns more than fifty (50%) percent of the controlled Business Entity, or
- The controlling Business Entity directs or has the right to direct daily operations of the controlled Business Entity, or
- The same person is a Principal in both businesses and directs the daily operations of the controlled Business Entity.

Investigations – is any official inquiry by any Government Agency, with the exception of background investigations for employment.

Officer – is any individual who serves in the function of chief executive officer, chief financial officer or chief operating officer of the Business Entity by whatever titles known.

Parent – is a Business Entity which owns more than fifty (50%) percent of another Business Entity.

Principal – is an individual, partnership, joint venture or corporation which holds ten (10%) percent or more ownership interest in the Business Entity.

Partner – shall mean a person or Business Entity that has a joint ownership in a particular business, but the ownership interest is not as a shareholder of a corporation.

Successor – is a person or Business Entity that takes the place that another has left. With reference to a corporation, a successor shall mean another corporation which, through amalgamation, consolidation, or other legal succession, becomes invested with the rights and assumes the burdens of the first corporation.

CONTRACTOR'S DISCLOSURE STATEMENT

CONTRACT NO.: _____

☐ Check if Subcontractor

Type Of Submission

(Put a X or √ next to the applicable type of submission)

1. **Fully Completed Contractor Disclosure Statement** _____
(Sign Oath on last page of Disclosure Statement)

2. **Changes Only Contractor Disclosure Statement** _____
(Attach copy of previously filed Contractor Disclosure Statement that you are amending. Denote any changes on the following Contractor Disclosure Statement. Sign Oath on last page of this Disclosure Statement)

3. **No Change** _____
(Fill out "No Change Affidavit" [below] and attach copy of previously filed Contractor Disclosure Statement)

NO CHANGE AFFIDAVIT

I swear that the attached Contractor Disclosure Statement was submitted to the County of Westchester on _____ and was true as signed, and that
(Date)
since the above date nothing has occurred which changes in any way the responses made to the questions contained in the attached Contractor Disclosure Statement.

Submitted by: _____
(Signature)

Name (Print): _____

Title (Print): _____

Sworn to before me this ____ day of _____, 200__

NOTARY PUBLIC

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CONTRACTOR'S DISCLOSURE STATEMENT

Questions:

1. The Business Address and taxpayer identification number of Contractor and primary telephone number for such location.

2. List the Business Addresses and primary telephone numbers for such locations, if different from answer to #1 above, where Contractor has been located over the last five (5) years.

3. List all other names and taxpayer identification numbers under which the Contractor, or the Principals and Officers of Contractor, have conducted business within the prior five (5) years.

4. For any response to #3 above, list any and all Westchester County contracts that were awarded to such "other name" Business Entity.

5. List the type of Business Entity that the Contractor is presently organized as (for example - sole proprietorship, partnership, joint venture or corporation).

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CONTRACTOR'S DISCLOSURE STATEMENT

6. If Contractor is a corporation, list the date that the Contractor was incorporated. Also list the name of the Government Agency and location of said Agency in which a certificate of incorporation, certificate of doing business or equivalent, has been filed and the date of any amendments thereto. If, however, the Contractor is a partnership, list the date that the partnership was formed and the name of the Government Agency and location of said Agency in which a business certificate for partnership or equivalent has been filed.

7. List all the names, current Business Addresses and business telephone numbers of the Principals and Officers of the Contractor. If the Contractor is a partnership, list all partners and their business telephone numbers.

8. List the names, current Business Addresses, telephone numbers and taxpayer identification numbers of all Affiliates of the Contractor.

9. List all the names, Business Addresses and telephone numbers of the Principals and Officers of the Affiliates listed in response to #7 above. If the Affiliate is a partnership, list the Business Addresses and business telephone numbers of all partners.

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CONTRACTOR'S DISCLOSURE STATEMENT

10. Is the Contractor Controlled by another Business Entity? ____ Yes ____ No. If you answered yes, please identify the name, Business Address and telephone number of that Controlling Business Entity and list any contracts that the Controlling Business Entity has had with Westchester County in the past five (5) years?

11. If the Contractor has Control of any other Business Entity that has had a Contract with the County of Westchester in the past five (5) years, please identify the name, Business Address and telephone number of that Controlled Business Entity.

12. List any and all contract sanctions imposed on the Contractor or on a Business Entity listed in response to #3 above that was imposed by a Government Agency during the prior five (5) years, including, but not limited to, all cautions, suspensions, debarments, cancellations of a contract based on business conduct, declarations of default, determinations of ineligibility to bid or whether any proceedings to determine eligibility to bid are pending.

13. List the contract sanction history for the past five (5) years, as defined in #12 above, for any Affiliate of the Contractor.

COMPLETE THIS FORM USING BLACK INK ONLY

CONTRACTOR'S DISCLOSURE STATEMENT

14. If you answered yes to #10 above, list the contract sanction history as defined in #12 above for the Controlling Business Entity during the past five (5) years.

15. List any and all prevailing wage or supplement payment violations; state labor law violations deemed willful and any other federal or state citations, notices, violation orders, pending administrative hearings or proceedings or determinations of a violation of any labor law or regulation regarding the Contractor.

16. List all Investigations of the Contractor, its Principals and Officers or, if a partnership, of the Contractor's Partners. Also list all investigations of Affiliates, their Principals and Officers or, if a partnership, of their Partners.

COMPLETE THIS FORM USING BLACK INK ONLY

CONTRACTOR'S DISCLOSURE STATEMENT

17. Have all Federal and State income tax returns, if required, been filed by Contractor during the last five (5) years? ____Yes ____No If you answered no, please explain why such returns were not filed.

18. Are there any criminal proceedings pending against the Contractor or any Principal or Officer of the Contractor or partner, if Contractor is a partnership? ____Yes ____No If you answered yes, please provide details of the pending criminal proceedings.

19. List the record of all criminal convictions of the Contractor, any Principal or Officer or partner, if Contractor is a partnership, and of any former Principal or Officer, of the Contractor or former partner, if Contractor is a partnership, for any crime related to truthfulness or business conduct and for any felony committed within the prior ten (10) years.

20. List all bankruptcy proceedings that the Contractor or its Affiliates have been the subject of within the past seven (7) years, whether pending or completed.

COMPLETE THIS FORM USING BLACK INK ONLY

CONTRACTOR'S DISCLOSURE STATEMENT

21. Is the Contractor a successor, assignee or Affiliate of a Business Entity that has ever been denied a Contract or deemed ineligible to bid on a Government Agency contract?

____ Yes No ____ If you answered yes, explain below.

OATH

I swear that all of the above answers are true based on my knowledge of the facts, or are believed by me to be true, based upon a review of records containing the facts or based upon information I obtained from someone who has knowledge of the facts; and that I have authority to sign this document; and that the answers given above have not been made in a manner intended to deceive or to defeat the purpose of the Contractor Disclosure Statement, which is to assist the County of Westchester in determining if the Contractor is a responsible bidder.

Submitted by: _____
(Signature)

Name (Print): _____

Title (Print): _____

Sworn to before me this ____ day of
_____, 20__

NOTARY PUBLIC

COMPLETE THIS FORM USING BLACK INK ONLY

REQUIRED DISCLOSURE OF RELATIONSHIPS TO COUNTY

(Prior to execution of a contract by the County, a potential County contractor must complete, sign and return this form to the County)

Contract Name and/or ID No.:

(To be filled in by County)

Name of Contractor:

(To be filled in by Contractor)

A potential County contractor must complete this form as part of the proposed County contract.

- 1.) Are any of the employees that the Contractor will use to carry out this contract also a County officer or employee, or the spouse, child, or dependent of a County officer or employee?

Yes _____ No _____

If yes, please provide details (attach extra pages, if necessary): _____

- 2.) Are any of the owners of the Contractor or their spouses a County officer or employee?

Yes _____ No _____

If yes, please provide details (attach extra pages, if necessary): _____

- 3.) Do any County officers or employees have an **interest**¹ in the Contractor or in any approved subcontractor that will be used for this contract?

Yes _____ No _____

If yes, please provide details (attach extra pages, if necessary): _____

By signing below, I hereby certify that I am authorized to complete this form for the Contractor.

Name: _____

Title: _____

Date: _____

¹ "Interest" means a direct or indirect pecuniary or material benefit accruing to a County officer or employee, his/her spouse, child or dependent, whether as the result of a contract with the County or otherwise. For the purpose of this form, a County officer or employee shall be deemed to have an "interest" in the contract of:

- 1.) His/her spouse, children and dependents, except a contract of employment with the County;
- 2.) A firm, partnership or association of which such officer or employee is a member or employee;
- 3.) A corporation of which such officer or employee is an officer, director or employee; and
- 4.) A corporation of which more than five (5) percent of the outstanding capital stock is owned by any of the aforesaid parties.

QUESTIONNAIRE REGARDING BUSINESS ENTERPRISES
OWNED AND CONTROLLED BY
SERVICE-DISABLED VETERANS

The County believes it is a laudable goal to provide business opportunities to veterans who were disabled while serving our country, and wants to encourage the participation in County contracts of certified business enterprises owned and controlled by service-disabled veterans. As part of the County's program to encourage the participation of such business enterprises in County contracts, and in furtherance of Article 17-B of the New York State Executive Law, we request that you answer the questions listed below.

The term "Certified Service-Disabled Veteran-Owned Business" shall mean a business that is a certified service-disabled veteran-owned business enterprise under the New York State Service-Disabled Veteran-Owned Business Act (Article 17-B of the Executive Law).

1. Are you a business enterprise that is owned and controlled by a service-disabled veteran in accordance with the standards listed above?

_____ No
_____ Yes

2. Are you certified with the State of New York as a Certified Service-Disabled Veteran-Owned Business?

_____ No
_____ Yes

3. If you are certified with the State of New York as a Certified Service-Disabled Veteran-Owned Business, please attach a copy of the certification.

Name of Firm/Business Enterprise: _____

Address: _____

Name/Title of Person completing Questionnaire: _____

Signature: _____

STATE OF NEW YORK)
) ss.:
COUNTY OF)

Notary Public

Date:

SCHEDULE "F"
CRIMINAL BACKGROUND DISCLOSURE
INSTRUCTIONS

Pursuant to Executive Order 1-2008, the County is required to maintain a record of criminal background disclosure from all persons providing work or services in connection with any County contract, including leases of County-owned real property and licenses:

- a.) If any of the persons providing work or services to the County in relation to a County contract are not subject to constant monitoring by County staff while performing tasks and/or while such persons are present on County property pursuant to the County contract; and
- b.) If any of the persons providing work or services to the County in relation to a County contract may, in the course of providing those services, have access to sensitive data (for example SSNs and other personal/secure data); facilities (secure facilities and/or communication equipment); and/or vulnerable populations (for example, children, seniors, and the infirm).

In those situations, the persons who must provide a criminal background disclosure ("Persons Subject to Disclosure") include the following:

- a.) Consultants, Contractors, Licensees, Lessees of County-owned real property, their principals, agents, employees, volunteers or any other person acting on behalf of said Contractor, Consultant, Licensee, or Lessee who is at least sixteen (16) years old, including but not limited to Subconsultants, subcontractors, Sublessess, or Sublicensees who are providing services to the County, and
- b.) Any family member or other person, who is at least sixteen (16) years old, residing in the household of a County employee who lives in housing provided by the County located on County property.

Under Executive Order 1-2008, it is the duty of every County Consultant, Contractor, Licensee, or Lessee to inquire of each and every Person Subject to Disclosure and disclose whether they have been convicted of a crime or whether they are subject to pending criminal charges, and to submit this form with that information.¹ Accordingly, you are required to complete the attached Criminal Background Disclosure Form and Certification.

Please note that under no circumstances shall the existence of a language barrier serve as a basis for the waiver of or an exception from the disclosure requirements of Executive Order 1-2008. If translation services are required by the Consultant, Contractor, Licensee, or Lessee to fulfill this obligation, it shall be at the sole cost and expense of the Consultant, Contractor, Licensee, or Lessee.

Please also note that the conviction of a crime(s) and/or being subject to a pending criminal charge(s) will not automatically result in a denial of a person's right to work on a County contract, right to be on County property, or license, but may, if the County determines that the prior conviction(s) or pending criminal charge(s) create an unacceptable risk. However, if a person fails to list or falsifies any part of his/her conviction history or any pending criminal charge(s) for any reason, he/she may be prohibited from working or being on County property without any risk assessment. If it is later determined that a Person Subject to Disclosure failed to disclose a criminal conviction or pending criminal charge for any reason, his/her right to work on a County contract, be on County property, or license may be terminated at any time.

Please further note that, pursuant to Executive Order 1-2008, and subject to the applicable provisions of New York Correction Law §§ 752 and 753, the County has the right to bar a Person Subject to Disclosure from providing work or services to the County or from being on County property if any such person has:

- a.) A conviction of a crime(s);
- b.) A pending criminal proceeding for a crime(s); or
- c.) Refused to answer questions concerning his/her criminal background

¹ For these disclosures, a "crime" or "pending criminal charge" includes all felonies and misdemeanors as defined under the New York State Penal Law or the equivalent under Federal law or the laws of any other State.

Please finally note that any failure by a County Consultant, Contractor, Licensee, or Lessee to comply with the disclosure requirements of Executive Order 1–2008 may be considered by the County to be a material breach and shall be grounds for immediate termination by the County of the related County contract.

Exemptions

Executive Order 1-2008 exempts from the aforementioned disclosure requirements Persons Subject to Disclosure:

- a.) for whom the County has already conducted a background check and issued a security clearance that is in full force and effect; and
- b.) for whom another state or federal agency having appropriate jurisdiction has conducted a security and/or background clearance or has implemented other protocols or criteria for this purpose that apply to the subject matter of a County contract that is in full force and effect.

If you are claiming an exemption for one or more Persons Subject to Disclosure, you must notify the Procuring Officer². The Procuring Officer will then determine whether the Person(s) Subject to Disclosure are actually exempt, and provide written notification of his/her determination. If the Procuring Officer determines that a Person Subject to Disclosure is not exempt, the Procuring Officer will notify you of that determination, and you will have to include disclosures for that person on your Criminal Background Disclosure Form and Certification.

² Procuring Officer” shall mean the head of the department or the individual or individuals authorized by the head(s) of the department(s) undertaking the procurement and with respect to those matters delegated to the Bureau of Purchase and Supply pursuant to Section 161.11(a) of the Laws of Westchester County, the Purchasing Agent.

Subconsultants, Subcontractors, Sublessees, or Sublicensees

Under Executive Order 1-2008, it is your duty to ensure that any and all approved subconsultants, subcontractors, sublessees, or sublicensees complete and submit the attached Criminal Background Disclosure Form and Certification for all of their respective Persons Subject to Disclosure. This must be done before such a subconsultant, subcontractor, sublessees, or sublicensees can be approved to perform work on a contract.

New Persons Subject to Disclosure

Under Executive Order 1-2008, you have a **CONTINUING OBLIGATION** to maintain the accuracy of the Criminal Background Disclosure Form and Certification (and any accompanying documentation) for the duration of this contract, including any amendments or extensions thereto. Accordingly, it is your duty to complete and submit an updated Criminal Background Disclosure Form and Certification whenever there is a new Person Subject to Disclosure for this contract. **NO NEW PERSON SUBJECT TO DISCLOSURE SHALL PERFORM WORK OR SERVICES OR ENTER ONTO COUNTY PREMISES UNTIL THE UPDATED CRIMINAL BACKGROUND DISCLOSURE FORM AND CERTIFICATION IS FILED WITH THE PROCURING OFFICER.** You shall also provide the County with any other updates that may be necessary to comply with the disclosures required by Executive Order 1-2008.

PLEASE CONTINUE TO THE

Criminal Background Disclosure Form and Certification

BEGINNING ON THE NEXT PAGE

CONTRACT #: _____

Name of Consultant, Contractor, Lessee, or Licensee: _____

CRIMINAL BACKGROUND DISCLOSURE
FORM AND CERTIFICATION

If this form is being completed by a subconsultant, subcontractor, sublessee, or sublicensee, please consider all references in this form to "consultant, contractor, lessee, or licensee" to mean "subconsultant, subcontractor, sublessee, or sublicensee" and check here: _____

I, _____, certify that I am a principal or a
(Name of Person Signing Below)

representative of the Consultant, Contractor, Lessee, or Licensee and I am authorized to complete and execute this Criminal Background Disclosure Form and Certification. I certify that I have asked each Person Subject to Disclosure the following questions:

- **Have you or your company ever been convicted of a crime (all felonies and misdemeanors as defined under the New York State Penal Law or the equivalent under Federal law or the laws of any other State) including, but not limited to, conviction for commission of fraud, embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements or receiving stolen property?**
- **Are you or your company subject to any pending criminal charges (all felonies and misdemeanors as defined under the New York State Penal Law or the equivalent under Federal law or the laws of any other State)?**

I certify that the names and titles of Persons Subject to Disclosure who refused to answer **either** of the questions above are:

1. _____
2. _____
3. _____
4. _____
5. _____

(If more space is needed, please attach separate pages labeled "REFUSED to Answer - Continued.")

I certify that the names and titles of Persons Subject to Disclosure who answered “Yes” to **either of the** questions above are:

1. _____
2. _____
3. _____
4. _____
5. _____

(If more space is needed, please attach separate pages labeled “YES Answers - Continued.”)

Each Person Subject to Disclosure listed above who has either **been convicted of a crime(s)** and/or **is subject to a pending criminal charge(s)** must answer additional questions. Those questions are below.

A Person Subject to Disclosure who has **been convicted of a crime(s)** must respond to the following (please attach separate pages with responses for each person, with their name and title):

- 1.) Describe the reason for being on County property if applicable, identify the specific duties and responsibilities on this project which you intend to perform for the County, including but not limited to, access to sensitive data and facilities and access to vulnerable populations.
- 2.) Please list all criminal convictions along with a brief description of the crime(s) (including all felonies and misdemeanors as defined under the New York State Penal Law or the equivalent under Federal law or the laws of any other State).
- 3.) Please provide the date and place of each conviction.
- 4.) Please provide your age at the time of each crime for which you were convicted.
- 5.) Please provide the legal disposition of each case.
- 6.) Please provide any information either produced by yourself or someone on your behalf in regards to your rehabilitation and good conduct.

A Person Subject to Disclosure who **is subject to a pending criminal charge(s)** must respond to the following (please attach separate pages with responses for each person, with their name and title):

- 1.) Describe the reason for being on County property and if applicable, identify the specific duties and responsibilities on this project which you intend to perform for the County, including but not limited to, access to sensitive data and facilities and access to vulnerable populations.
- 2.) Please identify all pending criminal charges (all felonies and misdemeanors as defined under the New York State Penal Law or the equivalent under Federal law or the laws of any other State).
- 3.) Please briefly describe the nature of the pending charges and the date upon which it is alleged that a crime was committed.

I hereby certify that all of the information provided herein (and in any and all attachments) is true and accurate and that all disclosures required by Executive Order 1-2008 and this Criminal Background Disclosure Form and Certification have been completed. By my signature below, I hereby affirm that all of the facts, statements and answers contained herein (and in any and all attachments) are true and correct. I understand that providing false or incomplete information or withholding by omission or intention pertinent information will be cause for refusing further consideration of my being utilized under this contract.

It is understood and agreed that no Person Subject to Disclosure shall perform work or services or enter onto County property until this required Criminal Background Disclosure Form and Certification is filed with the Procuring Officer.

It is understood and agreed that to the extent that new Persons Subject to Disclosure are proposed to perform work or provide services under this contract after filing of this Criminal Background Disclosure Form and Certification with the Procuring Officer, such new Persons Subject to Disclosure shall not perform work or provide services or enter into County property until an updated Criminal Background Disclosure Form and Certification has been filed with the Procuring Officer.

It is further understood and agreed that the consultant, contractor, lessee, or licensee has a continuing obligation to maintain the accuracy of the Criminal Background Disclosure Form and Certification for the duration of this contract, including any amendments or extensions thereto, and shall provide any updates to the information to the County as necessary to comply with the requirements of Executive Order 1-2008.

Name: _____
Title: _____
Date: _____

Notary Public

Date

SUBCONTRACTOR'S SEALED BID SUBMISSION

Westchester County Contract No.: _____

Name of Subcontractor: _____

Address: _____

Phone #: _____ Fax #: _____

E-mail address: _____

Name of Contractor to whom
this bid is submitted: _____

Scope of Work to be performed by Subcontractor (e.g., electrical, plumbing, HVAC):

The price agreed upon by and between Contractor and Subcontractor for the full
performance of the Subcontractor's work:

\$: _____

In words (e.g, one hundred thousand dollars and xx/100):

Subcontractor

Contractor

Signature

Signature

By _____
(print name & title)

By _____
(print name & title)

**THE SUCCESSFUL LOW BIDDER, BEFORE AWARD OF THE CONTRACT, MUST
PROCURE AND PROVIDE TO THE COUNTY, FROM EACH OF THE ABOVE
DENOTED SUBCONTRACTORS, A CONTRACT DISCLOSURE STATEMENT
(PROPOSAL PAGES 24-32) AND THE REQUIRED DISCLOSURE OF
RELATIONSHIPS TO COUNTY (PROPOSAL PAGES 33-34)**

COMPLETE THIS FORM USING BLACK INK ONLY

INFORMATION FOR BIDDERS



2. INFORMATION FOR BIDDERS

DEPARTMENT OF PUBLIC WORKS

Division of Engineering

INFORMATION FOR BIDDERS

1. ADDENDA AND INTERPRETATION

No interpretation of the meaning of the plans, specifications or other contract documents will be made to any bidder orally. Every request for such interpretation should be in writing addressed to the Westchester County Department of Public Works, Division of Engineering, Room 512, Michaelian Office Building, White Plains, New York, and to be given consideration must be received at least five (5) days prior to the date fixed for the opening of bids. Any and all such interpretations and any supplemental instructions will be in the form of written addenda to the specifications which, if issued, will be posted on the internet not later than three (3) days prior to the date fixed for the opening of bids. Revisions to plans or drawings requiring the issuance of additional or revised drawings will be noted on the internet with instructions how to acquire copies of such revised plans or drawings. Failure of any bidder to receive any such addendum or interpretation or any other form, instrument or document shall not relieve any bidder from any obligation under its bid as submitted. All addenda so issued shall become part of the contract documents.

A bidder's failure to request a clarification, interpretation, etc. of any portion of the plans, specifications, or contract or to point out any inconsistency therein will preclude such bidder from thereafter claiming any ambiguity, inconsistency, or error which should have been discovered by a reasonably prudent bidder and from asserting any claim for damages arising directly or indirectly therefrom.

2. VOIDED CLAUSES

Wherever in this booklet any page is stamped "VOID", only the section(s) or paragraph(s) so stamped are void. All other sections(s) and paragraph(s) remain in full force and effect.

3. PRE-BID SITE INSPECTION

Unless otherwise stated, on building construction work, bidders are free and encouraged to examine the work site during normal work hours preceding the date on which bids are to be opened. For those bidders requesting further clarification of the conditions, an appointment with the County's representative, on the eighth day (Tuesday) prior to the bid opening date, can be requested, by contacting the, Department of Public Works, Division of Engineering at (914) 995-2553.

Each bidder must inform itself fully of the conditions relating to the work to be performed. Failure to do so will not relieve a successful bidder of the obligation to furnish all material and labor necessary to carry out the provisions of the contract documents and to complete the contemplated work for the consideration set forth in its Bid.

At the time of the opening of bids each bidder will be presumed to have inspected the sites and to have read and to be thoroughly familiar with the Plans and Contract Documents (including all addenda).

4. BID SECURITY

Bid Security shall be provided in accordance with the "Notice to Contractors." Where

INFORMATION FOR BIDDERS

a Performance and Payment bond is required in the Notice to Contractors, the executed “Bid Bond and Consent of Surety” of the Proposal Pages must be submitted with the Bid when the bid is more than \$100,000. The successful bidder, no matter the size of its bid, will be required to furnish a Performance and Payment Bond.

Where a Performance and Payment Bond is not specified in the Notice to Contractors, then the required Security may be furnished in the form of a Certified Check; drawn to the order of “County of Westchester, clipped to the top of the front cover and submitted with the Bid.

Certified checks submitted will be returned to all bidders submitting certified checks within three (3) days after the opening of bids unless the bidder or bidders submitting certified checks are among the two lowest bidders. At any time after the opening of bids, the second lowest bidder, if the second lowest bidder has submitted a certified check, may substitute a bid bond for the certified check by presenting the bond to the Secretary of the Board of Acquisition and Contract. This bond shall be in the form and coverage required by the County and shall be in an amount not less than the amount of the bidder's certified check. After receipt, approval and acceptance of the bond by the County, the County will forward to the bidder a County check in an amount equal to the bidder's certified check.

All certified checks submitted will be returned to the two lowest bidders within 48 hours after the successful bidder executes the required contract and furnishes the County with all necessary bonds and insurance certificates.

In the event that the successful bidder has not executed the required contract and furnished the required bonds and insurance certificates within forty-five (45) days after the opening of bids, the County, upon demand from a bidder (except for the successful bidder), will send a County check to the bidder in the amount of the bidder's certified check.

Failure of the successful bidder to execute the contract and furnish the necessary bonds and insurance certificates shall result in forfeiture of the bid security, such sum to be retained by the County as liquidated damages.

5. PERFORMANCE AND PAYMENT BOND

If required pursuant to "Notice to Contractors."

If a Performance and Payment bond is required in accordance with the “Notice to Contractors”, the “Bid Bond and Consent of Surety” of the Proposal Pages must be executed by the Contractor’s Surety Company and submitted with the Bid for all bids over \$100,000.

Simultaneously with its delivery of the executed contract, the successful bidder shall deliver to the County an executed bond in the amount of one hundred percent of the accepted bid as security for the faithful performance of its contract and in the amount of one hundred percent for the payment of all persons performing labor or furnishing materials in connection therewith, prepared in satisfactory form and having as surety thereon such bond underwriter or surety that appears on the U.S. Treasury’s listing of approved sureties (Department Circular 570), and is licensed to transact business in New York State. In the event such Surety ceases to appear on the U.S. Treasury’s listing of approved sureties (Department Circular 570) or ceases to be licensed to transact business in New York State or becomes insolvent or enters liquidation proceedings, the Contractor, at its sole cost, shall furnish a replacement bond from a surety satisfactory to the County.

INFORMATION FOR BIDDERS

The form of contract and Performance and Payment Bond to be used in connection with this Contract and to become a part of the contract documents is attached in the section entitled "Sample Contract and Bond for Construction".

6. INDEMNIFICATION AGREEMENT

The Contractor agrees:

- A. that except for the amount, if any, of damage contributed to, caused by or resulting from the negligence of the County, the Contractor agrees to indemnify and hold harmless the County of Westchester, its officers, employees, elected officials, and agents from and against any and all liability, damage, claims, demands, costs, judgments, fees, attorneys' fees or loss arising directly or indirectly out of the performance or failure to perform hereunder by the Contractor or third parties under the direction or control of the Contractor; and
- B. to provide defense for and defend, at its sole expense, any and all claims, demands or causes of action directly or indirectly arising out of the Agreement and to bear all other costs and expenses related thereto.

7. INSURANCE REQUIREMENTS

The Contractor, upon award of the contract and throughout the term of the Agreement, shall obtain at its own cost and expense the required insurance as delineated below from insurance companies licensed in the State of New York, carrying a Best's financial rating of A or better. Contractor shall provide evidence of such insurance to the County of Westchester ("County"), either by providing a copy of policies and/or certificates as may be required and approved by the Director of Risk Management of the County ("Director"). The policies or certificates thereof shall provide that ten (10) days prior to cancellation or material change in the policy, notices of same shall be given to the Board of Acquisition and Contract of the County of Westchester by registered mail, return receipt requested, for all of the following stated insurance policies, with a copy also sent to the Director of Risk Management of the County. All notices shall name the Contractor and identify the Contract Number.

If at any time any of the policies required herein shall be or become unsatisfactory to the Director, as to form or substance, or if a company issuing any such policy shall be or become unsatisfactory to the Director, the Contractor shall upon notice to that effect from the County, promptly obtain a new policy, and submit the policy or the certificate as requested by the Director to the Office of Risk Management of the County for approval by the Director. Upon failure of the Contractor to furnish, deliver and maintain such insurance, the Agreement, at the election of the County, may be declared suspended, discontinued or terminated.

Failure of the Contractor to take out, maintain, or the taking out or maintenance of any required insurance, shall not relieve the Contractor from any liability under the Agreement, nor shall the insurance requirements be construed to conflict with or otherwise limit the contractual obligations of the Contractor concerning indemnification.

All property losses shall be made payable to the "County of Westchester" and adjusted with the appropriate County personnel.

In the event that claims, for which the County may be liable, in excess of the insured amounts provided herein are filed by reason of Contractor's negligent acts or omissions under the

INFORMATION FOR BIDDERS

agreement or by virtue of the provisions of the labor law or other statute or any other reason, the amount of excess of such claims or any portion thereof, may be withheld from payment due or to become due the Contractor until such time as the Contractor shall furnish such additional security covering such claims in form satisfactory to the Director.

In the event of any loss, if the Contractor maintains broader coverage and/or higher limits than the minimums identified herein, the County shall be entitled to the broader coverage and/or higher limits maintained by the Contractor. Any available insurance proceeds in excess of the specified minimum limits of insurance and coverage shall be available to the County.

The Contractor shall provide proof of the following coverage. (Other coverage may be required by the County of Westchester based on specific needs. If such other coverages are required for a specific contract, those coverages will be described in the "Special Clauses" of the contract specifications):

- a) Workers' Compensation and Employer's Liability. Certificate form C-105.2 or State Fund Insurance Company form U-26.3 is required for proof of compliance with the New York State Workers' Compensation Law. State Workers' Compensation Board form DB-120.1 is required for proof of compliance with the New York State Disability Benefits Law. Location of operation shall be "All locations in Westchester County, New York."

Where an applicant claims to not be required to carry either a Workers' Compensation Policy or Disability Benefits Policy, or both, the employer must complete NYS form CE-200, available to download at: <http://www.wcb.ny.gov>.

If the employer is self-insured for Workers' Compensation, he/she should present a certificate from the New York State Worker's Compensation Board evidencing that fact (Either SI-12, Certificate of Workers' Compensation Self-Insurance, or GSI-105.2, Certificate of Participation in Workers' Compensation Group Self-Insurance).

- b) Commercial General Liability Insurance with a combined single limit of \$1,000,000 (c.s.1) per occurrence and a \$2,000,000 aggregate limit naming the "County of Westchester" as an additional insured on a primary and non-contributory basis. This insurance shall include the following coverages:
 - i. Premises - Operations.
 - ii. Broad Form Contractual.
 - iii. Independent Contractor and Sub-Contractor.
 - iv. Products and Completed Operations.

NOTE: Additional insured status shall be provided by standard or other endorsement that extends coverage to the County of Westchester for both on-going and completed operations.

All Contracts involving the use of explosives, demolition and/or underground work shall provide proof that XCU is covered.

- c) Commercial Umbrella/Excess Insurance: \$2,000,000 each Occurrence and Aggregate naming the "County of Westchester" as additional insured, written on a "follow the form" basis.
- d) Owners Protective Liability Policy naming the County as insured, with a minimum limit of liability per occurrence of \$3,000,000 (where applicable, or as determined by the Director, Risk Management)
- e) Automobile Liability Insurance with a minimum limit of liability per occurrence of \$1,000,000 for bodily injury and a minimum limit of \$100,000 per occurrence for property damage or a

INFORMATION FOR BIDDERS

combined single limit of \$1,000,000 unless otherwise indicated in the contract specifications. This insurance shall include for bodily injury and property damage the following coverages and name the "County of Westchester" as additional insured:

- i. Owned automobiles.
 - ii. Hired automobiles.
 - iii. Non-owned automobiles.
- f) Construction Insurance: For the construction, renovation or repair of bridges, viaducts or similar structures, the Contractor at its own cost and expense shall provide and maintain a "Bridge Builder's Risk Form, All Risk Insurance Contract," with flat premium endorsement, until the construction contract is accepted by the Board of Acquisition and Contract of the County of Westchester. The coverage shall be written for 100% of the completed value, covering the Contractor and County of Westchester as the insureds. The Contractor shall provide the original and duplicate policy to the County (unless the County shall accept, in lieu thereof, all contained endorsements including all applicable provisions and coverages).

For the construction of (a) new buildings and (b) for additions or repairs of existing buildings or structures, the Contractor at its own cost and expense shall provide and maintain a "Builder's Risk Form, All Risk Insurance Contract," with flat premium endorsement, until the construction contract is accepted by the Board of Acquisition and Contract of the County of Westchester. The coverage shall be written for 100% of the completed value, covering the Contractor and County of Westchester as the insureds. The Contractor shall provide the original and duplicate policy to the County (unless the County shall accept, in lieu thereof, all contained endorsements including all applicable provisions and coverages).

All policies of the Contractor shall be endorsed to contain the following clauses:

(a) Insurers shall have no right to recovery or subrogation against the County (including its employees and other agents and agencies), it being the intention of the parties that the insurance policies so effected shall protect both parties and be primary coverage for any and all losses covered by the above-described insurance.

(b) The clause "other insurance provisions" in a policy in which the County is named as an insured, shall not apply to the County.

(c) The insurance companies issuing the policy or policies shall have no recourse against the County (including its agents and agencies as aforesaid) for payment of any premiums or for assessments under any form of policy.

(d) Any and all deductibles in the above described insurance policies shall be assumed by and be for the account of, and at the sole risk of, the Contractor.

INFORMATION FOR BIDDERS

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8. PREVAILING WAGE RATES AND SUPPLEMENTS

A. Wages to be Paid and Supplements to be Provided

Each laborer, workman or mechanic employed by the Contractor(s), Sub-contractor(s) or other person(s) doing or contracting to do the whole or part of the work contemplated by this Contract, shall be paid the prevailing wages and provide the supplements (including but not limited to health, welfare and pension benefits) as required by Article 8 (Section 220-223) and Article 9 (230-239) of the New York State Labor Law.

INFORMATION FOR BIDDERS

B. Schedule of Hourly Rates/Supplements

The "Schedule of Hourly Rates and Supplements" shows the prevailing hourly rates of wages to be paid and supplements to be provided. It is the County's preference that such supplements shall be paid to a Federally qualified Pension, Health and Welfare program and New York State Registered Apprentice Training Program.

Classifications not appearing on the rate sheet can be used only with the consent of the Commissioner of Public Works and then the rate to be paid will be given by the Commissioner of Public Works after advising with the State Department of Labor.

C. Grounds for Cancellation of Contract

In the event of a failure, to pay the prevailing wages and provide the supplements in accordance with the New York State Labor Law, and as described in this Contract, it shall be considered a material breach. For the breach or violation of this provision, without limiting any other rights or remedies to which the County or any individual may be entitled or any civil or criminal penalty for which any violator may be liable, the County shall have the right, in its discretion, to terminate this agreement immediately upon notice. In such event, the Contractor(s), Sub-Contractor(s), et al shall be liable to the County for any additional costs incurred by the County in the completion of the project.

In addition to any other remedies available to the County and irrespective of any applicable penalties pursuant to law, the County may deduct from the amount payable to the Contractor under this contract five hundred (\$500.00) dollars as reimbursement for the costs it incurs in investigating any violation of Section 220 of the Labor Law.

D. Records to be kept on Site

The Contractor(s), Sub-contractor(s), et al. shall certify their payrolls and keep them on site and available, in addition to the following informative records:

- 1) Record of hours worked by each workman, laborer and mechanic on each day;
- 2) Record of days worked each week by each workman, laborer and mechanic;
- 3) Schedule of occupation or occupations at which each workman, laborer and mechanic on the project is employed during each work day and week;
- 4) Schedule of hourly wage rates paid to each workman, laborer and mechanic for each occupation.
- 5) A statement or declaration signed by each workman, laborer and mechanic attesting that they have been provided with a written notice, informing them of the prevailing wage rates and supplements requirement for this contract.

E. Responsibility of the Contractor, Sub-Contractor, et al.

The Contractor(s), Sub-Contractor(s), et al. will display the posters in a conspicuous location at the site and distribute the wallet cards to the employees. These posters and wallet cards will inform the employees that they are entitled to receive the prevailing wages and supplements as determined by the Department of Labor and will list the

INFORMATION FOR BIDDERS

Department of Labor's Public Work field offices, with phone numbers for individuals to call if they believe their rights are being violated.

F. Pay for a Legal Day's Work & Use of Apprentices

The wages to be paid for a legal day's work, as hereinbefore defined, to laborers, workmen or mechanics upon such public works, shall be not less than the prevailing rate of wages as hereinafter defined. Serving laborers, helpers, assistants and apprentices shall not be classified as common labor and shall be paid not less than the prevailing rate of wages as hereinafter defined. No employee shall be deemed to be an apprentice unless he is individually registered in an apprenticeship program which is duly registered with the Industrial Commissioner in conformity with the provision of Article 23 of the Labor Law. The wages to be paid for a legal day's work, as hereinbefore defined, to laborers, workmen or mechanics upon any material to be used upon or in connection therewith shall be not less than the prevailing rate for a day's work in the same trade or occupation in the locality within the state where such public work on, about or in connection with which such labor is performed in its final or completed form is to be situated, erected or used and shall be paid in cash; provided, however, that an employer may pay his employees by check upon a Certificate of the Industrial Commissioner to be issued only after a hearing upon the application to pay by check, which hearing shall be with notice of at least five days to be served personally or by mail on all interested persons, or if not served as aforesaid, then to be published in a manner directed by the Industrial Commissioner, which shall afford interested persons the opportunity to appear and to be heard at such hearing, and after proof has been furnished satisfactorily to the Industrial Commissioner of the employer's financial responsibility and the employer gives assurance that such checks may be cashed by employees without difficulty and for the full amount for which they are drawn. Such Contracts shall contain a provision that each laborer, workman or mechanic, employed by such Contractor, Subcontractor or other person about or upon such public works, shall be paid the wages herein provided.

G. Fiscal Officer's Duty to Determine Schedule of Wages

It shall be the duty of the fiscal officer (the "New York State Commissioner of Labor"), to ascertain and determine the schedule of wages to be paid workmen, laborers and mechanics on each such public work, prior to the time of the advertisement for bids, and such schedule of wages shall be annexed to and form a part of the specifications for the work. Such fiscal officer shall file with the department having jurisdiction such schedule of wages to the time of the commencement of the advertisement for bids on all public works proposed to be constructed. The term "Contract" as used in this subdivision also shall include reconstruction and repair of any such public work.

Where Contracts are not awarded within ninety days of the date of the establishment of the prevailing rate of wages by the fiscal officer, the department of jurisdiction shall request of the fiscal officer a redetermination of a schedule of wages.

H. Penalty for Payment of Less than Prevailing Wages

Any person or corporation that willfully pays after entering into such Contract, less than such stipulated wage scale as established by the fiscal officer shall be guilty of a

INFORMATION FOR BIDDERS

misdemeanor and upon conviction shall be punished for such first offense by a fine of five hundred dollars or by imprisonment for not more than thirty days, or both fine and imprisonment; for a second offense by a fine of one thousand dollars, and in addition thereto the Contract on which the violation has occurred shall be forfeited and no such person or corporation shall be entitled to receive any sum nor shall any officer, agent, or employee of the state, municipal corporation or commission or board appointed pursuant to law pay the same or authorize its payment from the funds under his charge or control to any person or corporation for work done upon any Contract, on which the Contractor has been convicted for a second offense in violation of the provisions of this section.

9. LABOR AND COMPLIANCE WITH LABOR LAW

A. Preference for Westchester Residents

The Contractor agrees that in the performance of the work under this Contract he will give preference, and so far as legally possible, to employ citizens and residents of Westchester County.

B. Certifications To Be Filed

It is agreed that, in accordance with Section 220-d of the Labor Law as amended before final payment by or on behalf of the County for any sum due on account of a Contract for a public improvement, the Contractor and each and every Subcontractor of the Contractor or a Subcontractor is required to file a statement in writing in form satisfactory to the Commissioner of Finance certifying to the amounts then due and owing from such Contractor or Subcontractor filing such statement to or on behalf of any and all laborers for daily or weekly wages or supplements on account of labor performed upon the work under the Contract, setting forth therein the names of the persons whose wages or supplements are unpaid and the amount due to each or on behalf of each respectively, which statement so to be filed shall be verified by the oath of the Contractor or Subcontractor as the case may be that he has read such statement subscribed by him and knows the contents thereof, and that the same is true to his own knowledge.

C. Retention of Funds

It is further agreed that in accordance with Section 220b of the Labor Law, as amended:

- 1) In case any interested person shall have previously filed a protest in writing objecting to the payment to any Contractor or Subcontractor to the extent of the amount or amounts due or become due to him/her for daily or weekly wages or supplements for labor performed on the public improvement for which such Contract was entered into, or if for any other reason it may be deemed advisable, the Commissioner of Finance may deduct from the whole amount of any payment on account thereof the sum or sums admitted by any Contractor or Subcontractor in such statement or statements so filed to be due and owing by him on account of labor performed on such public improvement before making payment of the amount certified for payment in any estimate or voucher, and may withhold the amount so deducted for the benefit of the laborers, workmen or mechanics whose

INFORMATION FOR BIDDERS

wages or supplements are unpaid or not provided, as the case may be, as shown by the verified statements filed by any Contractor or Subcontractor, and may pay directly to any person the amount or amounts shown to be due to him or his duly authorized collective bargaining labor organization, as the case may be, for such wages or supplements by the statements filed as hereinbefore required, thereby discharging the obligation of the Contractor or Subcontractor to the person or his duly authorized collective bargaining labor organization receiving such payment to the extent of the amount thereof, or

- 2) When any interested person shall file a written complaint with the fiscal officer as defined in section 220-b of the Labor Law, alleging unpaid wages or supplements due for labor performed on a public improvement for which a Contract has been entered into, and said labor is alleged to have been performed within the two year period immediately preceding the date of the filing of said complaint, or if, on the fiscal officer's own initiative, unpaid wages or supplements appear to be due, the fiscal officer shall immediately so notify the financial officer of the civil division interested, or, if there are insufficient moneys still due to the Contractor or Subcontractor to satisfy said wages and supplements, including interest and penalty, the financial officer of another civil division which has entered or subsequently enters into a public improvement contract with the Contractor or Subcontractor, who shall withhold from any payment due or earned by the Contractor or Subcontractor executing said public improvement, sufficient moneys to satisfy said wages and supplements, including interest at the rate provided herein, and any civil penalty that may be assessed as provided herein, pending a final determination. The Commissioner of Finance shall immediately confirm in writing to the fiscal officer the amount of money withheld.
- 3) Moneys withheld pursuant to this section shall be held by the Commissioner of Finance for the sole and exclusive benefit of the workers employed on said public improvement and for payment of any civil penalty that may be assessed as provided herein and shall not be used for any other purpose except upon court order. Any person, partnership, association, corporation or governmental body who files a lien or commences a judicial proceeding with respect to any moneys withheld pursuant to this section shall notify the fiscal officer in writing of the lien or claim on or before the date of filing of the lien or commencement of the judicial proceeding. In any proceeding to obtain moneys withheld pursuant to this section by any person, partnership, association, corporation or governmental body, the Commissioner of Labor shall have the right to appear and be heard.
- 4) The fiscal officer shall then cause an investigation to be made to determine whether any amounts are due to the laborers, workmen or mechanics, or on their respective behalves, on such public improvement, for labor performed after the commencement of the three-year period immediately preceding the filing of the complaint or the commencement of the investigation on his own initiative, as the case may be, and shall order a hearing therein at a time and place to be specified and shall give notice thereof, together with a copy of such complaint, or a statement of the facts disclosed upon such investigation, which notice shall be served personally or by mail on all interested persons, including the person complained

INFORMATION FOR BIDDERS

against and upon the financial officer of the civil division; such person complained against shall have an opportunity to be heard in respect to the matters complained of, at the time and place specified in such notice, which time shall be not less than five days from the service of said notice. The fiscal officer in such an investigation shall be deemed to be acting in a judicial capacity and shall have the rights to issue subpoenas, administer oaths and examine witnesses. The enforcement of a subpoena issued under this section shall be regulated by the Civil Practice Law and Rules. Such investigation and hearing shall be expeditiously conducted, and upon such hearing and investigation, the fiscal officer shall determine the issues raised thereon and shall make and file an order in his office stating such determination and forthwith serve a copy of such order, either personally or by mail, together with notice of filing, upon the parties to such proceedings, and if the fiscal officer be the Comptroller, upon the Commissioner of the Department of Labor. Such order shall direct payment of wages or supplements found to be due, including interest at the rate of interest then in effect as prescribed by the Superintendent of Banks pursuant to Section fourteen (a) of the Banking law per annum from the date of the underpayment to the date of payment.

- 5) In addition to directing payment of wages or supplements, including interest found to be due, the order of the fiscal officer may direct payment of a further sum as a civil penalty in an amount not exceeding twenty-five percent of the total amount found to be due. In assessing the amount of the penalty, due consideration shall be given to the size of the employer's business, the good faith of the employer, the gravity of the violation, the history of previous violations of the employer or any successor or substantially-owned affiliated entity or any of the partners if the Contractor or Subcontractor is a partnership or any of the five largest shareholders of the Contractor or Subcontractor, as determined by the fiscal officer, and any officer of the Contractor or Subcontractor who knowingly participated in the violation of this article, and the failure to comply with record keeping or other non-wage requirements. Upon the fiscal officer's determination of the penalty, where the fiscal officer is the Commissioner of the Department of Labor, the penalty shall be paid to said Commissioner for deposit in the State Treasury.
- 6) Upon the entry and service of such order, the Commissioner of Finance shall pay to the claimant, from the moneys due to the Contractor or Subcontractor, the amount of the claim as determined by the fiscal officer and the amount of the civil penalty, if any, shall be paid as provided herein, provided that no proceeding pursuant to Article Seventy-Eight of the Civil Practice Law and Rules for review of said order is commenced by any party aggrieved thereby within thirty days from the date of said order was filed in the office of the fiscal officer. Said proceeding shall be directly in the appellate division of the Supreme Court. Where the fiscal officer is the Commissioner of the Department of Labor, the civil penalty shall be paid to said Commissioner for deposit in the State Treasury. In the event that such a proceeding for review is instituted, moneys sufficient to satisfy the claim and civil penalty shall be set aside by the Commissioner of Finance, subject to the order of the Court.

INFORMATION FOR BIDDERS

- 7) When final determination has been made and such determination is in favor of the complainant, said complainant may in addition to any other remedy provided by this article, institute an action in any Court of appropriate jurisdiction against the person or corporation found violating this article, any substantially-owned affiliated entity or any successor of the Contractor or Subcontractor, any officer of the Contractor or Subcontractor who knowingly participated in the violation of this article, and any of the partners if the Contractor or Subcontractor is a partnership or any of the five largest shareholders of the Contractor or Subcontractor, as determined by the fiscal officer, for the recovery of the difference between the sum, if any, actually paid to him by the Commissioner of Finance pursuant to said order and the amount found to be due him as determined by said order. Such action must be commenced, within three years from the date of the filing of said order, or if the said order is reviewed in a proceeding pursuant to Article Seventy-eight of the Civil Practice Law and Rules, within three years after the termination of such review proceeding.
- 8) When two final determinations have been rendered against a Contractor, Subcontractor, successor, or any substantially owned affiliated entity of the Contractor or Subcontractor, any of the partners if the Contractor or Subcontractor is a partnership, any officer of the Contractor or Subcontractor who knowingly participated in the violation of this article, any of the five largest shareholders of the Contractor or Subcontractor or any successor within any consecutive six-year period determining that such Contractor, Subcontractor, successor, or any substantially-owned affiliated entity of the Contractor or Subcontractor, any of the partners or any of the five largest shareholders of the Contractor or Subcontractor, any officer of the Contractor or Subcontractor who knowingly participated in the violation of this article has willfully failed to pay the prevailing rate of wages or to provide supplements in accordance with this article, whether such failures were concurrent or consecutive and whether or not such final determinations concerning separate public work projects are rendered simultaneously, such Contractor, Subcontractor, successor, or any substantially-owned affiliated entity of the Contractor or Subcontractor, any of the partners if the Contractor or Subcontractor is a partnership or any of the five largest shareholders of the Contractor or Subcontractor, any officer of the Contractor or Subcontractor who knowingly participated in the violation of this article shall be ineligible to submit a bid on or be awarded any public work contract or subcontract with the State, any municipal corporation or public body for a period of five years from the second final determination, provided, however, that where any such final determination involves the falsification of payroll records or the kickback of wages or supplements, the Contractor, Subcontractor, successor, or any substantially-owned affiliated entity of the Contractor or Subcontractor, any partner if the Contractor or Subcontractor is a partnership or any of the five largest shareholders of the Contractor or Subcontractor, any officer of the Contractor or Subcontractor who knowingly participated in the violation of this article shall be ineligible to submit a bid on or be awarded any public work contract with the State, any municipal corporation or public body for a period of five years from the first final determination.

INFORMATION FOR BIDDERS

- 9) Nothing in this subdivision shall be construed as affecting any provision of any other law or regulation relating to the awarding of public contracts.

Pursuant to Section 220-C of the Labor law, any Contractor or Subcontractor who shall upon his oath verify any statement required to be filed herein, which is known by him to be false, shall be guilty of perjury and punishable as provided by the Penal Law.

10. CONTRACTOR'S REPORT OF EMPLOYMENT AND WEEKLY AFFIDAVIT

Each week the Contractor shall furnish to the Commissioner of Public Works the "Contractor's Report Of Employment And Weekly Affidavit" of the Sample Forms.

11. LAWS/REGULATIONS AND APPROPRIATIONS

- A. The Contractor shall, at its own cost and expense, comply with all provisions of the Labor Law (i.e. prevailing rate of wages and supplements), Lien Law, Workmen's Compensation Law and all other laws and ordinances affecting this contract or order, either Federal, State or local.
- B. It is recognized and understood by the Parties that when this Agreement is subject to future appropriation by the Westchester County Board of Legislators for funds not presently appropriated to pay for this Agreement; the County shall have no liability under this agreement beyond the funds, if any, that are appropriated and available for payment of the amounts due under this Agreement. The Parties understand and intend that the obligation of the County to pay the amounts due hereunder shall constitute a current expense of the County and shall not in any way be construed to be a debt of the County in contravention of any applicable constitutional or statutory limitations or requirements concerning the creation of indebtedness by the County, nor shall anything contained in this Agreement constitute a pledge of the general tax revenues, funds or monies of the County. The County shall pay amounts due under this Agreement exclusively from legally available funds appropriated for this purpose. Notwithstanding the foregoing, the County will do all things lawfully within its power to obtain, maintain, and properly request and pursue funds from which payments under this Agreement may be made, including: (i) the County Executive making provisions for such payments to the extent necessary in the annual budget submitted to the Board of Legislators for the purpose of obtaining funding; and (ii) using its reasonable efforts to have such portion of the budget approved.

12. REFUSAL TO ANSWER QUESTIONS

It is understood and agreed by the Contractor that he/she bears an affirmative obligation to answer questions specifically or directly relating to this agreement before any official, board or agency authorized or empowered to inquire into such matters. This section shall not be construed as barring the Contractor, its directors, officers or employees from exercising their constitutional privilege against self-incrimination.

The foregoing, however, shall not be construed as limiting the rights and remedies of the County in the event of such refusal, and when such body or agency is wholly civil in nature,

INFORMATION FOR BIDDERS

failure or refusal to fully cooperate with and diligently answer the inquiries of such official, board or agency may constitute grounds for the termination of this agreement and/or the exercise of any and all other rights or remedies which the County may have by reason of such failure or refusal.

Any and all contracts made with the State, the County of Westchester, or any public department, agency or official thereof, since July 1, 1959 by such person and by any firm, partnership or corporation of which he is a member, partner, director or officer, may be canceled or terminated by the County of Westchester, without incurring any penalty or damages on account of such cancellation or termination, but any monies owing pursuant to said transaction or contract prior to the cancellation and termination, shall be paid.

The successful bidder will be required to make all books and records concerning this contract available during business hours, upon reasonable notice, to duly authorized County personnel for the purpose of ascertaining compliance and/or performance of all provisions of this contract. This provision shall survive the termination of this agreement and for a period of six (6) years thereafter.

13. BID REQUIREMENTS

The Bid must be made on the "Proposal Pages" included in this specification or as provided with an addendum. All blank spaces on said Proposal Pages must be filled in and no change shall be made in the phraseology or in the items as contained therein.

Any bid which fails to name a price per unit of measurement for each of the items for which quantities are given, may be held to be informal and rejected. Bids submitted on Proposal Pages that contain any omissions, alterations, additions or items not called for in the bid documents, or that are illegible, unbalanced, conditional, incomplete or contain irregularities of any kind, may be rejected as informal. If the various parts of the work have been divided into classes and/or items to enable the bidder to bid for different portions of the work in accordance with its estimate of their costs, in the event of any increase or decrease in the quantity will be paid for at the price bid for that particular item. The sum of the amounts for each class or item, obtained by multiplying the approximate quantity by the unit price, shall constitute the total sum bid.

In the event of a discrepancy between the written bid amount and the numerical bid amount, the written amount will take precedence and be controlling as to the amount of the Bid. Any such discrepancy shall be corrected as set forth in Article "Correction Of Errors" of the Information for Bidders.

14. MISCELLANEOUS ADDITIONAL WORK (ITEM W-800)

A. Description - Under this item each Contractor shall furnish all labor, material and equipment required to accomplish miscellaneous additional work:

- 1) Necessitated by encountering during the course of the work field conditions of a nature not determinable during design; or
- 2) For which no unit prices are applicable.

INFORMATION FOR BIDDERS

- B. Method of Measurement - Only that miscellaneous additional work shall be performed by the Contractor and will be paid for by the County, which has been authorized by the Commissioner or the Construction Administrator in writing, prior to its commencement.
- C. Article “Increase or Decrease of Quantities: Elimination of Items” of the Information for Bidders, will still apply relative to the percentage of the total awarded contract price that the work under the contract may be increased or decreased.
- D. Payment - The total amount paid to the Contractor will be determined in strict accordance with the provisions of Article “Extra Work: Increased Compensation/ Decreased Work: Credit to the Owner” of the General Clauses, and such payment will include only that overhead and profit that is applicable to the work performed under this item.
- E. Each Contractor shall include in its total bid the lump sum printed in the Proposal and any bid other than the specified amount will be considered informal.

15. CORRECTION OF ERRORS

Relative to dollar bid items and the required computations as submitted and performed by bidders on the proposal sheets, if there are any inconsistencies derived in multiplying unit bid prices by the stated quantities, the Commissioner reserves the right to reconcile the unit bid prices or the products of the unit bid prices and the stated quantities, when in the Commissioner's professional opinion such reconciliation(s) would concur with the apparent intent of a bidder and the Commissioner's estimated values of the respective bid items of the proposed contract work. In addition to the foregoing, the Commissioner reserves the right to correct all mathematical errors in additions or subtractions.

16. SHOWN QUANTITIES

All bids shall be submitted upon the following express conditions, which shall apply to and become a part of every bid received. The Bidders accept the quantities shown on the Proposal Pages opposite items of the work for which unit prices are to be bid as being approximate estimated quantities. Bidders shall satisfy themselves by personal examination of the location of the proposed work and surroundings thereof, and by such other means as they may prefer, as to the scope of the work and the accuracy of the approximate estimated quantities; and shall not at any time after submission of their bids dispute such approximate estimated quantities nor assert that there was any misrepresentation by the County or any misunderstanding by the Contractor in regard to the quantity or kind of materials to be furnished, or work to be done.

17. QUALIFICATION OF BIDDERS

The County may make such investigation as it deems necessary to determine the ability of the bidder to perform the work, and the bidder shall furnish all information and data for this purpose as may be requested. The County reserves the right to reject any bid if the evidence submitted by, or the investigation of such bidder fails to satisfy the County, in the County's sole discretion, that it is properly qualified to carry out the obligations of the contract and to complete the contemplated work.

INFORMATION FOR BIDDERS

18. REQUIRED EXPERIENCE

The County requires that each contractor possess not less than five (5) year's experience in performing work substantially similar in scope and size to the work for which it is bidding. The contractor agrees that upon request of the County the contractor will furnish a detailed statement of each project that it has performed during the most recent five (5) years (including but not limited to the name and address of the project, the name of the awarding entity/owner, the name of the awarding entity's/owner's representative, a current telephone number where that representative can be reached, the description of the project, general scope of the contractor's work, contract price, dates of performance, whether the contract was terminated for cause or convenience, whether the contract was completed and whether liquidated damages were assessed against the contractor [and if so, provide a written explanation]). The County reserves the right to require additional information as it deems appropriate concerning the history of the contractor's performance of each such contract. The final determination of whether the contractor possesses the requisite experience rests in the sole discretion of the County.

19. INCREASE OR DECREASE OF QUANTITIES: ELIMINATION OF ITEMS

In entering into this contract, the Contractor agrees that quantities shown on the Proposal Pages opposite items of the work for which unit prices have been requested are approximate estimated quantities, and that during the progress of the work the County may find it advisable and shall have the right to omit portions of the work, and to increase or decrease the shown approximate estimated quantities, or the scope of the whole work; and that the County reserves the right to add to or take from the total amount of the work up to a limit of thirty percent of the total amount of the contract based upon the executed contract price for all the specified work.

The Contractor shall make no claim for anticipated profits or loss of profits, because of any difference between the quantities of the various classes of work actually done, or of the materials actually furnished, and the original specified scope of work and the shown approximate estimated quantities.

The aforesaid thirty- percent pertains to the total amount of the contract and not to any individual item. Individual items may be increased or decreased any amount or may be eliminated entirely if so ordered by the Commissioner, excepting that the total amount of the contract as adjusted shall not result in a net increase or decrease of more than thirty percent except by mutual agreement between both parties thereto.

The Contractor waives all claims of any nature due to a misunderstanding of the location, character, or other conditions surrounding the work or of the shown approximate estimated quantities of items of the work.

20. BREAKDOWN COST OF LUMP SUM ITEMS AND CONTRACTS

After award of the contract and prior to actual start of the work, the successful bidder shall submit an itemized schedule of its estimated costs of lump sum items and or lump sum total contract work, for approval by the County. The schedule shall be submitted as an outline series with minor subdivisions, in accordance with the directives of the County. As part of

INFORMATION FOR BIDDERS

this Schedule, the Contractor will be required to include a sum sufficient, as determined in the County's sole discretion, for the preparation and submission of approved final "As-builts", record drawings, guarantees, warranties, and operations and maintenance manuals.

21. ENGINEERING CHARGES

In addition to any and all other remedies available to the County when the work embraced in the contract is not completed on or before the date specified herein, engineering and inspection expenses incurred by the County of Westchester upon the work from the completion date originally fixed in the contract to the final date of completion of the work may be charged to the Contractor and be deducted from monies due the Contractor. Consideration of any extra work or supplemental contract work added to the original contract, as well as extenuating circumstances beyond the control of the Contractor, will be given due consideration by the County before assessing engineering and inspection charges against the Contractor. Such charges will be assessed, however, in cases where in the opinion of the Commissioner, the Contractor has delayed the work.

22. ESTIMATES AND PAYMENTS

As the work progresses but not more often than once a month and then on such days as the Construction Administrator may fix, the Contractor will submit a requisition in writing of the amount and value of the work performed and the materials and equipment provided to the date of the requisition, less any amount previously paid to the Contractor. The Contractor must complete at least ten (10%) percent of the work before submitting any claims for mobilization. From each requisition, the County will retain five percent (5%) plus one hundred fifty percent (150%) of the amount necessary to satisfy any claims, liens or judgments against the Contractor that have not been suitably discharged. The Commissioner will thereupon cause the balance of the requisition therein to be paid to the Contractor. In lieu of all or part of the cash retainage the County shall only accept bonds or notes of United States of America, New York State or political subdivisions thereof. As a condition to the making of any progress payment as set forth in this paragraph, the County, in its sole discretion may require the Contractor to submit such document as may be reasonably required to establish that the Contractor (and its subcontractor(s)) have timely and properly paid their respective subcontractor(s) and materialmen of whatever tier.

VENDOR DIRECT PAYMENT: All payments made by the County to the Contractor will be made by electronic funds transfer ("EFT") pursuant to the County's Vendor Direct program. The Contractor is required to complete the Vendor Direct Payment Authorization Form, which is located in the Forms Section on page 11 and 12. Payments will be automatically credited to the Contractor's designated bank account at the Contractor's financial institution. Payments are anticipated to be deposited two business days after the voucher/invoice is processed for payment. Saturdays, Sundays, and legal holidays are not considered business days. Under the Vendor Direct program you will receive an e-mail notification two days prior to the day the payment will be credited to your designated account. The e-mail notification will come in the form of a remittance advice with the same information that currently appears on County check stubs and will contain the date that the funds will be credited to your account. If there is a discrepancy in the amount received please contact

INFORMATION FOR BIDDERS

your Westchester County representative as you would have in the past if there were a discrepancy in a check.

In the unlikely event that you do not receive the money in your designated bank account on the date indicated in the e-mail, please contact the Westchester County Accounts Payable Department at 914-995-3748. Whenever you change your bank or change or close your account a new Vendor Direct Payment Authorization Form must be submitted. Please contact the Westchester County Accounts Payable Department at 914-995-3748 and a new form will be e-mailed to you. When completing the payment authorization form you must either supply a voided check or have it signed by a bank official to ensure the authenticity of the account being set up to receive your payments. Failure to return the completed authorization form prior to award of the contract may result in the bid being considered non-responsive and the bid may be rejected.

When the work or major portion thereof, as contemplated by the terms of the contract (see Substantial Completion Payment and Final Payment later in this article), are substantially completed in the judgment of the Commissioner, the Contractor shall submit a requisition for the remainder of the contract balance. An amount equal to two (2) times the value of the remaining items to be completed plus one hundred fifty percent (150%) of the amount that the Commissioner deems necessary to satisfy any claims, liens or judgments against the Contractor which have not been suitably discharged shall be deducted from the requisition. As the remaining items of work are satisfactorily completed or corrected, the County will, upon receipt of a requisition, pay for these items less one hundred fifty percent (150%) of the amount necessary to satisfy any claims, liens or judgments.

Contractor agrees, in the event of any withdrawal by the contractor of amounts retained from payments to the contractor pursuant to the terms hereof, that notwithstanding any contrary interpretation of Section 106 of the New York General Municipal Law, the contractor will be obliged to maintain the market value of securities deposited in an amount equal to the amount withdrawn pursuant to said Section 106. The Contractor will, within five (5) days of demand therefore by the fiscal officer of the County, deposit with such fiscal officer cash, or securities of the kind provided in Section 106, of a market value sufficient to maintain the market value of all securities on deposit at a level equal (as of the date such notice of the fiscal officer is given to the contractor) to the amount which the County shall be entitled to retain from payments to the contractor pursuant to the terms of the contract.

All estimates will be made for actual quantities for work performed and materials and equipment incorporated in the work as determined by the measurements of the Engineer, and this determination shall be accepted as final, conclusive and binding upon the Contractor. All estimates will be subject to correction in any succeeding estimate.

Payment will be made for materials pertinent to the project which have been delivered to the site or off-site by the Contractor and/or Subcontractor and suitably stored and secured in first-class condition as required by the Construction Administrator. Payment may be limited to materials in short and/or critical supply and materials specially fabricated for the project, as defined by the contract. Payment will be made only upon the written request of the contractor. The Contractor must submit certified copies of the manufacturer's or vendor's invoices or statements establishing the true purchase value of the material or equipment; freight bills, release of liens and certificate of insurance covering all equipment and materials. Then the County will include in the following monthly payment an amount not to

INFORMATION FOR BIDDERS

exceed the lesser of the bid breakdown or the total purchase price of the stored equipment and materials less retainage provided that such equipment and materials are suitable for their intended use.

The Contractor shall be responsible for safeguarding stored equipment and materials against loss or damage of any nature whatsoever, shall retain title until incorporated into the work and acceptance by the County and in case of loss or damage, the Contractor shall replace such lost or damaged equipment and materials at no cost to the County.

After receipt of payment, the Contractor shall not remove from the site equipment and materials for which such payment was made without written authorization from the Commissioner.

No major equipment item shall be brought to the site until the following conditions are met:

- 1) The County must have received the manufacture's recommendations for on-site storage in writing.
- 2) The structure in which the equipment is to be installed is roofed (roofing must be watertight) and has such protection of doorways, windows, and other openings that will provide reasonable protection from the weather.
- 3) Prior to the County making a Partial Payment on a major equipment item the following conditions must be met:
 - a. The Contractor must certify to the County, in writing, that the equipment has been properly stored.
 - b. The Shop Drawings must be approved and the draft Operation and Maintenance Manuals must have been submitted.

The Contractor shall furnish to the Construction Administrator, prior to the making up of any Partial or Final Estimate, a copy of its and its Subcontractors' weekly payrolls for each and every preceding payroll period. The payroll submitted shall be a certified true copy and shall contain full information including but not limited to the number of hours worked, rate, classification and total sum paid each employee charged to or working on the job. With all except the first estimate, the Contractor shall furnish to the Construction Administrator a sworn statement listing all unpaid bills and liabilities incurred under the Contract.

A. Substantial Completion Payment

- 1) Within thirty (30) days after receiving written notice from the Contractor of substantial completion of the work under this Agreement, the Commissioner will cause an inspection to be made of the work done under this contract. If, upon such inspection, the Engineer determines that the work is substantially complete, a Substantial Completion Payment to the Contractor for the work done under this Contract, less any and all deductions authorized to be made by the Commissioner under this contract or by law, will be issued.
- 2) Such a Payment shall be considered a Partial and not a Final Payment.
- 3) As a condition precedent to receiving payment therefore, the Contractor must have received County approval of all Shop Drawing submittals, the Operation and Maintenance Manuals, and As-Built Drawing(s). Together with its application for substantial completion payment the Contractor shall also deliver to the

INFORMATION FOR BIDDERS

Construction Administrator a verified statement certifying that all claims or liabilities arising from the completed work, including all charges for Extra Work, Change Orders, additional time, damages or credits (collectively referred to as "claims") have been presented to the County. All such claims shall be described in sufficient detail so as to be easily identified. The Contractor's failure to submit the verified statement shall constitute a full and final waiver of all claims against the County from the beginning of the project through the date of substantial completion as established by the County. The presentation of the verified statement to the County shall not constitute an acknowledgement by the County that any such claim is valid. The County expressly reserves its right to assert that any such claim(s) is waived or precluded by reason of other provisions of the contract documents. Only claims particularly identified on the Contractor's verified statement shall be preserved; all other claims whatever nature shall be deemed waived and released. It shall also submit proof of title of the materials and equipment covered by the contract. The Contractor shall also, prior to the issuance of said Substantial Completion Payment, supply to the County affidavits and certificates for labor, material and equipment (where applicable).

B. Final Payment

- 1) Within ten (10) days after receiving written notice from the Contractor of completion of all the work, the Engineer will make a final inspection. If upon inspection the Engineer determines that no further work is needed, the Commissioner will request that the Board of Acquisition and Contract approve the completion of the project and authorize payment of the Final Estimate. Also required prior to the Board of Acquisition and Contract approval is a Condition Report by the Contractor that any damage of public or privately owned properties resulting from the Contractor's work has been satisfactorily repaired.
- 2) As a condition precedent to receiving Final Payment therefore the Contractor shall submit a supplementary verified statement similar to that required under, "A. Substantial Completion Payment", hereof. This verified statement must include only those charges for Extra Work, Change Orders, additional time, damages or credits (collectively referred to as "claims") that accrued between substantial completion and final completion. The Contractor's failure to submit the verified statement shall constitute a full and final waiver of all claims against the County from the beginning of the project through the date of substantial completion as established by the County. The presentation of the verified statement to the County shall not constitute an acknowledgement by the County that any such claim is valid. The County expressly reserves its right to assert that any such claim is waived or precluded by reason of other provisions of the contract documents. Only claims particularly identified on the Contractor's supplementary verified statement shall be preserved; all other claims of whatever nature shall be deemed waived and released.
- 3) The Contractor shall also, prior to the issuance of Final Payment, supply to the County affidavits and certificates for labor, material and equipment (where applicable).

INFORMATION FOR BIDDERS

- 4) The County will, not less than thirty (30) days after the Final Acceptance of the work under this contract, by the Board of Acquisition and Contract, pay the Contractor upon the receipt of all required documentation the balance of funds due thereunder after deduction of all previous payments, liens and all percentages and amounts to be kept and retained under provision of this contract.

All prior Partial Payments, being merely estimates made to enable the Contractor to prosecute the work more advantageously, shall be subject to correction in the Final Estimate and Payment

- 5) The acceptance by the Contractor or by anyone claiming by or through him of the Final Payment shall operate as and shall be a release to the County and every officer and agent thereof, from any and all claims of the Contractor for anything done or furnished in connection with this work or project and for any act or omission of the County or of any others relating to or affecting the work. No payment, however, final or otherwise, shall operate to release the Contractor or its Sureties from any obligation under this contract or the Performance and Payment Bond. Should the Contractor refuse to accept the final payment as tendered by the County, it shall constitute a waiver of any rights to interest thereon. Nor shall refusal to accept final payment extend any applicable statute of limitation.

23. PAYMENTS TO SUBCONTRACTORS AND MATERIALMEN BY CONTRACTOR

Within fifteen calendar days of the receipt of any payment from the County, the contractor shall pay each of its sub-contractors and materialmen the proceeds from the payment representing the value of the work performed and/or materials furnished by the subcontractor and/or materialmen as reflected in the payment from the owner less an amount necessary to satisfy any claims, liens or judgment against the subcontractor or materialman which have not been suitably discharged and less any retained amount as hereafter described. The contractor shall retain not more than five per centum of each payment to the subcontractor and/or materialman except that the contractor may retain in excess of five per centum but not more than ten per centum of each payment to the subcontractor provided that prior to entering into a subcontract with the contractor, the sub-contractor is unable or unwilling to provide a performance bond and a labor and material bond both in the full amount of the sub-contract at the request of the contractor. However, the contractor shall retain nothing from those payments representing proceeds owed the subcontractor and/or materialman from the County's payments to the contractor for the remaining amounts of the contract balance as provided in Article "Estimates and Payments" of the Information For Bidders. Within fifteen calendar days of the receipts of payment from the contractor, the subcontractor and/or materialman shall pay each of its subcontractors and materialmen in the same manner as the contractor has paid the subcontractor.

Nothing provided herein shall create any obligation on the part of the County to pay or to see the payment of any moneys to any subcontractor or materialman from any contractor nor shall anything provided herein serve to create any relationship in contract or otherwise, implied or expressed between the subcontractor or materialman and the County. Notwithstanding anything to the foregoing, the County may tender payments to the Contractor in the form of joint or dual payee checks.

INFORMATION FOR BIDDERS

NOTICE: No direct payment will be made for work done or materials furnished under the General Clauses, Information for Bidders, General Clauses and Special Clauses, except where expressly stated elsewhere, but compensation shall be deemed to be included in the contract lump sum price for the total work and/or the contract unit prices for the various items of the work.

24. TIME OF STARTING

Time being of the essence, all bidders shall take notice that the timely completion of the work called for under this contract is of the greatest importance. The contractor shall commence its work within ten (10) days after "notice to proceed" has been given it by the Commissioner (unless a definite starting date is stated). Prior to commencing its work, the Contractor shall notify the Director of Project Management, Division of Engineering and Department of Public Works, at least forty-eight (48) hours prior to the planned date of its "start", so that a Construction Administrator can be assigned to the work.

25. SAFETY AND HEALTH REGULATIONS FOR CONSTRUCTION AND DEMOLITION WORK

At all times the Contractor shall use all required and necessary precautions for the safety and protection of the public, County personnel, construction employees, and private and public property on or adjacent to the work.

The Contractor shall comply fully with all the applicable provisions of the following listed governmental regulations and standards, noting that in case of conflict, the Contractor shall comply with the most stringent rule or regulation:

- 1) State of New York, Department of Labor, Bureau of Standards and Appeals, Industrial Code Rule 23 "Protection of Persons Employed in Construction and Demolition Work."
- 2) United States Department of Labor, Bureau of Labor Standards, "Safety and Health Regulations for Construction," as promulgated in accordance with the Occupational Safety and Health Act of 1970, Public Law 91-596; 84 Stat. 1590, Laws of 91st Congress - 2nd Session.

It shall be the sole responsibility of the Contractor to ascertain which of the regulations and standards contained in the foregoing listed publications effect its construction activities, and it shall be solely responsible for the penalties resulting from its failure to comply with such applicable rules and regulations. Copies of the listed publications are available for reference purposes only, in the Westchester County Department of Public Works, Division of Engineering, Design Section, Room 500, Michaelian Office Building, White Plains, New York.

The West Nile Mosquito control program:

- 1) Routinely, the work site should be inspected for potential habitats (i.e. stagnant/standing water) for mosquitoes.
- 2) Conditions that would require remediation include: improper site grading, ruts/other depressions, water in debris (i.e. containers, tires, etc.), stored or

INFORMATION FOR BIDDERS

discarded materials, and excavations, and those cited by the Construction Administrator.

- 3) Under the direction of the Construction Administrator, the Contractor shall take all necessary preventive and/or corrective action to eliminate the potential breeding grounds.

26. ACCIDENT PREVENTION AND FIRST AID FACILITIES

In addition to conforming to the applicable governmental regulations and standards referred to in Article "Fire Prevention And Control" of the Information For Bidders, the Contractor shall conduct its work in accordance with the recommendations contained in the latest edition of the "Manual of Accident Prevention in Construction," as published by the Associated General Contractors of America, Inc. and the most recent safety codes approved by the American Standards Association. In case of the conflict with the referenced governmental regulations and standards, the most stringent regulation, standard or recommendation shall govern.

Further, and without in any way limiting the Contractor's obligations hereunder, and in accordance with the instructions of the Construction Administrator, the Contractor shall provide barricades, warning lights, danger and caution signs and other safeguards at all places where the work in any way is a hazard to the public.

The Contractor shall also provide and maintain upon the site at each location where major work is in progress, a completely equipped first aid kit that shall be readily accessible when construction activities are in progress. Posted on each first aid kit shall be the name, location and telephone number of the nearest hospital or doctor with whom the Contractor has previously made arrangements for emergency treatment in case of accident.

27. FIRE PREVENTION AND CONTROL

The Contractor shall abide by such rules and instructions as to fire prevention and control as the municipality having jurisdiction may prescribe. It shall take all necessary steps to prevent its employees from setting fires not required in the construction of the facility and shall be responsible for preventing the escape of fires set in connection with the construction.

It shall at all times provide the proper housekeeping to minimize potential fire hazards, and shall provide approved spark arresters on all steam engines, internal combustion engines and fuels.

Free access to fire hydrants and standpipe connections shall be maintained at all times during construction operations, and portable fire extinguishers shall be provided by the Contractor and made conveniently available throughout the construction site. The Contractor shall also notify its employees of the location of the nearest fire alarm box at all locations where work is in progress.

INFORMATION FOR BIDDERS

28. STATE AND LOCAL SALES TAX EXEMPTION

The Contractor's attention is directed to Section 1115 of the Tax Law of New York State, Chapters 513 and 514 of the Laws of 1974. In connection with capital improvement contracts entered into on or after September 1, 1974, all tangible personal property which will become an integral component of a structure, building or real property of New York State, or any of its political sub-divisions, including the County of Westchester, is exempt from State and local retail sales tax and compensating use tax.

Bidders' proposals shall exclude dollar amounts for the payment of State and Local retail sales tax and compensating use tax, for tangible personal property defined above.

The successful bidder shall be obliged to file the required Contractor Exempt Purchase Certificates, which may be obtained from the New York State Department of Taxation and Finance (1-800-462-8100), in order to utilize such exemption.

29. APPRENTICES

The attention of all bidders is directed to Section 220(3-e) of the New York State Labor Law, which is hereby incorporated herein by reference, which requires, among other things, that "Apprentices who are registered under a Bona Fide New York State Registered Apprentice Training Program shall be permitted to work."

30. AFFIRMATIVE ACTION PROVISION

During the performance of this Contract, the Contractor agrees that it will not discriminate against any employee or applicant for employment because of race, color, religion, sex, national origin, age or handicap. Contractor shall take affirmative action to ensure that applicants are employed and that employees are treated during employment without regard to their race, color, religion, sex, national origin, age or handicap. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoffs or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. Contractor agrees to include, or require the inclusion of the above provision in any subcontract made pursuant to its contract with the County.

31. AFFIRMATIVE ACTION PROGRAM REQUIREMENT

Relative to the award of this Contract, it is required that all bidders completely answer all questions contained in the questionnaire entitled "Affirmative Action Program Requirement" of the Proposal Pages, and properly attest to same.

It is also required that all subcontractors completely answer all questions contained in the questionnaire entitled "Affirmative Action Program Requirement-Subcontractors" of the Sample Forms, and properly attest to same. This form is to be submitted with the request to utilize subcontractor(s).

INFORMATION FOR BIDDERS

32. AUTHORITY TO DO BUSINESS IN NEW YORK

Any corporation not incorporated under the Laws of New York State, must furnish a copy of its certificate of authority, from the New York State Secretary of State, to do business in the State of New York, in accordance with Article 13 of the New York State Business Corporation Law.

33. LICENSE REQUIREMENTS (ELECTRICAL)

- A. In accordance with the requirements of Local Law No. 20-1997 of Westchester County, no person shall perform work under any contract with the County of Westchester except (i) a licensed Master Electrician; (ii) a licensed "Special Electrician"; or (iii) a Journeyman Electrician working under the direct supervision and control of a Master Electrician.

In no event shall the County incur any liability to pay for any electrical work performed in violation of the licensing requirements of Local Law No. 20-1997 of Westchester County.

- B. Contract with separate bids:

If the project is one where separate bid specifications are required pursuant to the provisions of the New York General Municipal Law, then any person, partnership, corporation, business organization or other business entity submitting a bid for the electrical portion of the project must possess, at the time of submission of the Bid, a valid Master/"Special" Electrician's license issued by the Westchester County Electrical Licensing Board in accordance with Chapter 277 Article XVII of the Laws of Westchester County and the Westchester County Electrical Licensing Board Rules & Regulations, in particular No. 11, which states as follows:

No individual holding a Master Electrician's License shall lend such License to any person or allow any other person to carry on, engage in, or labor at the business as defined herein of installing, removing, altering, testing, replacing, or repairing electrical systems. A violation of this section by any person holding a License shall be sufficient cause for revocation of such License.

However, nothing herein shall be construed to prohibit the use of a License by the holder thereof for or on behalf of a partnership, corporation or other business association, provided that fifty-one (51) percent or more of the control of the voting capital stock of such partnership, corporation, or other business association is owned by one (1) or more holders of a Westchester County Master Electrical License and that all work performed by such partnership, corporation or other business association is performed by or under the direct supervision of such License holder or holders.

- C. Contract with single bid:

Where the project does not involve separate bids pursuant to the New York General Municipal Law but where some electrical work is contemplated along with other work, the person, firm, partnership or corporation engaged to perform said electrical work

INFORMATION FOR BIDDERS

must possess a valid Master/"Special" Electrician's license issued by the Westchester County Electrical Licensing Board.

- D. An electrical bidder must complete the "Certificate of License (Electrical)" of the Proposal Pages and will be required to furnish a copy of such license with the sealed Bid. Other bidders will be required to furnish a copy of such license for the applicable person engaged to perform the electrical work when request by the County, prior to awarding the contract.
- E. The license must be maintained at all times during the performance of the work contemplated under the contract. The suspension, revocation or the failure to maintain or renew such license shall, in addition to any other right or remedy available to the County, be grounds for immediate termination of the contract, effective immediately upon notice from the Commissioner.

34. LICENSE REQUIREMENTS (PLUMBING)

- A. In accordance with the requirements of Chapter 277, Article XV of the Laws of Westchester County, no person shall perform plumbing work under any contract with the County of Westchester except (i) a licensed Master Plumber; (ii) a certified Journey Level Plumber employed by and under the direction of a licensed Master Plumber; or (iii) an Apprentice Plumber working under the direct supervision and control of a Master Plumber or under the direct supervision and control of a certified Journey Level Plumber in the employ of a licensed Master Plumber.

In no event shall the County incur any liability to pay for any plumbing work performed in violation of the licensing requirements of Chapter 277, Article XV of the Laws of Westchester County.

- B. Contract with separate bids:

If the project is one where separate bid specifications are required pursuant to the provisions of the New York General Municipal Law, then any person, partnership, corporation, business organization or other business entity submitting a bid for the plumbing portion of the project must possess, at the time of submission of the Bid, a valid Master Plumber's license issued by the Westchester County Board of Plumbing Examiners in accordance with the Westchester County Board of Plumbing Examiners Rules and Regulations and Chapter 277 Article XV of the Laws of Westchester County, in particular Section 277.509A, which states as follows:

- A. No holder of a license or certification issued under this article shall authorize, consent to or permit the use of his or her license or certification by or on behalf of any other person. No person who has not qualified or obtained a license or certification under this article shall represent himself or herself to the public as holder of a license or certification issued under this article, either directly, by means of signs, sign cards metal plates or stationery, or indirectly in any other manner whatsoever. However, nothing herein shall be construed to prohibit the use of a license by the holder thereof for or on behalf of a partnership, corporation or other business association, provided that 51 percent or more of the control of the voting capital stock of such partnership, corporation or other business

INFORMATION FOR BIDDERS

association is owned by one or more holders of a Westchester County master plumbing license and that all work performed by such partnership, corporation or other business association is performed by or under the direct supervision of such license holder or holders.

C. Contract with single bid:

Where the project does not involve separate bids pursuant to the New York General Municipal Law but where some plumbing work is contemplated along with other work, the person, firm, partnership or corporation engaged to perform said plumbing work must possess a valid Master Plumber's license issued by the Westchester County Board of Plumbing Examiners.

- D. A plumbing bidder must complete the "Certificate of License (Plumbing)" of the Proposal Pages and will be required to furnish a copy of such license and the County issued identity badge with the sealed Bid. Other bidders will be required to furnish a copy of such license and the County issued identity badge for the applicable person engaged to perform the plumbing work when request by the County, prior to awarding the contract.
- E. A restricted Master Plumber's license issued by the Westchester County Board of Plumbing Examiners shall satisfy the requirements of this section provided such restricted license authorizes the Master Plumber to engage in the business of plumbing within the local municipality in which the work under the contract is to be performed.
- F. The license must be maintained at all times during the performance of the work contemplated under the contract. The suspension, revocation or the failure to maintain or renew such license shall, in addition to any other right or remedy available to the County, be grounds for immediate termination of the contract, effective immediately upon notice from the Commissioner.

35. LICENSE REQUIREMENTS (HAULERS)

(Haulers Of Solid Waste; Recyclables; Construction And Demolition Debris; Garden And Yard Waste And/Or Scrap Metal)

A. DEFINITIONS:

- 1) "Class A" refers to all haulers except those whose hauling business is limited solely to Class C, Class D or Class E activities or whose recycling business is limited to Class B activities. Class A Licensees may also conduct Class B, Class C, Class D and Class E activities.
- 2) "Class B" refers to Recyclable brokers. Class B Licensees may also conduct Class C, Class D and Class E activities.
- 3) "Class C" refers to haulers who exclusively handle construction and demolition debris. Class C Licensees may also conduct Class D and Class E activities. With respect to Class C haulers, the following shall apply: a. Class "C-1" shall refer to a business or subsidiary which generates construction and demolition debris, as defined herein, and which, incidental to such business, transports, stores, processes, transfers or disposes of the construction and demolition debris generated by the

INFORMATION FOR BIDDERS

operations of such business or subsidiary. Class "C-1" Licensees may also conduct Class E activities; b. Class "C-2" shall refer to all other businesses which otherwise transport, collect, store, transfer, process, or dispose of construction and demolition debris. Class "C-2" haulers may also conduct Class "C-1", Class D and Class E activities.

- 4) "Class D" refers to (i) haulers who collect, store, transport, transfer, process or dispose of garden and yard waste generated, originated or brought within the County where such garden and yard waste was previously generated by a person or entity other than the Licensees and/or (ii) haulers who collect, store, transport, transfer, process or dispose of garden and yard waste and which own, lease, or control one or more vehicles having three (3) or more axles which vehicles will be used in the collection, storage, transfer, transportation, processing or disposal of garden and yard waste generated, originated or brought within the County.
- 5) "Class E" refers to haulers who exclusively conduct a scrap peddler business.
- 6) "Construction and Demolition Debris" means uncontaminated Solid Waste resulting from the construction, remodeling, repair and demolition of structures and roads, and uncontaminated Solid Waste consisting of vegetation resulting from land clearing and grubbing, utility line maintenance and seasonal and storm-related cleanup. Such waste includes, but is not limited to, bricks, concrete and other masonry materials, soil, rock, wood, wall coverings, plaster, drywall, plumbing fixtures, non-asbestos insulation, roofing shingles, asphaltic pavement, glass, plastics that are not sealed in a manner that conceals other waste, electrical wiring and components containing no hazardous liquids, metals, and trees or tree limbs that are incidental to any of the above.
- 7) "Hauler" means any person excluding municipalities, the County and any County district including, but not limited to, Refuse Disposal District No. 1 and all County sewer and water districts, who, for a fee or other consideration, collects, stores, processes, transfers, transports or disposes of Solid Waste, Recyclables or construction and demolition debris that is generated or originated within the County or brought within the boundaries of the County for disposal, storage, transfer or processing.
- 8) "Recyclables" means those materials defined as "Recyclables" under Section 825.30 (8) of the Westchester County Source Separation Law.
- 9) "Scrap Peddler" shall mean any person who collects scrap materials for sale to a Recyclable broker using no more than one vehicle for collection and transportation of such materials.
- 10) "Solid Waste" means all putrescible and non-putrescible materials or substances, except as described in Paragraph 4 of 6 NYCRR Part 360-1.2(a), and/or regulated under 6 NYCRR Part 364, that are discarded or rejected as being spent, useless, worthless or in excess to the owners at the time of such discard or rejection including, but not limited to, garbage, refuse, commercial waste, rubbish, ashes, incinerator residue and construction and demolition debris. "Solid Waste" shall not be understood to include Recyclables as defined above.

INFORMATION FOR BIDDERS

- B. **PLEASE TAKE NOTICE** - In accordance with the requirements of Chapter 826-a, Article III of the Laws of Westchester County, it is unlawful for any person to collect, store, transfer, transport or dispose of solid waste; recyclables; construction and demolition debris; garden and yard waste and/or scrap metal, as defined herein, that is generated or originated within the County or brought within the boundaries of the County for disposal, storage, transfer or processing, or to conduct any activities defined as Class A, Class B, Class C, Class D or Class E activities under Chapter 826-a of the Laws of Westchester County, in Westchester County (hereinafter collectively referred to as "hauling") without having first obtained a license therefore from the Westchester County Solid Waste Commission.

In no event shall the County incur any liability with respect to any hauling activities conducted by the bidder or any subcontractor of the bidder in violation of Chapter 826-a of the Laws of Westchester County.

- C. Where the project necessitates that hauling be performed, either the bidder or the person, partnership, corporation, business organization or other business entity engaged to perform such hauling work on behalf of the bidder (hereinafter the "subcontractor") must possess a valid license issued by the Westchester County Solid Waste Commission at the time of submission of the bid and throughout the duration of any contract issued pursuant thereto.
- D. A hauler bidder must complete the "Certificate of License (Hauler)" of the Proposal Pages and will be required to furnish a copy of such license with the sealed bid. Other bidders will be required to furnish a copy of such license for the applicable person engaged to perform the hauling work when requested by the County, prior to awarding the contract.
- E. The suspension, revocation, or the failure to maintain or renew such license may, in addition to any other right or remedy available to the County, be grounds for termination of the contract, effective immediately upon notice from the Commissioner. The bidder which is awarded the contract hereunder shall have a continuing obligation to notify the Commissioner, within (2) business days, of any suspension, revocation or other action taken with respect to any license issued by the Westchester County Solid Waste Commission which may limit or impair the bidder's ability, or the ability of any authorized subcontractor, to perform such hauling work in the County of Westchester.

It shall be the bidder's responsibility to ensure that any subcontractor who will perform the hauling services required under any contract issued pursuant to this bid specification has a valid license for the duration of the term of any contract awarded hereunder.

- F. In the event that a license held by the bidder or its subcontractor is revoked, suspended or otherwise discontinued by the Westchester County Solid Waste Commission, or in the event that the bidder is otherwise required to obtain the services of a new or alternate subcontractor for the hauling work, the bidder shall immediately notify the Commissioner and seek the Commissioner's approval for the use of such subcontractor to provide the hauling services which are required under the contract, and shall provide the Commissioner with a copy of the license issued by the Westchester County Solid Waste Commission to such subcontractor. No bidder or subcontractor shall provide

INFORMATION FOR BIDDERS

hauling services under the contract until a copy of its license has been provided to the Commissioner and the Commissioner has approved of such bidder or subcontractor.

36. MINORITY PARTICIPATION POLICY

- A. Pursuant to Chapter 308 of the Laws of the County of Westchester, the County encourages the meaningful and significant participation of business enterprises owned by persons of color and women - Minority Business Enterprise (MBE) and Women Business Enterprise(WBE); on County of Westchester contracts.
- B. It is the goal of the County of Westchester to use its best efforts to encourage, promote and increase participation of business enterprises owned and controlled by persons of color or women (MBE/WBE) in contracts and projects funded by all departments of the County and to develop a policy to efficiently and effectively monitor such participation.
- C. In recognition of the need to promote the development of business enterprises owned and controlled by persons of color and women to achieve a goal of equal opportunity, and overcome the existing under representation of these groups in the business community, the County of Westchester acting through its Office of Economic Development shall as a lawful public and County purpose provide technical and informational assistance to such business enterprises with a particular emphasis on education programs to encourage participation in the contract procurement process.
- D. For the purposes of this Local Law, a business enterprise owned and controlled by women or persons of color shall be construed to mean a business enterprise including a sole proprietorship, partnership or corporation that is: (a) at least 51% owned by one or more persons of color or women; (b) an enterprise in which such ownership by persons of color or women is real, substantial and continuing; (c) an enterprise in which such ownership interest by persons of color or women has and exercises the authority to control and operate, independently, the day-to-day business decisions of the enterprise; and (d) an enterprise authorized to do business in this state which is independently owned and operated. In addition, a business enterprise owned and controlled by persons of color or women shall be deemed to include any business enterprise certified as an MBE or WBE pursuant to Article 15-a of the New York State Executive Law and implementing regulations, 9 NYCRR Subtitle N Part 540 et seq., or as a small disadvantaged business concern pursuant to the Small Business Act, 15 U.S.C. 631 et seq., and the relevant provisions of the Code of Federal Regulations as amended.
- E. The Contractor hereby acknowledges and agrees:
 - 1) That in the hiring of employees for the performance of work under this contract or any subcontract hereunder, no contractor, subcontractor, nor any person acting on behalf of such contractor or subcontractor, shall be reason of race, creed, color, religion, gender, age, ethnicity, disability, sex, alienage or citizenship status, national origin, marital status, sexual orientation, familial status, genetic predisposition or carrier status discriminate against any citizen of the State of New York who is qualified and available to perform the work to which the employment relates;

INFORMATION FOR BIDDERS

- 2) That no contractor, subcontractor, nor any person on its behalf shall, in any manner, discriminate against or intimidate any employee hired for the performance of work under this contract on account of race, creed, color, religion, gender, age, ethnicity, disability, sex, alienage or citizenship status, national origin, marital status, sexual orientation, familial status, genetic predisposition or carrier status;
 - 3) That there may be deducted from the amount payable to the contractor by the County under this contract a penalty of fifty (50) dollars for each person for each calendar day during which such person was discriminated against or intimidated in violation of the provisions of the contract;
 - 4) That this contract may be canceled or terminated by the County, and all moneys due or to become due hereunder may be forfeited, for a second or any subsequent violation of the terms or conditions of this section of the contract; and
 - 5) The aforesaid provisions of this section covering every contract for or on behalf of the County for the manufacture, sale or distribution of materials, equipment or supplies shall be limited to operations performed within the territorial limits of the State of New York.
 - 6) Contractor agrees to include, or require the inclusion of the above provision in any subcontract made pursuant to its contract with the County.
- F. In furtherance of the Contractor's obligation to make documented good faith efforts to utilize Minority Business Enterprises (MBE) and Women's Business Enterprises (WBE) for the Work required by this Contract, the Contractor shall provide the Minority/Women Business Enterprise Questionnaire signed by an officer of the Contractor, and any additional information requested by the County, including but not limited to the following, which shall be delivered to the Construction Administrator and _____, Program Manager of Minority- and Women-Owned Business Program, County of Westchester, Room 911, 148 Martine Avenue, White Plains, New York 10601 coincident with the Contractor's delivery to the County of its bid and shall be provided by the Contractor with any request for approval of subcontractors:
- 1 (a) The name, address, telephone number and contact person of each MBE and WBE solicited verbally by Contractor during the applicable period for the performance of any portion of the Contractor's Work and the date(s) that each such solicitation was made;
 - 1 (b) A description of the portion of the Contractor's Work for which each such solicitation is made.
 - 1 (c) A listing of the project documents, if any, furnished to each such MBE and WBE.
 2. A copy of each written solicitation sent by the Contractor to each MBE and WBE and the name and address of each MBE and WBE to whom the solicitation was made.
 - 3) The name and address of each MBE and WBE that performs any portion of the Contractor's Work, a description of such portion of the Work and the dollar

INFORMATION FOR BIDDERS

amount therefore.

- 4) A statement that the Contractor reviewed a list of MBE and WBE contractors in their outreach efforts. A list can be found at www.westchestergov.com/mwob.
- 5) Indicate those MBE and WBE contractors found on the list that provided the type of subcontractor services required for this project. If none were found, please indicate.
- 6) Describe other outreach efforts, including other MBE and/or WBE lists, organizations or individuals that were contacted.

The failure of the low bidder to comply with the provisions of this subparagraph F may result in the County NOT awarding this contract to your firm. Failure of the Contractor to comply with the provisions of this subparagraph F may constitute a material breach of this Contract. Failure to comply with the Minority Participation Policy may be considered by the County when awarding contracts.

37. SEXUAL HARASSMENT POLICY

- A. As with discrimination involving race, color, religion, age, sexual orientation, disability, and national origin, Westchester County also prohibits sex discrimination, including sexual harassment of its employees in any form. The County will take all steps necessary to prevent and stop the occurrence of sexual harassment in the workplace.
 - 1) **This policy applies to all County employees and all personnel in a contractual relationship with the County.** Depending on the extent of the County's exercise of control, this policy may be applied to the conduct of non-County employees with respect to sexual harassment of County employees in the workplace.
 - 2) This sexual harassment policy includes, but is not limited to, inappropriate forms of behavior described by the Equal Employment Opportunity Commission.
- B. Sexual advances that are not welcome, requests for sexual favors, and other verbal or physical conduct of a sexual nature constitutes sexual harassment when:
 - 1) Submission to such conduct is made either explicitly or implicitly a term or condition of an individual's employment; -OR-
 - 2) Submission to or rejection of such conduct by an individual is used as the basis for employment decisions, such as promotion, transfer, or termination, affecting such individuals; -OR-
 - 3) Such conduct has the purpose or effect of unreasonably interfering with an individual's work performance or creating an intimidating, hostile or offensive working environment.
- C. Sexual harassment refers to behavior that is not welcome, that is personally offensive, that fails to respect the rights of others, that lowers morale and that, therefore, interferes

INFORMATION FOR BIDDERS

with an employee's work performance and effectiveness or creates an intimidating, hostile or offensive working environment.

38. SMOKE-FREE WORKPLACE POLICY

- A. By way of Executive Order No. 5 of 1998 and Local Law 3 of 2003, it is now the policy of the County of Westchester to institute a smoke-free “workplace”.
- B. Every indoor County “workplace”, shall become a smoke-free area. The smoking or carrying of lighted cigarettes, cigars, pipes, or any other tobacco-based products, or products that result in smoke, is hereby banned.
- C. Every indoor County “workplace” shall be covered under this Executive Order, including the County Jail in Valhalla and the Westchester County Center in White Plains. This Executive Order shall not, however, apply to County-owned facilities that are not County “workplaces”, such as employees housing or privately run restaurants on County property (e.g. at the County golf courses).
- D. The Richard J. Daronco County Courthouse shall not, for purposes of this Executive Order, be considered a County “workplace”, and therefore shall not be required to be smoke-free.
- E. This Executive Order is intended to be consistent with, and not modify, any provisions of the New York State Public Health Law.
- F. This Executive Order shall take effect immediately and remain in full force and effect until otherwise superseded or revoked.

39. COUNTY ENERGY EFFICIENT PURCHASING POLICY

- A. By way of Executive Order No. 9 of 2002, it is now the policy of the County of Westchester to institute an Energy Efficient Purchasing Policy.
- B. This policy shall apply to all purchases made by and for the County in accordance with applicable laws, rules and regulations.
- C. Wherever the price is reasonably competitive and the quality adequate for the purpose intended, purchase and utilization of products that meet Energy Star requirements for energy efficiency as determined by the United States Environmental Protection Agency and the United States Department of Energy is hereby recommended.
- D. If the Energy Star label is not available with respect to a particular product, than it is recommended that products in the upper twenty-five percent of energy efficiency as designated by the United States Federal Energy Management Program shall be purchased and utilized if the prices of those products are reasonably competitive and the quality adequate for the purpose intended.

40. RESTRICTION ON USE OF TROPICAL HARDWOODS

- A. The bidder/proposer shall not use or propose to use any tropical hardwoods or tropical hardwood products in any form, except in accordance with State Finance Law § 165 (Use of Tropical Hardwoods), as may be amended from time to time. Pursuant to the

INFORMATION FOR BIDDERS

State Finance Law § 165, any bid/proposal which proposes or calls for the use of any tropical hardwood or wood product in the performance of the contract shall be deemed non-responsive.

41. DISCLOSURE OF RELATIONSHIPS TO COUNTY

- A. The successful bidder is required to complete the form entitled “Required Disclosure of Relationships to County” on Proposal Pages 32-33 before award of the contract.
- B. In the event that any information provided on the completed Proposal Pages entitled “Required Disclosure of Relationships to County” changes during the term of this agreement, the Contractor shall notify the Commissioner in writing within ten (10) days of such event by submitting a revised “Required Disclosure of Relationships to County” form.

42. CONTRACTOR DISCLOSURE STATEMENT

The Contractor and each Major Subcontractor represents that all information provided by the Contractor and Major Subcontractor in the form entitled “Contractor Disclosure Statement” on Proposal Pages 23-31 is in all respects true and correct. In the event the information provided on that document changes during the term of this agreement or for a period of three (3) years after the date that the Contractor and/or the Major Subcontractor receives final payment under this agreement, the Contractor and/or Major Subcontractor shall notify the Commissioner in writing within ten (10) days of such event by submitting a revised “Contractor/Major Subcontractor Disclosure Statement”. Bidders must complete the Required Disclosure of Relationships to County form. The Required Disclosure of Relationships to County form is located on Proposal Pages 32-33.

43. CRIMINAL BACKGROUND INFORMATION

Pursuant to Executive Order 1-2008 and subject to the applicable provisions of New York Correction Law §§ 752 and 753, the County shall have the right to bar the following “Persons Subject to Disclosure” (Persons shall mean individuals or legal entities) from providing work or services to the County or from being on County property:

(a) Consultants, Contractors, Licensees, Lessees of County owned real property, their principals, agents, employees, volunteers or any other person acting on behalf of said Contractor, Consultant, Licensee, or Lessee who is at least sixteen (16) years old, including but not limited to Subconsultants, Subcontractors, Sublessees or Sublicensees who are providing services to the County; and

(b) Any family member or other person, who is at least sixteen (16) years old, residing in the household of a County employee who lives in housing provided by the County located on County property.

If any of the above mentioned Persons Subject to Disclosure has either one of the following:

(a) A conviction of a crime (all felonies and misdemeanors as defined under the New York State Penal Law or the equivalent under Federal law or the laws of any other State);

(b) A pending criminal proceeding for a crime(s) as defined above; or

INFORMATION FOR BIDDERS

(c) A refusal to answer such questions.

Where the following criteria apply:

(a) If any of the Persons Subject to Disclosure providing work or services to the County in relation to a County Contract are not subject to constant monitoring by County staff while performing tasks and/or while such persons are present on County property pursuant to the County Contract; and

(b) If any of the Persons Subject to Disclosure providing work or services to the County, in relation to a County Contract may, in the course of providing those services, have access to sensitive data (for example, Social Security Numbers and other personal/secure data); facilities (secure facilities and/or communication equipment); and/or vulnerable populations (for example, children, seniors and the infirm).

Accordingly, the Contractor is required to review the Instructions found in the instructions and complete “Contractor and all persons subject to Disclosure Certification Forms” located at Forms Pages 11-13 as well as any other applicable criminal disclosure forms (i.e., Forms Pages 14 through 19,” together with Forms Pages 11-13 collectively referred to as “Disclosure Forms”).

However, the following Persons Subject to Disclosure are **exempt** from Executive Order 1-2008: (i) those persons for whom the County has already conducted a background check and issued a security clearance that is in full force and effect; or (ii) those persons for whom another state or federal agency having appropriate jurisdiction has conducted a security and/or background clearance or has implemented other protocols or criteria for this purpose that apply to the subject matter of this Contract that is in full force and effect.

If a Person Subject to Disclosure is exempt from the disclosure described in Executive Order 1-2008 because of either “i” or “ii” above, then the Contractor shall notify the Procuring Officer¹ in the respective Department of its claim of exemption and it shall be the responsibility of the Procuring Officer to verify each exemption. If the Procuring Officer determines that the Contractor is exempt under sections “i” or “ii” above, the Procuring Officer shall confirm same with the Contractor and maintain a written record including all supporting details of the verification of and acknowledgement of said exemption.

If the Procuring Officer determines that the Contractor is not exempt under sections “i” or “ii” above, the Procuring Officer shall notify the Contractor in writing, and the appropriate Disclosure Forms shall be required.

It shall be the Contractor’s duty to disclose and to inquire of each and every Person Subject to Disclosure, whether they have been convicted of a crime or whether they are currently subject to pending criminal charges. It shall be the duty of the Contractor to submit a completed Certification Form “Forms Pages 11-13”annexed hereto as ,” which certifies that the Contractor and every Person Subject to Disclosure has been asked whether they have been convicted of a crime or are currently subject to pending criminal charges.

Should the Contractor or any Person Subject to Disclosure (also referred to as “Person”)

¹ “Procuring Officer” shall mean the head of the department or the individual(s) authorized by the head(s) of the department(s) undertaking the procurement and with respect to those matters delegated to the Bureau of Purchase and Supply pursuant to Section 161.11(a) of the Laws of Westchester County, the Purchasing Agent.

INFORMATION FOR BIDDERS

affirmatively advise that they have been convicted of a crime said Person shall be identified in Forms Page 14 entitled “Names And Titles Of Persons Subject To Disclosure That Answered Yes” to any questions on Forms Pages 11-13 and shall complete Forms Pages 15-16 entitled, “Criminal Background Disclosure Form For Persons Who Have Been Convicted of A Crime.”

Should the Contractor or any Person Subject to Disclosure advise that they are subject to pending criminal charges, said Person shall be identified in Forms Page 14 and shall complete the form annexed hereto as Forms Pages 17-18 entitled, “Criminal Background Disclosure Form For Persons Who Are Subject to Pending Criminal Charges.”

Should the Contractor or any Person Subject to Disclosure refuse to answer whether they have been convicted of a crime or are currently subject to pending criminal charges, the name and title of said Person(s) shall be listed on Forms Page 19 entitled “Persons That refused To Answer”.

It shall be the duty of the Contractor to submit to the Procuring Officer all of the attached applicable Disclosure Forms prior to the commencement of this Contract. It is the responsibility of each Contractor to assure that all of their proposed Subcontractors complete the criminal background and disclosure certification forms and submit the forms to the Procuring Officer before they will be approved to perform work on the contract.

Under no circumstances shall the existence of a language barrier serve as a basis for the waiver of or an exception to this obligation. If the Contractor needs to obtain translation services to fulfill this obligation, it shall be at the sole cost and expense of the Contractor.

The Contractor shall be required to make the same inquiry and forward updated Disclosure Forms to the Procuring Officer regarding additional Persons Subject to Disclosure in connection with this Contract during the term of this Contract. **NO NEW PERSON SUBJECT TO DISCLOSURE SHALL PERFORM WORK OR SERVICES OR ENTER ONTO COUNTY PREMISES UNTIL THE UPDATED DISCLOSURE FORMS ARE FILED WITH THE PROCURING OFFICER.**

THE CONTRACTOR HAS A CONTINUING OBLIGATION TO MAINTAIN THE ACCURACY OF THE DISCLOSURE FORMS FOR THE DURATION OF THIS CONTRACT, INCLUDING ANY AMENDMENTS OR EXTENSIONS THERETO AND SHALL PROVIDE ANY UPDATES TO THE PROCURING OFFICER AS NECESSARY TO COMPLY WITH THE DISCLOSURE REQUIREMENTS BY EXECUTIVE ORDER 1-2008.

Any failure by the Contractor to comply with the disclosure requirements of Executive Order 1-2008, absent proof of exemption deemed satisfactory by the County Procuring Officer, may be considered by the County, a material breach by the Contractor and may be grounds for immediate termination of this Agreement by the County.

44. MANDATORY OSHA CONSTRUCTION SAFETY AND HEALTH TRAINING

Pursuant to NYS Labor Law §220-h – On all public work projects of at least \$250,000 all laborers, workers and mechanics employed, in the performance of the contract on the public work site, either by the contractor, sub-contractor or other person doing or contracting to do the

INFORMATION FOR BIDDERS

whole or a part of the work contemplated by the contract, are required to be certified as having successfully completed an OSHA construction safety and health course of at least 10 hours prior to performing any work on the project.



3. GENERAL CLAUSES

DEPARTMENT OF PUBLIC WORKS

Division of Engineering

GENERAL CLAUSES

1. MATERIAL AND WORKMANSHIP

It is the intent of these specifications to require first-class work and new and best quality materials. For any unexpected features arising during the progress of the work and not fully covered herein the specifications shall be interpreted to require first-class work and materials, and such interpretations shall be binding upon the Contractor.

- 1) Upon award of the Contract, the Contractor shall furnish in writing to the Construction Administrator the sources of supply for concrete, and other materials that it proposes to use in the work, and material shall not be furnished from other sources of supply except after written approval by the Construction Administrator. The Contractor shall, before ordering equipment verify that Suppliers of equipment will provide the required warranties, guarantees, and maintenance services.

2. DEFINITIONS

COMMISSIONER - The head of the Department of Public Works of the County of Westchester.

CONSTRUCTION ADMINISTRATOR- The representative of the Commissioner of Public Works at the project site who, unless specifically designated otherwise in the Contract, shall in the first instance, make such determinations as are necessary for the expeditious completion of the Work, except for those determinations that are reserved to the Commissioner.

CONTRACT - Shall mean each of the various parts of these documents both as a whole or severally and except for titles, subtitles, headings and table of contents, shall include the Notice to Bidders, Information for Bidders, the Proposal, the Specifications, the Performance Bond, the Plans, the Contract Form, and all addenda and provisions required by law.

CONTRACTOR - Party of the second part to the Contract acting directly or through its agents, subcontractors, or employees, and who is responsible for all debts pertaining to and for the acceptable performance of the work for which it had contracted.

COUNTY - Party of the first part to the Contract as represented by the Board of Acquisition and Contract and the Commissioner of Public Works for the County of Westchester.

ENGINEER - An Engineer or Architect that designed the project and is serving as the duly authorized representative of the Commissioner of Public Works who, in addition to the duties set forth in the Contract, shall, in the first instance, make such determinations as are necessary to ensure the Contractor's compliance with its obligations for the preparation and submission of shop drawings and all other submittals required for the Work. If there is no Engineer the duties of the Engineer shall be performed by the Construction Administrator and all references in this

GENERAL CLAUSES

Agreement to the Engineer shall be deemed to mean the Construction Administrator.

MAJOR SUBCONTRACTOR- Subcontractors performing all or a portion of the work for Electrical; Heating, Ventilating and Air Conditioning; Fire Prevention; General Construction; and/or any Subcontractor whose subcontract price is equal to or greater than ten percent (10%) of the Contract Price.

OWNER - The County of Westchester.

PLANS - All official drawings or reproductions of drawings pertaining to the work or to any structure connected therewith.

SPECIFICATIONS - The body of directions, requirements, etc. contained in this present volume, together with all documents of any descriptions and agreements made (or to be made), pertaining to the methods(or manner) of performing the work or to the quantities and quality. Specifications shall also include the Notice to Contractors, Instructions to Bidders, Bond, Proposal and Contract Agreement.

SURETY - The corporate body, which is bound with and for the Contractor and which engages to be responsible for the faithful performance of the contract, and to indemnify the County against all claims for damages.

A.A.S.H.O. - American Association of State Highway Officials

A.R.E.A. - American Railway Engineering Association

A.S.T.M. - American Society for Testing Materials

A.W.W.A. - American Water Works Association

N.E.C. - National Electrical Code

N.E.M.A. - National Electric Manufacturers Association

3. BOUNDARIES OF WORK

The County will provide land or rights-of-way for the work specified in this Contract. Other contractors, employees or concessionaires of the county, may for all necessary purposes enter upon the work and premises used by the Contractor, and the Contractor shall give to other contractors and employees of the County all reasonable facilities and assistance for the completion of adjoining work.

4. OVERLAPPING WORK

The Contractor shall take notice that because of work on other contracts within and adjacent to the contract limits it may not have exclusive occupancy of the territory within or adjacent

GENERAL CLAUSES

to the contract limits, and that during the life of this contract the owners and operators of Public Utilities may make changes in their facilities.

The said changes may be made by utility employees or by contract within or adjacent to the contract limits and may be both temporary and permanent.

The Contractor shall cooperate with other Contractors and owners of various utilities and shall coordinate and arrange the sequence of its work to conform with the progressive operations of work already or to be put under contract. Cooperation with Contractors already or to be engaged upon the site is essential to properly coordinate the construction efforts of all Contractors, Utility Owners and Subcontractors engaged in work within and adjacent to the contract limits.

The Contractor shall coordinate the work of its various Subcontractors. Their respective operations shall be arranged and conducted so that delays are avoided. Where the work of the Contractor or Subcontractor overlaps or dovetails with that of other Contractors, materials shall be delivered and operations conducted so as to carry on the work continuously in an efficient and workmanlike manner. The Contractor shall coordinate its work to be done hereunder with the work of the other Contractor(s) and the Contractor shall fully cooperate with such other Contractor(s) and carefully fit its own work to that provided under other contracts as may be directed by the Construction Administrator. If the Construction Administrator shall determine that the Contractor is failing to coordinate its work with the work of the other Contractor(s) as the Construction Administrator has directed, then the Commissioner shall have the right, at its sole option, to withhold any payments otherwise due hereunder until the Construction Administrator's directions are complied with by the Contractor and/or deduct the costs incurred by the County due to the Contractor's failure or refusal to so cooperate. Delays or oversights on the part of the Contractor or Subcontractors or Utility Owners in performing their work in the proper manner thereby causing cutting, removing and replacing work already in place, shall not be the basis for a claim for extra compensation.

In the event of interference between operations of Utility Owners and other Contractors, or among the Contractors themselves, the Construction Administrator shall be the sole judge of the rights of each Contractor insofar as the sequence of work necessary to expedite the completion of the entire project, and in all cases its decision shall be final. The Contractor agrees that it has included in its unit prices bid for the various items of the contract the possible additional cost of performing the work under this contract because it may not have a clear site for its work and because of possible interference of roadway use, other Contractors and necessary utility work, and the necessity or desirability of opening certain sections of pavement to traffic before the entire work is completed. The County shall not be liable for any damages suffered by any Contractor by reason of another Contractor's failure to comply with the directions of the Construction Administrator, or by reason of another Contractor's default in performance or by any act or failure to act of any Utility Owner or anyone working on its behalf, it being understood that the County does not guarantee the responsibility or continued efficiency of any Contractor or Utility Owner and under no circumstances shall the County be liable to any Contractor or Utility Owner for any delays, interferences or any other impediment or hindrance to the Contractor's or Utility Owner's work .

GENERAL CLAUSES

Should the Contractor sustain any damage through any act or omission of any other contractor having a Contract with the County for the performance of work upon the site or of work which may be necessary to be performed for the proper prosecution of the work to be performed hereunder, or through any act or omission of a supplier or subcontractor of whatever tier of such contractor, the Contractor shall have no claim against the County for such damage, but shall have a right to recover such damage from the other contractor under the provision similar to the following provision that has been or will be inserted in the Contracts with such other contractors.

Should any other Contractor having or who shall hereafter have a Contract with the County for the performance of work upon the site sustain any damage through any act or omission of the Contractor hereunder or through the act or omission of any subcontractor of whatever tier of the Contractor, the Contractor agrees to reimburse such other Contractor for all such damages and to defend at his own expense any suit based upon such claim and if any judgment or claims against the County shall be allowed the Contractor shall pay or satisfy such judgment or claim and pay all costs and expenses, including attorney's fees, incurred by the County in connection therewith and to indemnify and hold the County harmless from all such claims.

The County's right to indemnification hereunder shall not be diminished or waived by its assessment against the Contractor of liquidated damages as may be provided elsewhere herein.

Delays in availability of any part of the site or any delays due to interference between the several Contractors and the Utility Owners shall be compensated for by the Construction Administrator solely through granting an extension of time in which to complete the work of the contract without assessment of Engineering charges. The Contractor in submitting its bid hereby agrees that it shall make no other claim against the County for any damages due to such delays or interference.

5. PROPER METHOD OF WORK AND PROPER MATERIALS

The Construction Administrator shall have the power in general to direct the order and sequence of the work, which will be such as to permit the entire work under this contract to be begun and to proceed as rapidly as possible, and such as to bring the several parts of the work to a successful completion at about the same time.

If at any time before the commencement or during the progress of the work the materials and appliances used or to be used appear to the Construction Administrator as insufficient or improper for securing the quality of work required, or the required rate of progress, he may order the Contractor to increase their efficiency or to improve their character, and the Contractor shall promptly conform to such order; but the failure of the Construction Administrator to demand any increase of such efficiency or improvement shall not release the Contractor from its obligation to secure the quality of work or the rate of progress specified.

GENERAL CLAUSES

6. CONTROL OF AREA

Unloading of materials and parking of equipment shall be subject to the orders of the Construction Administrator so far as he may find necessary for the protection and safety of the traveling public and the preservation of property.

7. PERMITS, FEES, ETC.

The County will obtain at its sole cost the necessary New York State Pollutant Discharge Elimination System ("SPDES") Permit and will sign the associated Notice of Intent ("NOI"). The Contractor and its subcontractors will sign the required Certification Statement (a copy of which is contained as Proposal Page) when it signs the contract.

All necessary permits from County, State or other concerned Public Authorities shall be secured at the cost and expense of the Contractor. It shall also give all notices required by law, ordinance, or the rules and regulations of the concerned Public Bureaus or Departments, and also as a part of the Contract, comply without extra charge or compensation with all State Laws and all other Ordinances or Regulations that may be applicable to this work. Contractor, however, shall first notify the Commissioner before proceeding with securing of all necessary permits and the giving of required notices.

8. TRAFFIC

The General Contractor shall be responsible for the Maintenance and Protection of traffic at all times until the date of completion and acceptance of its work.

During the whole course of the work the Contractor shall so conduct its work and operations so as to interfere with traffic passing the work as little as possible and effect by every reasonable means the safety and comfort of pedestrians, vehicles and vehicle passengers passing the work.

9. INSPECTION

The Contractor shall at all times provide convenient access and safe and proper facilities for the inspection of all parts of the work. No work, except such shop work as may be so permitted, shall be done except in the presence of the Construction Administrator or his/her assistants. No material of any kind shall be used upon the work until it has been inspected and accepted by the Construction Administrator. All materials rejected shall be immediately removed from the work and not again offered for inspection. Any materials or workmanship found at any time to be defective shall be remedied at once, regardless of previous inspection. The inspection and supervision of the work by the Construction Administrator is intended to aid the Contractor in supplying labor and materials in accordance with the specifications, but such inspection shall not operate to release the Contractor from any of its contract obligations.

10. STOPPING WORK

The Commissioner, Construction Administrator or Engineer may stop by written order any work or any part of the work under this contract if, in his/her opinion, the methods employed

GENERAL CLAUSES

or conditions are such that unsatisfactory work might result. When work is so stopped it shall not be resumed until the methods or conditions are revised to the satisfaction of the Commissioner, which must be signified in writing. The Contractor agrees to make no claim for increased costs arising from the issuance of any stop work order.

11. DIMENSIONS

Figured dimensions on the plans shall be given preference over scaled dimensions, but shall be checked by the Contractor before starting construction. Any errors, omissions or discrepancies shall be brought to the attention of the Engineer and his/her decision thereon shall be final.

12. PAYMENTS TO COUNTY

Wherever in the Contract Documents the Contractor is required to make a payment to the County, the Contractor agrees that the County has the option to withhold such sum(s) from payments otherwise due to the Contractor and that all such sums withheld shall be deemed not to be earned by the Contractor.

13. PROTECTION OF UTILITIES AND STRUCTURES

The Contractor shall be responsible for the preservation of all public and private underground and surface utilities/structures at or adjacent to the construction work; insofar as they may be endangered by the work. This shall hold true whether or not they are shown on the contract drawings. If they are shown on the drawings, the County does not guarantee their locations even though the information will be from the best available sources.

The Contractor shall give ample and reasonable notice to all private, corporate or municipal owners before work is done near their utility or structure; shall properly protect all utilities/structures encountered; shall at their expense repair/replace any items that are damaged; and shall proceed with caution to prevent undue interruptions to utility services.

Investigation and/or on-site mark-out, by the County, must be done prior to excavation work at the Valhalla Campus. This investigation/mark-out is to serve as a guide for the Contractor and does not absolve the Contractor from the responsibility to repair/replace identified or non-identified utilities/structures, at no cost to the County.

All excavation work performed at the Valhalla Campus requires the submission of a completed "Ground Penetration" form/sketch(es) will be distributed to the appropriate utility owners. Therefore, the Contractor should assume that no excavation work can be performed until approximately twenty (20) working days after submission of the form/sketch(es), but not prior to approval by the DPW-BO Superintendent of Buildings.

14. PROTECTION OF WATER RESOURCES & THE ENVIRONMENT

The Contractor is responsible to review the specifications and drawings as they relate to this Agreement to ascertain what procedures must be followed in order to comply with all applicable stormwater management, water quality control, erosion, and sediment control

GENERAL CLAUSES

laws, rules, regulations and permits. If the Contractor is of the opinion that any work required, necessitated, or contained in the specifications or otherwise ordered conflicts with the applicable stormwater management, water quality control, erosion, and sediment control laws, rules, regulations, procedures, and permits, including, without limitation, all applicable provisions of the New York State Stormwater Management Design Manual, and the New York Standards and Specifications for Erosion and Sediment Control as they may be amended from time to time, it must promptly notify the First Deputy Commissioner of the Department of Public Works in writing.

In addition to all other requirements contained in this Agreement, the Contractor recognizes and understands that it is an essential element of this Agreement that the Contractor complies with the County's policies to protect water resources and the environment. The Contractor must comply with all applicable stormwater management, water quality control, erosion, and sediment control laws, rules, regulations, permits, procedures and specifications, including, without limitation, all applicable provisions of the New York State Stormwater Management Design Manual,¹ the New York Standards and Specifications for Erosion and Sediment Control as they may be amended from time to time. All of these documents should be obtained from the New York State Department of Environmental Conservation to ensure that the Contractor has the latest version. It should be noted that the standards set forth in the New York State Stormwater Management Design Manual, and the New York Standards and Specifications for Erosion and Sediment Control apply to ALL work done for the County, regardless of the size of the project. In case of a conflict among the governmental regulations and standards, the most stringent regulation, standard or recommendation shall apply to the work done under this Agreement.

The Contractor and its subcontractors shall execute the required Stormwater Pollution Prevention Certification, which is located at Proposal Page 20. In addition, the Contractor acknowledges that if the work required under this Agreement requires that a State Pollutant Discharge Elimination System ("SPDES") permit be obtained from the New York State Department of Environmental Conservation, then the Contractor must comply with the terms and conditions of the SPDES permit for stormwater discharges from construction activities and the Contractor will not take any action or fail to take any necessary action that will result in the County being held to be in violation of said permit or any other permit. The Contractor shall cooperate with the County in obtaining the permit and comply with the SPDES permit and all other applicable laws, rules, regulations and permits.

The Contractor shall provide, as the Commissioner or his designee may request, proof of compliance with the County's policies to protect water resources and the environment, and all applicable stormwater management, water quality control, erosion and sediment control laws, rules, regulations, permits, procedures and specifications.

The Contractor is responsible to ascertain which of the laws, rules, regulations, permits and standards referenced above affect its construction activities, and the Contractor shall be solely responsible for all costs and expenses, including any penalties or fines, incurred by the County, due to the Contractor's failure to comply with such applicable laws, rules,

¹ available at <http://www.dec.state.ny.us/website/dow/swmanual/swmanual.html> - The location of this reference is provided to assist the Contractor; it does not relieve the Contractor from the obligation of obtaining and complying with the latest version of the document.

GENERAL CLAUSES

permits, regulations, standards and County policies. The Contractor shall be responsible to defend and indemnify the County from any and all claims resulting from the Contractor's failure to comply with the applicable laws, rules, regulations, permits, standards and County policies.

Failure of the Contractor to comply with the County's policies to protect water resources and the environment, and all applicable stormwater management, water quality control, erosion and sediment control laws, rules, regulations, permits, procedures and specifications may result in the withholding of progress payments to the Contractor by the County. Such withholding of progress payments shall not relieve the Contractor of any requirements of the Agreement including the completion of the work within the specified time, and any construction sequence requirement of the Agreement.

The Contractor acknowledges that its failure to comply with the County's policies to protect water resources and the environment, and all applicable stormwater management, water quality control, erosion and sediment control laws, rules, regulations, permits, procedures and specifications shall constitute a material breach under this contract. For the breach or violation of this provision, without limiting any other rights or remedies to which the County may be entitled, the County shall have the right, in its sole discretion to suspend, discontinue or terminate this Agreement immediately upon notice to the Contractor. In such event, the Contractor shall be liable to the County for any additional costs incurred by the County in the completion of the project.

The failure of the Contractor to comply with these requirements could lead to a determination that the Contractor is not a responsible bidder when the Contractor is bidding on other projects.

15. SANITARY REGULATIONS

The Contractor shall obey and enforce such sanitary regulations and orders and shall take such precautions against infectious diseases as may be deemed necessary. The building of shanties or other structures for housing the men, tools, machinery or supplies will be permitted only at approved places, and the sanitary condition of the grounds in and at such shanties or other structures must be at all times maintained in a satisfactory manner.

16. CLEANING UP

Upon completion of the work, the Contractor shall remove all equipment, rubbish, debris and surplus materials from the buildings, and grounds, and provide a suitable dumping place for such materials. The premises shall be left in a neat, clean and acceptable condition.

No litter, debris of any kind shall be allowed to accumulate for more than one day in any portion of the buildings or grounds, and must be removed from the area at the end of each workday.

17. PREVENTION OF DUST HAZARD

In accordance with the New York State Labor Law, Section 22a, in the event a silica or other harmful dust hazard is created due to construction operations under the contract, the Contractor shall install, maintain and keep in effective operation the appliances and methods

GENERAL CLAUSES

for the elimination of such silica dust or other harmful dust as have been recommended and approved by State and local authorities.

18. REPRESENTATIVE ALWAYS PRESENT

The Contractor in case of its absence from the work shall have a competent representative **fluent in English** or foreman present, who shall obey without delay, all instructions of the Construction Administrator in the prosecution and completion of the work in conformity with this contract, and shall have full authority to supply labor and material immediately.

19. WORK IN BAD WEATHER

During freezing, stormy or inclement weather, no work shall be done except such as can be done satisfactorily and in a manner to secure first-class construction throughout.

20. PROTECTION OF WORK UNTIL COMPLETION

The Contractor shall be responsible for the protection and maintenance of its work until the same has been accepted by the Owner and shall make good any damage to the work caused by floods, storms, settlements, accidents, or acts of negligence by its employees or others so that the complete work when turned over to the Owner will be in first-class condition and in accordance with the plans and specifications.

21. REMOVAL OF TEMPORARY STRUCTURES AND CLEANING UP

On or before the completion of the work the Contractor shall, without charge therefore, tear down and remove all buildings and other structures built by him for facilitating the carrying out of the work, shall remove all rubbish of all kinds from the grounds which he has occupied, shall do any small amount of additional trimming and grading and shall leave the entire work and premises clean, neat and in good condition. The Contractor shall provide at its own expense suitable dumping places for such material. When the necessity for protecting traffic ends, the Contractor shall remove all signs, lighting devices, barricades and temporary railings from the site of the work.

22. GROSS LOADS HAULED ON HIGHWAY

The Contractor shall at no time during the construction of this contract, haul gross loads exceeding the legal limit prescribed by the Highway Law over the highways of access to, or the highway included in this contract.

23. CONCRETE BATCH PROPORTIONS - YIELD

No Construction Administrator or Engineer is authorized to instruct or inform the Contractor, or any of its agents or employees, or its concrete supplier as to the weights of the ingredients to be used to produce a cubic yard of concrete or as to the yield to be used to produce a cubic yard of concrete or as to the yield to be expected from any batch. The Contractor shall make its own determination and give its own instructions to its agents, employees and concrete supplier as to the total quantity of ingredients to be purchased as a

GENERAL CLAUSES

cubic yard of concrete. The right is reserved to the Construction Administrator and Engineer, however, to verify yields after batch weights have been established by the Contractor and to order a reduction in total weight per load in the event his/her calculations show that the rated capacity of truck mixers, if approved for use, will be exceeded.

24. DAMAGE DUE TO CONTRACTOR'S OPERATIONS

In the event that damage is caused to structures, surfacing, pavement, shrubbery, trees or to grassed areas through trucking operations, delivery of materials, the actual performance of the work, or other causes, the Contractor shall fully restore the same to their original condition at its own expense. In the event that more than one contractor causes damages to any one area, the Director of Project Management will apportion the amount of repair work to be done by each contractor. The decision of the Director of Project Management shall be final and binding upon the Contractor(s) and may not be challenged except pursuant to a proceeding brought pursuant to Article 78 of the Civil Practice Law and Rules.

25. PROPERTY DAMAGE

The Contractor shall not enter upon nor make use of any private property along the line of work except when written permission is secured from the owner of that property. In case of any damage or injury done along the line of work in consequence of any act or omission on the part of the Contractor, or any one in its employ, in carrying out the contract, the Contractor shall at its own expense restore the same or make repairs as are necessary in consequence thereof in a manner satisfactory to the owner of the affected property; provided, however, that the obligation thus assumed by the Contractor shall not inure directly or indirectly to the benefit of any insurer of physical damage to property or loss of use, rents or profits of property regardless of whether the insurer has actually paid the claim or made only a loan to its insured, nor to the latter if it shall waive or abandon any claim against its insurer or insurers.

In case of failure on the part of the Contractor to restore or repair such property in a manner satisfactory to the owner of the affected property, the party of the first part may upon forty-eight hours notice to the Contractor proceed with such restoration or repair. The expense of such restoration or repair shall be deducted from any monies, which are due or may become due the Contractor under its contract. The Construction Administrator shall be the sole judge as to what constitutes failure to restore or repair as above stated and service of notice by mail addressed to the Contractor at the address stated in the proposal shall be sufficient.

26. CLAIMS FOR DAMAGES

The Contractor agrees that it will make no claim against the County or any of its representatives for damages for delay, interference or disruption of any kind in the performance of its Contract and further agrees that any such claim arising from acts or failure to act of the County or any of its representatives shall be fully and exclusively compensated for by an extension of time to complete the performance of the work as provided herein.

GENERAL CLAUSES

27. EXTENSIONS OF TIME

An extension or extensions of time may be granted only by the Commissioner and only upon a verified application therefore by the Contractor. Each application for an extension of time must set forth in detail the nature of each cause of delay in the completion of the work, the date upon which each such cause of delay began and ended, and the number of days attributable to each of such causes. If the schedule for this project is based upon the Critical Path Method, the Contractor must also demonstrate that the delay for which an extension of time is sought occurred on the critical path. A formal written notice of the Contractor's intent to apply for an extension of time must be submitted to the Commissioner within seven (7) calendar days of the start of the alleged delay. The formal application for the extension of time must be submitted to the Commissioner no later than ten (10) calendar days after the end of the delay, but in no event later than the Contractor's submittal of its application for its substantial completion payment. The failure of the Contractor to timely submit either its formal written notice of its intent to apply for an extension of time or the application thereof shall be deemed a waiver of any entitlement to any extension of time.

The Contractor shall be entitled to an extension of time for delay in completion of the work caused solely (1) by the acts or omissions of the County, its officers, agents or employees; or (2) by the acts or omissions of other Contractors on this project; or (3) by supervening conditions entirely beyond the control of either party hereto (such as, but not limited to, Acts of God, excessive inclement weather, war, or any other national emergency making performance temporarily impossible or illegal, or strikes or labor disputes not brought about by any act or omission of the Contractor).

The Contractor shall not be entitled to receive a separate extension of time for each of several causes of delay operating concurrently, but, if at all, only for the actual period of delay in completion of the work as determined by the Engineer or Commissioner. If one of multiple causes of delay operating concurrently results from any act or omission of the Contractor or of its subcontractors of whatever tier, and would of itself (irrespective of concurrent causes) have delayed the work, no extension of time will be allowed for the period of delay resulting from such act or omission and the Contractor shall re-arrange his Progress Schedule and operations so as to complete the Work within the time set forth in the Contract and minimize the impact of the Work on the other Prime Contractors.

The determination made by the Commissioner or Engineer on an application for an extension of time shall be binding and conclusive on the Contractor and may not be challenged except in a proceeding commenced pursuant to Article 78 of the Civil Practice Law and Rules.

Permitting the Contractor to continue with the work after the time fixed for its completion has expired, or after the time to which such completion may have been extended has expired, or the making of any payment to the Contractor after such time, shall not operate as waiver on the part of the County of any of its rights or remedies under this contract nor shall it relieve the Contractor from his obligation under the Contract, including without limitations its liability to the County for liquidated damages, engineering costs, delays, damages, and/or costs incurred by the County.

If the Commissioner deems it advisable and expedient to have the Contractor complete and furnish the Work after the expiration of the time of Completion of Work (see "Required

GENERAL CLAUSES

Time For Completion Of The Work” of the General Requirements) and in order that the County’s fiscal officers may be permitted to make payment to the Contractor for Work performed beyond that date, the Commissioner may extend the Contract solely for the purpose of enabling the Contractor to be paid for Work performed. This extension shall in no way relieve the Contractor from his obligation under the Contract, including without limitations its liability to the County for liquidated damages, engineering costs, delays, damages, attorney’s fees and/or costs incurred by the County, nor shall such extension of time be asserted by the Contractor in any action or proceeding as evidence that it completed its work in a timely manner.

The time necessary for review by the Engineer of all submittals including vendors, shop drawings, substitutions, etc., and delays incurred by normal seasonal and weather conditions should be anticipated and is neither compensatory nor eligible for Extensions of Time.

When the Work embraced in the Contract is not completed on or before the date specified herein, engineering and inspection expenses incurred by the County of Westchester upon the Work from the completion date originally fixed in the Contract to the final date of completion of the Work may be charged to the Contract and be deducted from the final monies due the Contractor.

28. REQUEST FOR APPROVAL OF EQUAL

A. GENERAL REQUIREMENTS

Wherever in the Contract Documents an article, material, apparatus, product or process is called for by trade name or catalog reference, or by the name of the patentee, manufacturer or dealer, it is understood that it constitutes the standard requirement to meet the contract specifications. Where two or more articles, materials, apparatus, products or processes are listed as acceptable by reference to trade name or otherwise, the choice of these will be optional to the bidder.

Bidders may base their bid on one of the specified items, or they may base their bid on an “equal”. However, the bidder should be aware that the County makes the final determination as to what constitutes an equal.

If the Engineer shall reject the proposed equal as not being the equal of that specifically named in the contract, the successful bidder (Contractor) shall immediately proceed to furnish the designated article, material, apparatus, product or process as specified or an approved equal without additional cost or time delay to the County.

B. REVIEW PROCESS

- 1) Within fifteen (15) days from the Notice to Proceed, requests for approval of equals must be proposed to the Commissioner on the “Request For Approval Of Equal” form of the Sample Forms. This Period for submitting requests will be strictly enforced. Such requests shall conform to the requirements of this Article.
- 2) Requests for approval of equals will be received and considered from Prime Contractors only and not from manufacturers, suppliers, Subcontractors, or other third parties.
- 3) If the materials and equipment submitted are offered as equals to the Contract

GENERAL CLAUSES

Documents the Contractor shall advise the County and the Engineer of the requested equal and comply with the requirements hereinafter specified in this Article.

- 4) Where the acceptability of an equal is conditioned upon a record of satisfactory operation and the proposed equal does not fulfill this requirement, the Engineer, at his/her sole discretion, may accept the equal if the Contractor provides a bond or cash deposit which guarantees replacement at no cost to the County for any failure occurring within the specified time. The equal item must meet all other technical requirements contained in the Specification.
- 5) The successful bidder shall furnish such information as required by the Engineer to demonstrate that the equal article, material, apparatus, product or process is the equal of that specified in quality, finish, design, efficiency and durability and has been elsewhere demonstrated to be equally serviceable for the purpose for which it is intended. The Contractor shall set forth the reasons for desiring to utilize the proposed equal.
- 6) Contractor shall submit:
 - a. For each proposed request for approved equal sufficient details, complete descriptive literature and performance data together with samples of the materials, where feasible, to enable the Engineer to determine if the proposed request for approved equal is equal, including manufacturer's brand or trade names, model numbers, description of specification of item, performance data, test reports, samples, history of service, and other data as applicable.
 - b. Certified tests, where applicable, by an independent laboratory attesting that the proposed equal is equal.
 - c. A list of installations where the proposed equal equipment or materials is performing under similar conditions as specified.
- 7) Requests for approval of equal after the period set forth in B. REVIEW PROCESS, Paragraph 1, above will not be accepted for evaluation except in case of strikes, discontinuance of manufacturer or other reason deemed valid by the Engineer whereby the specified products or those approved are unattainable. In such case the Contractor shall provide substantial proof that the acceptable products are unavailable.
- 8) Where the approval of an equal requires revision or redesign of any part of Work, including that of other Contracts, all such revision and redesign, and all new drawings and details required therefore, shall be provided by the Contractor at its own cost and expense, and shall be subject to the approval of the Commissioner.
- 9) In the event that the Engineer is required to provide additional engineering services, then the engineer's charges for such additional services shall be promptly paid by the Contractor to the County.
- 10) Any modifications in the Work required under other Contracts to accommodate the changed design will be incorporated in the appropriate Contracts and any resulting increases in Contract prices will be paid by the Contractor who initiated the

GENERAL CLAUSES

changed design to the County.

- 11) In all cases the Engineer shall be the judge as to whether a proposed equal is to be approved. The Contractor shall abide by his/her decision when proposed equal items are judged to be unacceptable and shall in such instances furnish the item specified or indicated. No equal items shall be used in the Work without written approval of the Engineer.
- 12) In making request for approval of equal, Contractor represents that:
 - a. Contractor has investigated proposed equal, and determined that it is equal to or superior in all respects to the product, manufacturer or method specified.
 - b. Contractor will provide the same or better warranties or bonds for proposed equal as for product, manufacturer or method specified.
 - c. Contractor waives all claims for additional costs or extension of time related to proposed equal that subsequently may become apparent.
 - d. Contractor shall have and make no claim for an extension of time or for damages by reason of the time taken by the Engineer in considering an equal proposed by the Contractor or by reason of refusal of the Engineer to approve an equal proposed by the Contractor. Any delays arising out of consideration, approval, or utilization of an equal shall be the sole responsibility of the Contractor requesting the equal and it shall arrange its operations to make up the time lost.
- 13) Proposed Equal Will Not Be Accepted If:
 - a. Acceptance will require substantial revision of Contract Documents.
 - b. They will change design concepts or Technical Specifications.
 - c. They will delay completion of the Work, or the Work of other Contractors.
 - d. They are indicated or implied on a Shop Drawing and are not accompanied by a formal request for approval of equal from Contractor.
- 14) Only those products originally specified and/or added by approved requests for equals submitted in accordance with the preceding paragraphs may be used in the Work. Whenever requests for equals are approved, it shall be understood that such approval is conditional upon strict conformance with all requirements of the Contract and further subject to the following:
 - a. Any material or article submitted for approval in accordance with the above procedure must be equal, in the sole opinion of the Engineer, to the material or article specified. It must be readily available in sufficient quantity to prevent delay of any Work; it must be available in an equivalent color, texture, dimension, gauge, type and finish as to the item or article specified; it must be equal to the specified item in strength, durability, efficiency, serviceability, compatibility with existing systems, ease and cost of maintenance; it must be compatible with the design and not necessitate substantial design modifications; it must be equal in warranties and guarantees; its use must not impose substantial additional Work, or require substantial changes in the Work of any

GENERAL CLAUSES

other Contractor. Availability of spare parts shall be assured for the useful life of the Project.

- b. The Engineer reserves the right to disapprove, for aesthetic reasons, any material or equipment on the basis of design or color considerations alone, without prejudice to the quality of the material or equipment, if the manufacturer cannot meet the required colors or design.
 - c. All requests for approval of equals of materials or other changes from the contract requirements shall be accompanied by an itemized list of all other items affected. The Engineer shall have the right, if such is not done, to rescind any approvals for equals or changes and to order such Work removed and replaced with Work conforming to the specified requirements of the contract, all at the Contractor's expense, or to assess all additional costs resulting from the equal to the Contractor.
- 15) Approval of an equal will not relieve Contractor from the requirement to submit Shop Drawings or any of the provisions of the Contract Documents.
- 16) In the event that the Engineer is required to provide additional engineering services as a result of a request for approval of an equal of materials or equipment which are not "or equal" by the Contractor, or changes by the Contractor in dimension, weight, power requirements, etc., of the equipment and accessories furnished, or as a result of Contractor's errors, omissions or failure to conform to the requirements of the Contract Documents or if the Engineer is required to examine and evaluate any changes proposed by the Contractor solely for the convenience of the Contractor, or for evaluation of deviations from Contract Documents, then the Engineer's charges in connection with such additional services shall be paid by the Contractor to the County.
- 17) The Contractor shall respond to required submittals with complete information and with a degree of accuracy to achieve approvals within three (3) submissions. All costs to the Engineer involved with subsequent submissions requiring approval, will be paid by the Contractor to the County.

29. SUBSTITUTION

- A. Should the Contractor desire to substitute other articles, materials, apparatus, products or processes than those specified or approved as equal, the Contractor shall apply to the Engineer in writing for approval of such substitution. It should be noted that the bid shall not be based on a substituted article, material, apparatus, product or process. With the application shall be furnished such information as required by the Engineer to demonstrate that the article, material, apparatus, product or process he wishes to use is the equivalent of that specified in quality, finish, design, efficiency and durability and has been elsewhere demonstrated to be equally serviceable for the purpose for which it is intended. The Contractor shall set forth the reasons for desiring to make the substitution and shall further state what difference, if any, will be made in the construction schedule and the contract price for such substitution should it be accepted; it being the intent hereunder that any savings shall accrue to the benefit of the County.

GENERAL CLAUSES

- B. If the Engineer shall reject any such desired substitution as not being the equivalent of that specifically named in the contract, or if it shall determine that the adjustment in price in favor of the County is insufficient, the Contractor shall immediately proceed to furnish the designated article, material, apparatus, product or process.
- C. Request for substitutes must be proposed to the Commissioner on the "Request For Approval Of Substitution" form of the Sample Forms. Such requests shall conform to the requirements of this Article.
- D. Requests for substitutions shall include full information concerning differences in cost, and any savings in cost resulting from such substitutions shall be passed on to the County.
- E. Requests for utilization of substitutes will be reviewed during the course of the project. The impact on the project and the timeliness of submission will be of key consideration.
- F. The approval of utilization of a substitute is subject to the sole and final discretion of the Engineer.
- G. REVIEW PROCESS
 - 1) Requests for approval of substitutions will be received and considered from Prime Contractors only and not from manufacturers, suppliers, Subcontractors, or other third parties.
 - 2) If the materials and equipment submitted are offered as substitutions to the Contract Documents or approved equal the Contractor shall advise the County and the Engineer of the requested substitutions and comply with the requirements hereinafter specified in this Article.
 - 3) Where the acceptability of substitution is conditioned upon a record of satisfactory operation and the proposed substitution does not fulfill this requirement, the Engineer, at his/her sole discretion, may accept the substitution if the Contractor provides a bond or cash deposit which guarantees replacement at no cost to the County for any failure occurring within the specified time. The substitution item must meet all other technical requirements contained in the Specification.
 - 4) The Contractor shall furnish such information as required by the Engineer to demonstrate that the equal article, material, apparatus, product or process is the equivalent of that specified in quality, finish, design, efficiency and durability and has been elsewhere demonstrated to be equally serviceable for the purpose for which it is intended and/or that it offers substantial benefits to the County in saving of time and/or cost. The Contractor shall set forth the reasons for desiring to make this substitution.
 - 5) Contractor shall submit:
 - a. For each proposed request for approved substitute sufficient details, complete descriptive literature and performance data together with samples of the materials, where feasible, to enable the Engineer to determine if the proposed request for approval should be granted, including manufacturer's brand or trade names, model numbers, description of specification of item, performance data, test reports, samples, history of service, and other data as applicable.

GENERAL CLAUSES

- b. Certified tests, where applicable, by an independent laboratory attesting to the performance of the substitute.
 - c. A list of installations where the proposed substitute equipment or materials is performing under similar conditions as specified.
- 6) Where the approval of a substitute requires revision or redesign of any part of Work, including that of other Contracts, all such revision and redesign, and all new drawings and details required therefore, shall be provided by the Contractor at its own cost and expense, and shall be subject to the approval of the Engineer.
- 7) In the event that the Engineer is required to provide additional engineering services, then the engineer's charges for such additional services shall be paid by the Contractor to the County.
- 8) Any modifications in the Work required under other contracts to accommodate the changed design will be incorporated in the appropriate contracts and any resulting increases in contract prices will be charged to the Contractor by the County who initiated the changed design.
- 9) In all cases the Engineer shall be the judge as to whether a proposed substitute is to be approved. The Contractor shall be bound by his/her decision. No substitute items shall be used in the Work without written approval of the Engineer.
- 10) In making request for approval of substitute, Contractor represents that:
- a. Contractor has investigated proposed substitute, and determined that it is equal to or superior in all respects to the product, manufacturer or method specified or offers other specified advantages to the County.
 - b. Contractor will provide the same or better warranties or bonds for proposed substitute as for product, manufacturer or method specified.
 - c. Contractor waives all claims for additional costs or extension of time related to proposed substitute that subsequently may become apparent.
 - d. Contractor shall have and make no claim for an extension of time or for damages by reason of the time taken by the Engineer in considering a substitute proposed by the Contractor or by reason of failure of the Engineer to approve a substitute proposed by the Contractor. Any delays arising out of consideration, approval, or utilization of a substitute shall be the sole responsibility of the Contractor requesting the substitute and it shall arrange its operations to make up the time lost.
- 11) Proposed substitute will not be accepted if:
- a. Acceptance will require substantial revision of Contract Documents.
 - b. They will substantially change design concepts or Technical Specifications.
 - c. They will delay completion of the Work, or the Work of other Contractors.
 - d. They are indicated or implied on a Shop Drawing and are not accompanied by a formal request for approval of substitute from Contractor.
- 12) The Engineer reserves the right to disapprove, for aesthetic reasons, any material or

GENERAL CLAUSES

equipment on the basis of design or color considerations alone, without prejudice to the quality of the material or equipment, if the manufacturer cannot meet the required colors or design.

- 13) All requests for approval of substitutes of materials or other changes from the contract requirements, shall be accompanied by an itemized list of all other items affected by such substitution or change. The Engineer shall have the right, if such is not done, to rescind any approvals for substitutions and to order such Work removed and replaced with Work conforming to the specified requirements of the contract, all at the Contractor's expense, or to assess all additional costs resulting from the substitution to the Contractor.
- 14) Approval of a substitute will not relieve Contractor from the requirement to submit Shop Drawings or any of the provisions of the Contract Documents.
- 15) In the event that the Engineer is required to provide additional engineering services as a result of a request for approval of a substitute results in changes by the Contractor in dimension, weight, power requirements, etc., of the equipment and accessories furnished, or as a result of Contractor's errors, omissions or failure to conform to the requirements of the Contract Documents or if the Engineer is required to examine and evaluate any changes proposed by the Contractor solely for the convenience of the Contractor, or for evaluation of deviations from Contract Documents, then the Engineer's charges in connection with such additional services shall be paid by the Contractor.
- 16) Structural design shown on the Drawing is based upon the configuration of and maximum loading for major items of equipment as indicated on the Drawings and as specified. If the substituted equipment furnished differs from said features, the Contractor shall pay to the County all costs of redesign and for any construction changes required to accommodate the equipment furnished, including the Engineer's charges in connection therewith.
- 17) The Contractor shall respond to required submittals with complete information and with a degree of accuracy to achieve approvals within two (2) submissions. All costs to the Engineer involved with subsequent submissions of Shop Drawings, Samples or other items requiring approval, will be paid by the Contractor to the County, by deducting such costs from payments due for Work completed. In the event an approved item is requested by the Contractor to be changed or substituted for, all costs involved in the reviewing and approval process will likewise be backcharged to the Contractor unless determined by the Engineer that the need for such substitution and/or deviation from Contract Documents is beyond the control of the Contractor.

30. EXTRA WORK: INCREASED COMPENSATION/DECREASED WORK: CREDIT TO THE OWNER

The Director of Project Management may, at any time, by a written order, and without notice to the sureties, require the performance of Extra Work or require or approve changes in the work, or Decreased Work ("work" to include but not be limited to specified methods of performing work) as he may deem necessary or desirable. The amount of compensation

GENERAL CLAUSES

to be paid to the Contractor for any Extra Work, as so ordered, or credit to the Owner for such decreased work, as so ordered or approved, shall be determined as follows:

- 1) **First:** By such applicable unit prices, if any, as set forth in the Contract; or
- 2) **Second:** If no such prices are so set forth, then by unit prices or by a lump sum, or sums, mutually agreed upon by the Director of Project Management and the Contractor; or
- 3) **Third:** If, in the opinion of the Director of Project Management, the aforesaid unit prices, under "First" above, are not applicable, or if the two parties hereto cannot reach agreement as to new unit prices or a lump sum, or sums, under "Second" above, then by the actual net cost in money to the Contractor of the materials and of the wages of applied labor (including cost of supplements provided and premiums for Workmen's Compensation Insurance, FICA, and Federal and State Unemployment Insurance) required for such Extra Work, plus twenty (20%) percent as compensation for all items of profit and costs or expenses including administration, overhead, superintendence, insurance (other than those specifically noted above) materials used in temporary structures, allowances made by the Contractor to subcontractors, including those made for overhead and profit, additional premiums upon the performance bond of the Contractor and the use of small tools and any and all other costs and expenses not enumerated above, plus such rental for plant and equipment (other than small tools) required and approved for such extra work. Where extra work is performed by a Subcontractor, the twenty percent stipulated above shall be divided between the Contractor and the Subcontractor as per their contractual agreement, or if not defined therein, then as the Contractor sees fit.

Rental rates for any power operated machinery, trucks or equipment, which it may be found necessary to use as in "Third" above, shall be reasonable and shall be based on those prevailing in the area of the County where such work is to be done, and they shall be agreed upon in writing before the work is begun.

In no case shall the rental rates submitted exceed the rates set up in the current edition of "Equipment Watch" plus the cost of fuel and lubricants.

These rates shall include all repairs, fuel, lubricants, applicable taxes, insurance, depreciation, storage and all attachments complete, ready to operate, but excluding operators. Operators shall be paid as stated here in above for labor.

For equipment, which is already on the project, the rental period shall start when ordered to work by the Construction Administrator, and shall continue until ordered to discontinue by him. The minimum payment for any one rental period shall be four hours, unless otherwise agreed upon between the Construction Administrator and the Contractor.

For equipment which has to be brought to the project, specifically for use as in "Third" above, the County will pay all loading and unloading costs, also all transportation costs will not be paid, if the equipment is used for work other than in "Third" above while on the project. The rental period shall begin at the time the equipment has been unloaded on the

GENERAL CLAUSES

project, and shall end on and include the day the order to discontinue the use of the equipment as in "Third" above is given to the Contractor by the Construction Administrator.

The daily rate shall apply for rental periods of four calendar days or less, the weekly rate shall apply for rental periods of more than four and not exceeding twenty-one calendar days, and the monthly rate shall apply for rental periods in excess of twenty-one calendar days. For fractional periods above the full unit rental period (day, week, month) reimbursement shall be proportioned on the basis of the applicable rental period. (Day-8 hrs.; Week-7 calendar days; Month-30 calendar days).

No percentage shall be added to the amounts of equipment rental prices agreed upon, but the price agreed upon shall be the total compensation allowed for the use of such equipment.

The provisions hereof shall not affect the power of the Contractor to act in case of emergency.

31. DISPUTED WORK - NOTICE OF CLAIMS FOR DAMAGES

If the Contractor is of the opinion that any work required, necessitated, or ordered violates or conflicts with or is not required by the terms and provisions of this Contract, it must promptly, within five (5) calendar days after being directed to perform such work, notify the Construction Administrator, in writing, of its contentions with respect thereto and request a final determination thereon. If the Construction Administrator determines that the work in question is contract and not extra work, or that the order complained of is proper, he will direct the Contractor in writing to proceed and the Contractor shall promptly comply. In order, however, to preserve its right to claim compensation for such work or damages resulting from such compliance, the Contractor must, within seven (7) calendar days after receiving notice of the Construction Administrator's determination and direction, notify the Construction Administrator, in writing that the work is being performed or that the determination and direction is being complied with, under protest. Failure of the Contractor to so notify shall be deemed as a waiver of claim for extra compensation or damages therefore.

While the Contractor is performing disputed work or complying with a determination or order under protest in accordance with this Article, in each such case the Contractor shall furnish the Construction Administrator daily with three copies of written statements signed by the Contractor's representatives at the site showing:

- 1) the name of each worker employed on such work or engaged in complying with such determination or order, the number of hours employed thereon, and the character of the work each is doing; and
- 2) the nature and quantity of any materials, plant and equipment furnished or used in connection with the performance of such work or compliance with such order, and from whom purchased or rented.

It is expressly agreed that no dispute over the scope of the Contractor's work or any portion thereof shall cause any delay or interruption to the Contractor's work.

In addition to the foregoing statements, the Contractor shall, upon notice from the Board of Acquisition and Contract, produce for examination by the duly appointed representative of

GENERAL CLAUSES

the Board of Acquisition and Contract, all its books of accounts, bills, invoices, payrolls, subcontracts, time books, daily reports, bank deposit books, bank statements, check books and canceled checks, showing all of its acts and transactions in connection with or relating to or arising by reason of this contract, and submit itself, its agents, servants and employees for examination under oath by any duly appointed representative designated by the Board of Acquisition and Contract to investigate claims made against the County. Unless the aforesaid statements shall be made and filed within the time aforesaid and the aforesaid records submitted for examination and the Contractor, its agents, servants, and employees submit themselves for examination as aforesaid, the County shall be released from all claims arising under, relating to or by reason of this contract, except for the sums certified by the Construction Administrator to be due and agreed that no person has power to waive any of the foregoing provisions, and that in any action against the County to recover any sum in excess of the sums certified by the Construction Administrator to be due under or by reason of this contract, the Contractor must allege in its complaint and prove, at the trial, strict compliance with the provisions of this article.

Before final acceptance of the work by the County, all matters of dispute must be adjusted to the mutual satisfaction of the parties thereto. Determinations and decisions in case any question shall arise, shall constitute a condition precedent to the right of the Contractor to receive the money therefore, until the matter in question has been adjusted.

32. CONTRACTOR'S SUBCONTRACTS AND MATERIAL LISTS

Within fifteen (15) days after execution of the Contract, the successful bidder shall submit to the County for approval a list of the subcontractors, materialmen and materials that he/she plans to use in the performance of the work and statements of the work they are to perform. The format and content of the list shall be in accordance with directives from the Construction Administrator. He/sit shall also submit additional information regarding their qualifications as may be later requested by the County. No part of the work may be sublet until after the Contractor has received the County's approval.

The Contractor shall be fully responsible for all acts and omissions of its subcontractors and persons directly or indirectly employed by them, and the County's approval to sublet parts of the work will in no way relieve the Contractor of any of its obligations under the Contract. All dealings of the Construction Administrator with the subcontractors shall be through the Contractor, subcontractors being recognized by the County only as employees of the Contractor.

By executing the Agreement, the Contractor represents that the Contractor shall insert appropriate clauses in all subcontracts to bind the subcontractors to the Contractor by all applicable provisions of the Contract Documents executed between the Contractor and the County, but this shall not be construed as creating any contractual relationships between subcontractors and the County. Prior to approval of the subcontractors, the County has the right to review and recommend changes in the subcontracts. The County reserves the right to reject any subcontractor proposed by the Contractor if in the reasonable opinion of the County such subcontractor lacks the experience, capability or integrity to perform its subcontract work or is otherwise non-responsible.

GENERAL CLAUSES

By executing the Agreement, the Contractor represents that the Contractor shall insert appropriate clauses in each subcontract that require that if the Contractor is terminated by the County either for default or convenience that at the sole option of the County the subcontract shall automatically attach to the County and the subcontractor shall continue without delay or interruption to fully perform all of the obligations required by its subcontract.

Where the specifications permit the Contractor a choice of different materials or manufactured products, it shall state the choice he has made in making up its bid, with the understanding that all choices must subsequently be approved by the Commissioner, after award of the contract to the successful bidder. If the bidder wishes to propose utilization of materials or manufactured products other than those specified, it shall so state and submit the required information in accordance with Article "Request For Approval Of Equal" of the General Clauses."

33. ASSIGNMENT OF CONTRACT

The Contractor shall not assign, transfer, convey or otherwise dispose of the contract or any part of it or any monies due and payable under the contract, without prior written approval of the County. If such approvals are granted by the County, they shall in no way relieve the Contractor or from any obligations under the terms of this Contract.

All documents assigning the contract or any part of it or any monies due and payable under the contract shall contain a clause stating that all monies to be paid the assignee in accordance with the terms of the Contractor's contract with the County, are subject to a prior lien for services rendered or materials and equipment supplied, in favor of all persons, firms or corporations rendering such services or supplying such materials and equipment.

34. PAYMENT FOR GENERAL PROVISIONS

No direct payment will be made for work done or materials furnished in compliance with the General Provisions of the specifications, unless otherwise noted. All compensation to the Contractor for its performance of the requirements of any general provision shall be considered to have been included in the prices he has bid for the individual items if a unit price contract and/or for a lump sum price if a lump sum contract.

In the event the Contractor fails or refuses to proceed with its work and/or correct or repair deficient or defective work then without prejudice to any and all of the County's other rights and remedies, and upon three (3) days notice to Contractor, the County may perform and/or employ any other person or persons to correct and/or repair any or all such work. All costs incurred by the County pertaining thereto shall be paid forthwith by the Contractor to the County.

35. COSTS INCURRED BY COUNTY

Wherever in these Contract Documents the County is entitled to recover costs from the Contractor or charge the Contractor for the costs incurred for the correction, supervision or for any other reason related to the Contractor's work or arising from the Contractor's failure or refusal to proceed with its work in a timely manner, such costs and/or charges shall be

GENERAL CLAUSES

deemed to include, but not be limited to, the County's costs and fees for inspection(s), engineering, consultant(s) and attorneys.

36. GUARANTEE OF WORK

- A. Except as otherwise specified, all work performed under the Contract shall be guaranteed by the Contractor against defects resulting from the use of inferior materials, equipment or workmanship for one year from the guarantee starting date (which shall be defined as the date of the County's approval of the final Certificate for Payment or the date of actual full occupancy of the building, whichever is earlier). The building, section thereof, or item of equipment, shall be occupied or put into actual use by the Owner only after judged completed by the Construction Administrator and Owner and approved by him as ready for occupancy.
- B. If, within any guarantee period, repairs or changes are required in connection with guaranteed work, which in the opinion of the Construction Administrator or Owner is rendered necessary as a result of the materials, equipment or workmanship which are inferior, defective, or not in accordance with terms of the Contract, the Contractor shall promptly upon receipt of notice from the Construction Administrator or Owner and without expense to the Construction Administrator or Owner:
 - 1) Place in satisfactory condition, in every particular, all of such guaranteed work, correct all defects thereof, and
 - 2) Make good all damages to the building or site, or equipment or contents thereof, and
 - 3) Make good any work or material, or equipment and contents of said building or site disturbed in fulfilling any such guarantee.
- C. In any case where in fulfilling requirements of the Contract or of any guarantee embraced in or required thereby the Contractor disturbs any work, it shall restore such disturbed work to a condition satisfactory to the Construction Administrator.
- D. If the Contractor, after notice, fails to proceed promptly to comply with terms of its guarantee, the Owner may have the defects corrected and the Contractor shall be liable for all expenses incurred.
- E. All special guarantees applicable to definite parts of the work that may be stipulated in the Specifications or other papers forming a part of the Contract shall be subject to the requirements and term of this article.

37. SEPARATE CONTRACTS

- A. Contractor's attention is specifically directed to the fact that, because of the work of other contracts within and adjacent to the limits of this Contract they may not have exclusive occupancy of the territory within or adjacent to the limits of this Contract.
- B. Contractor's attention is further directed to the fact that, during the life of this Contract the owners and operators of Public Utilities may make changes in their facilities. These changes may be made by the Utility employees or by contract within the limit or adjacent to these contracts and may be both temporary and permanent.

GENERAL CLAUSES

- C. Contractor shall be required to cooperate with other contractors and the owners of the various utilities, and to coordinate and arrange the sequence of their work to conform to the progressive operations of the work already under contract and to be put under contract.
- D. Contractor shall be responsible for the coordination of the work of their various subcontractors. Their respective operations shall be arranged and conducted so that delays will be avoided. Where the work of a subcontractor overlaps or dovetails with that of other subcontractors, materials shall be delivered and operations conducted so as to carry on the work continuously in an efficient and workmanlike manner. Delays or oversights on the part of Contractor or its subcontractors or utility owners in getting any or all of their work done in the proper way thereby causing cutting, removing and replacing work already in place, shall not be the basis for claim for extra compensation.
- E. In case of interference between the operations of the utility owners and different Contractors, the Construction Administrator will be the sole judge of the rights of each Contractor and the sequence of work necessary to expedite the completion of the entire project, and in all cases the Construction Administrator's decision shall be accepted as final and may not be challenged except in a proceeding brought pursuant to Article 78 of the Civil Practice Law and Rules.

38. COOPERATION WITH OWNER

Each Contractor shall cooperate with the Owner as to parking of vehicles, availability of storage and working areas and confining of activities and personnel to same. **NO PARKING FOR CONTRACTOR'S EMPLOYEES.**

39. JOB MEETINGS & PROJECT SUPERINTENDANT

- A. An officer of the Contractor, or its project manager or superintendent, who is fluent in English and authorized to make binding decision on behalf of the Contractor shall attend job meetings with the Commissioner and/or the Construction Administrator, and any subcontractors whom the Inspector may designate; for the purpose of discussing expedition, execution and coordination of the work.
- B. Job meetings will be scheduled periodically (the first to be prior to commencement of construction) at a time and place designated by the Construction Administrator.
- C. The Contractor shall not commence any work prior to the first (pre-construction) meeting between the Contractor, Commissioner and/or Construction Administrator, client, and other concerned governmental and utility company representatives.
- D. At the pre-construction meeting, the scheduling of the work on an arrow-flow diagram (showing chronologically and in detail the sequence and methods that will be followed) will be provided, and details for the proper execution and special requirements of the work will be explained and discussed.
- E. The Contractor shall be responsible for providing a detailed construction schedule that provides for a Critical Path Method ("CPM") and which is compatible with any of the state of the art CPM Method scheduling software.

GENERAL CLAUSES

- F. Updated coordinated arrow-flow diagrams or CPM schedules, as the case may be, will be provided by the Contractor, as above, on a monthly basis to the County.

The Contractor shall indicate on the construction schedules noted above, time for shop drawing preparation, approvals, fabrication and delivery of materials and equipment for major items. The County may request that additional important items be included on the schedule.

- G. The Contractors shall ensure that its Project Superintendent shall be on site full time at all times when the Contractor's Work is being performed.

40. PATENT WARRANTY

- A. Contractor expressly represents, warrants and agrees that he has the legal right to furnish and install and to authorize the County to purchase and use the equipment hereby offered and each and every one of its several parts and every feature thereof, under one or the other, or partly under one and partly under the other of the following representations.
- 1) That the Contractor possesses a valid patent(s) covering the equipment to be furnished hereunder or part or features thereof or has or will obtain permit(s) and license(s) authorizing the Contractor to furnish and install same and to authorize the purchase and use thereof by the County.
 - 2) The Contractor is responsible before ordering material, equipment, parts, systems, etc, to verify that the suppliers of all such material, equipment, parts, systems, etc, will supply the required warranty, guarantee, O & P manual, and maintenance service schedule.
 - 3) That the equipment offered or certain parts or features thereof are not covered by any valid patent(s) within the knowledge of the Contractor.
- B. Contractor further warrants and agrees that if any patent(s) is hereafter issued to any person whatsoever with respect to the equipment or any part or features thereof, to be furnished and installed hereunder, the Contractor will obtain such permit(s) or license(s) from the Patentee as may be necessary to authorize the use of the equipment by the County.
- C. Contractor further represents, warrants and agrees that he and its sureties shall hold themselves responsible for and defend any claims made against the County for any infringement of patents due to the purchase and use by the County of said equipment or any part or feature thereof; that they will indemnify and save harmless the County from all costs, expenses and damages which it shall be obliged to pay by reason of any such infringement of patent(s); that in case the use of any such equipment is enjoined, they will bear the expenses of removing same and replacing same with equipment which will satisfactorily perform the function without constituting an infringement of any patent(s); and in case the use of any equipment shall be enjoined, that they shall pay to the County the sum of \$1,000.00 per day, as liquidated damages, for each and every day during which the County shall be enjoined from using the same up to the day on which such

GENERAL CLAUSES

equipment is replaced by other equipment which will satisfactorily perform the same function but which will not constitute an infringement of any other patent(s).

- D. The Contractor further agrees in the event the use of any of the equipment is enjoined and the Contractor is unable within a reasonable time to devise other equipment which will satisfactorily perform the same functions without infringement on any patent(s), that he will remove the equipment and refund to the County the entire cost of its purchase and installation, plus the sum of \$ 1,000.00 per day as liquidated damages for each and every day until the substitute equipment has been purchased and installed by the County, excepting however that such period shall not exceed three months.
- E. The Contractor further agrees in the event that any claim or notice of claim for infringement of patent(s) are made or filed prior to the making of payment by the County for the equipment and/or material proposed to be furnished and installed hereunder, that the County may withhold any sum due to the Contractor for such equipment and/or material until such claims shall have been settled or adjudicated or until additional surety bonds or other guarantees of indemnification shall have been posted, if deemed necessary by the County for its protection.

41. MATERIALS

A. Quality

- 1) It is the intent of these Specifications to describe definitely and fully the character of materials and workmanship required with regard to all ordinary conditions of the work and to require first-class work and new and best quality materials in all particulars. For unexpected conditions arising during the progress of the work and not fully covered herein, the Specifications shall be interpreted by the Construction Administrator to require first-class work and materials and such interpretations shall be accepted by the Contractor.
- 2) The Contractor is responsible before ordering material, equipment, parts, systems, etc, to verify that the suppliers of all such material, equipment, parts, systems, etc, will supply the required warranty, guarantee, O & P manual, and maintenance service schedule.
- 3) Where materials or devices are specified in these documents by reference to government, manufacturer's association, or professional society standards, the pertinent sections of the latest edition of such standards shall have the same force and effect as if set forth in full in these Specifications. The following abbreviations shall be used as indicated for the principal societies:

AASHO	American Association of State Highway Officials
ACI	American Concrete Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
ANSI	American National Standards Institute

GENERAL CLAUSES

ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
AWI	American Woodworking Institute
AWS	American Welding Society
BHMA	Builders Hardware Manufacturers Association
CS	Commercial Standards
FS	Federal Specifications
IEEE	Institute of Electrical and Electronic Engineers
NEC	National Electric Code
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
SDI	Steel Deck Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association, Incorporated
TCA	Tile Council of America, Incorporated
TMCA	Tile and Marble Contractors of America
UL	Underwriter's Laboratories, Incorporated

B. Delivery, Storage and Handling:

- 1) Materials shall be delivered in manufacturer's original sealed containers with complete identification of contents and manufacturer, and kept sealed in original containers until used. Labels shall not be removed until materials have been installed and inspected.
- 2) Materials shall be delivered, stored, and handled with proper equipment and in a manner to protect them from damage.
- 3) The Contractor shall make arrangements for the receipt of materials delivered to the construction site. No representative of the County will accept any materials ordered by the Contractor.
- 4) Finish materials shall be protected from dirt and damage, and perishable materials shall be stored within appropriate weatherproof enclosures.
- 5) Delivery of materials shall be coordinated with the Operations Schedule.
- 6) The Contractor shall confine the apparatus, the storage of materials and the operations of the workmen to the limits indicated by law, ordinances, permits, or directions of the Construction Administrator, and shall not encumber the premises beyond the contract limits.

GENERAL CLAUSES

- 7) The Contractor shall not load or permit any part of the structure to be loaded with a weight that will endanger its safety.
- 8) Whenever the Contract Documents require delivery by the Contractor of any materials, equipment, or other items, the term delivery shall be deemed to include unloading and storing with proper protection where directed.

C. Federal Regulations

- 1) Should the Federal Government, because of Declaration of an Emergency, or other cause, establish controls over the use of certain construction materials, then the Contractor, immediately after signing the Contract or immediately after Declaration of an Emergency, shall furnish the Commissioner with an itemized list of all critical materials required for use on the project. For each item, the quantity required and the approximate date on which delivery will be required shall be indicated.

D. Name Plates

- 1) Each piece of operable equipment to be furnished and installed by a Contractor under its Contract such as motors, pumps, heaters, fans, transformers, switch and fuse racks and other similar equipment shall be provided with a substantial name plate of non-corrodible metal securely fastened in place and clearly and permanently inscribed with the manufacturer's name, the model or type designation, the serial number, the principal rated capacities, the electrical or other power characteristics and other similar and appropriate information.
- 2) Manufacturer's identification shall be inconspicuous, but where nameplates contain information relative to characteristics or maintenance, they shall be clearly visible and located for easy access.
- 3) The nameplate of a subcontractor or a distributor will not be permitted.

E. Manufacturer's Certification

- 1) Prior to the delivery of any water or sewer pipe to the construction site, the Contractor shall furnish properly attested documents certifying as to the type, class, name of manufacturer and source of supply of the pipe. One copy of each document shall be forwarded to the Construction Administrator at the construction site and to the Director of Project Management care of the Engineering Division, Michaelian Office Building, White Plains, New York.

F. Samples

- 1) The Contractor shall furnish, for approval of the Engineer, any samples required by the specifications or that may be requested by the Owner, of all materials he proposes to use, and shall pay all shipping charges for the samples. The Contractor shall send all samples to the office of the Engineer, except when directed otherwise. The sample of approved material will remain on file in the Engineer's office. A disapproved sample will be returned to the Contractor.
- 2) No samples are to be submitted with bids.
- 3) No materials or equipment of which samples are required to be submitted for

GENERAL CLAUSES

approval shall be used on the work until such approval has been given by the Engineer or Construction Administrator, save only at the Contractor's risk and expense.

- 4) Each sample shall have a label indicating the material represented, its place of origin and the names of the producer, the Contractor and the Contract for which the material is intended.
- 5) Approval of any sample shall be only for characteristics or for uses named in such approval, and no other. No approval of a sample shall be taken in itself to change or modify any Contract requirement. When a material has been approved, no additional sample of that material will be considered and no change in brand or make will be permitted. Approved samples held by the Engineer will be returned to the Contractor upon completion of the work, if requested.
- 6) Transactions with manufacturers or subcontractors shall be through the Contractor.

G. Dissimilar Materials

- 1) Where metals are placed in contact with or fastened to dissimilar metals, concrete, masonry, wood or other absorptive materials subject to repeated wetting or wood treated with a preservative non-compatible with the metal or if drainage from dissimilar materials passes over the work; treat the contact surfaces with a heavy coat of approved alkali-resident bituminous paint.
- 2) Where one of the metals is aluminum, a coat of zinc-chromate primer shall be applied prior to the bituminous paint.

42. STANDARD OF QUALITY

Wherever in the contract documents an article, material, apparatus, device, product or process is called for by trade name or catalog reference, or by the name of the patentee, manufacturer or dealer, it shall be construed as establishing a standard of quality and not construed as limiting competition. In such instances, the Contractor may use any article, material, etc. which, in the judgment of the Engineer, expressed in writing, is equal to and acceptable for the intent specified.

43. PROPRIETARY ITEM

Whenever less than three names are used in proprietary item specifications, it has been determined that:

- A. The use of trade names is necessary for effective and workable specifications for the item.
- B. All manufacturers known by the individuals familiar with the trade involved have been listed.
- C. Equal items may be approved in accordance with Article "Request For Approval Of Equal" of the General Clauses.

GENERAL CLAUSES

44. SHOP DRAWINGS

A. Shop Drawing Schedule

- 1) Within fifteen (15) days after the Notice to Proceed, the Contractor shall prepare and submit two (2) copies of its schedule of Shop Drawing submissions to the Engineer for review and approval. The schedule is to be submitted on the “Shop Drawing Schedule” form of the Sample Forms.
- 2) In order to maintain the construction schedule for this project the Contractor shall submit all Shop Drawings per approved schedule. The Contractor is expressly cautioned that its failure or refusal to timely submit a shop drawing schedule acceptable to the Engineer and/or any deviation from the approved shop drawing schedule shall be deemed a default under this Contract.
- 3) Shop Drawings shall be submitted without fail in time to permit correction, resubmission and final approval, as hereinafter specified, without causing any delay in the construction of any Work.
- 4) Samples and Shop Drawings, which are related to the same unit of Work or Specification Section, shall be submitted at the same time. If related Shop Drawings and Samples are submitted at different times, they cannot be reviewed until both are furnished to the Engineer.
- 5) The schedule shall be updated every four-(4) weeks or more frequently as required by the Engineer.
- 6) Two (2)-updated copies of the schedule shall be submitted to the Engineer with each application for Partial Payment.
- 7) Form of Schedule

Schedule shall be in tabular form with appropriate spaces to insert the following information for principal items of equipment and materials:

- a. Date on which Shop Drawings are requested and received from the manufacturer.
- b. Dates on which Shop Drawings are transmitted to the Engineer by the Contractor.
- c. Dates on which Shop Drawings are returned by the Engineer for revisions.
- d. Dates on which Shop Drawings are revised by manufacturer and resubmitted to the Engineer.
- e. Date on which Shop Drawings are returned by Engineer annotated either “Approved” or “Approved as Noted”.
- f. Date on which accepted Shop Drawings are transmitted to manufacturer and Contractor’s Invoice Number.
- g. Date of manufacturer’s scheduled delivery.
- h. Date on which delivery is actually made.

GENERAL CLAUSES

- i. Sample of schedule follows on next page.

B. Shop Drawing Requirements

- 1) Shop Drawings for the Work shall include working and setting drawings, schedules, shop details, wiring diagrams, manufacturer's catalog cuts and brochures and all other drawings, schedules and diagrams necessary for the proper correlation of the Work.

Insofar as it is practicable, all drawings shall be uniform in size. They shall be dated, numbered consecutively and shall be identified with the Contract Number and Title, a description of the material or equipment and the area of the work and where it is to be installed. Shop drawings shall accurately and clearly show sizes, work, erection dimensions, arrangement and sectional views, necessary details including information for making connection with the work of other items as may be required, materials and finishes, detailed parts lists, and performance characteristics and capacities as may be required.

- 2) All detailing for structural components shall be done in accordance with the provisions for design and workmanship in the latest additions of the publications listed below except as may be modified in the Contract Documents:

- a. "Manual of Steel Construction" of the American Institute of Steel Construction.
- b. "Building Code Requirements for Reinforced Concrete" and "Manual of Standard Practice for Detailing Reinforced Concrete Structures" of American Concrete Institute.

- 3) Detailing practices for other components shall be done to conform to the best trade practices.

4) Contractor Responsibilities

- a. Before submitting Shop Drawings to the Engineer all submittals from its Subcontractors, manufacturers or suppliers shall be sent directly to the Contractor for preliminary review, coordination and checking.

Contractor shall be responsible for their submission at the proper time so as to prevent delays in delivery of material or equipment. Contractor shall thoroughly check all drawings for accuracy and conformance to the intent of the Contract Documents. Drawings found to be inaccurate or otherwise in error shall be returned to the Subcontractors, manufacturers, or suppliers by the Contractor for correction.

- b. All submittals, including Shop Drawings prepared by or under the direction of the various Contractors, shall be thoroughly checked by the Contractor for accuracy and checked by the Contractor for accuracy and conformance to the intent of the Contract Documents before being submitted to the Engineer and shall bear the Contractor's signature certifying that they have been so checked. Before submitting them to the Engineer, all submittals shall be properly labeled and consecutively numbered. In a clear space above the title block, the Contractor shall provide the "Shop Drawing ID" form of the Sample Forms, and enter the required information:

GENERAL CLAUSES

- c. Shop Drawings shall be submitted as a single package including all associated drawings for any operating system and shall include all items of equipment and any mechanical units involved or necessary for the functioning of such system. Where applicable, the submittal shall include elementary wiring diagrams showing circuit functioning and necessary interconnecting wiring diagrams for construction.
- d. If the submittals contain any departures from the Contract Documents, specific mention thereof shall be made in the Contractor's letter of transmittal. Otherwise, the review of such submittals shall not constitute approval of the departure. The Contractor shall also call the Engineer's attention to any changes by the use of larger letters of at least 1" in height on the Shop Drawings along with a letter by the Contractor advising the Engineer to the recommended change and the reason therefore. If this is not done, even if the Work is incorporated in the construction, it will not be accepted by the Engineer even if Shop Drawings are "Approved".
- e. No materials or equipment shall be ordered, fabricated or shipped or any Work performed until the Engineer returns to the Contractor the submittals herein required, annotated "Approved".
- f. Where errors, deviations, and/or omissions are discovered at a later date in any of the submittals, the Engineer's prior review of the submittals does not relieve the Contractor of the responsibility for correcting all errors, deviations and/or omissions.
- g. Two (2) copies of Preliminary Operations and Maintenance Manuals shall be submitted with the final Shop Drawings for each item of equipment.
- h. Submittals shall be transmitted in strict compliance with Special Clause 10. A.2 and in sufficient time to allow the Engineer adequate time for review and processing so as not to delay the Project per the approved Shop Drawing Schedule.
- i. Contractor shall transmit five (5) prints of each submittal to the Engineer for review. Any submissions, which in the opinion of the Engineer, are not legible will not be reviewed and will be returned to the Contractor annotated "Disapproved".
- j. Contract drawings are for engineering and general arrangement purposes only and are not to be used as Shop Drawings.
- k. Shop Drawings shall accurately and clearly present the following:
 - All working and installation dimensions.
 - Arrangement and sectional views.
 - Units of equipment in the proposed positions for installation, details of required attachments and connections, and dimensioned locations between units and in relation to the structures.
 - Necessary details and information for making connections between the

GENERAL CLAUSES

various trades including, but not limited to, power supplies and interconnecting wiring between units, accessories, appurtenances, etc.

- l. Structural and all other layout drawings prepared specifically for the Project shall have a plan scale of not less than 1/4-inch equal to 1 foot and they shall be not larger than the size of the Contract Drawings.
 - m. Where manufacturer's publications in the form of catalogs, brochures, illustrations, compliance certificates, or other data sheets are submitted in lieu of prepared Shop Drawings, such submissions shall specifically indicate the item for which approval is requested. Identification of items shall be made in ink, and submissions showing only general information are not acceptable.
 - n. The Contractor shall provide all required copies for the use of the various trades and at the Site, and one (1) copy of approved Shop Drawings shall be provided by the Contractor to each of the other Prime Contractors unless otherwise noted in writing by the Engineer.
 - o. The Contractor shall respond to required submittals with complete information and accuracy to achieve required approvals within three (3) submissions. All costs to the Owner involved with subsequent submissions of Shop Drawings, Samples or other items requiring approval, will be backcharged to the Contractor, at the rate of 3.0 times direct technical labor cost, by deducting such costs from payments due for Work completed. In the event an approved item is requested by the Contractor to be changed or substituted, all involved costs in the review process will likewise be paid by the Contractor to the County unless determined by the Director of Project Management or Commissioner that the need for such deviation is beyond the control of the Contractor. Contractor shall be responsible for coordinating its Work and submittals with its Subcontractors.. Should Contractor cause the need for additional submissions or reviews of previous submissions all involved costs will similarly be paid to the County.
- 5) Procedure for Review
- a. Shop Drawings will be checked for design conformance with the Contract Documents and general arrangement only.
 - b. Submittals will be annotated by the Engineer in one of the following ways:
 - "Approved" - no exceptions are taken.
 - "Approved as Noted" - minor corrections are noted and shall be made and a resubmittal is required.
 - "Disapproved because" - with specific deficiencies noted.
 - "Disapproved" - based on the information submitted, the submission is not in conformance with the Contract Documents. The deviations from the Contract Documents are too numerous to list and a completely revised submission of the proposed equipment or a submission of other equipment is required.

GENERAL CLAUSES

c. One copy of the reviewed submittals will be returned to the Contractor. It is the Contractor's responsibility to provide copies to:

- Its Subcontractors.
- Its Materialmen and Suppliers.

unless notified otherwise in writing by the Engineer.

- 6) Disapproved drawings will be returned to the Contractor for correction and resubmission. After the Contractor has had the required corrections made on the original drawing, it shall again submit five copies for review by the Engineer.
- 7) The acceptance of Shop Drawings by the Engineer shall be only general in nature and shall not relieve the Contractor of any responsibility for the accuracy of the drawings, the proper fitting and construction of the Work or for the furnishing of materials or other Work required by the Contract Documents, but not shown on the Shop Drawings. Acceptance of Shop Drawings by the Engineer shall not be construed as approving departures from the Contract requirements unless specifically noted by the Engineer. Acceptance of Shop Drawings for one item shall not be construed as approval for other changes even if noted by the Contractor on the drawing.
- 8) Shop Drawings submitted other than in accordance with the outlined procedures will be returned to the Contractor for resubmission and the Contractor shall bear all expense and risk of all delays as if no Shop Drawings had been submitted.
- 9) No Work shall be performed until the Shop Drawings have been accepted by the Owner, and the Contractor shall be responsible for all costs and damages, which may result from proceeding prior to the approval of the Shop Drawings.

45. SEQUENCE OF CONSTRUCTION OPERATIONS

- A. It is mandatory that the premises continue to be occupied and facilities therein shall continue to function during the performance of the construction work.
- B. Detailed sequence of construction and availability of spaces in areas through which services must pass shall be coordinated between the Owner and the Contractor, before actual commencement of the Work.
 - 1) To enable the Work to be laid out and prosecuted in an orderly and expeditious manner, Contractor shall provide a proposed Progress Schedule, within fifteen (15) days after the issuance of the Notice to Proceed of this Contract unless otherwise directed in writing by the Construction Administrator. The proposed Progress Schedule shall show the anticipated time of commencement and completion of each of the various operations to be performed under this Contract; together with all necessary and appropriate information regarding the sequence and correlation of Work; and the Schedule of Shop Drawings and delivery of all materials and equipment required for the Work. The Contractor shall prepare a Master Progress Schedule (Schedule) for the Work. Contractor as directed by the Construction Administrator shall revise the proposed Schedule until each activity is properly sequenced to provide that the Work will be completed in the proper order and

GENERAL CLAUSES

within the allotted Contract duration, without any conflicts. When the Construction Administrator has accepted the Schedule the Contractor will sign it. The Contractor shall then provide one (1) copy of such approved Schedule to each Subcontractor and two (2) copies to the Construction Administrator. Contractor shall afford its Subcontractors a reasonable opportunity for the introduction and storage of their materials and the execution of their Work and shall properly connect and coordinate its Work with others.

Contractor shall strictly adhere to the Schedule unless changed as provided for in the following paragraph.

- 2) Within five (5) days after receiving notice of any change in the Contract, or of any Extra Work to be performed, or of any suspension of the whole or any portion of the Work, or of any other conditions which are likely to cause or are actually causing delays, Contractor must notify the Construction Administrator in writing of the effect, if any, of such change or Extra Work or suspension or other condition upon the previously approved schedule, and must state in what respects, if any, the Schedule should be revised, with the reasons therefor. These proposed changes in the Schedule shall be reviewed and, if appropriate, approved, in writing, by the Construction Administrator. Contractor must strictly adhere to the revised Schedule. Distribution of the revised Schedule shall be as described in paragraph B-1 above. Contractor's compliance with the requirements of this paragraph is in addition to, and not in lieu of, compliance with other notice requirements pertaining to delays and extensions of time contained elsewhere in the contract.
 - 3) The Schedule shall be reviewed by Contractor every two (2) weeks or as directed by the Construction Administrator.
 - 4) If Contractor shall fail to adhere to the approved Schedule, or to the Schedule as revised, they must promptly adopt additional means and methods of construction with no additional cost to the County that will make up for the lost time and will assure completion in accordance with such Schedule. The proposed means and methods shall be described in writing to the County within two (2) days after the Contractor discovered or should have reasonably discovered that the Schedule would not be met as originally proposed. Failure to comply with this requirement may result in the County enforcing its rights under the Contract including, without limitation, default of the Contract.
- C. From time to time as the Work progresses and in the sequence indicated by the approved Schedule, the Contractor must submit to the Construction Administrator a specific request in writing for each item of information or approval required. These requests shall be submitted sufficiently in advance of the date upon which the information or approval is actually required by the Contractor to allow for the time the Construction Administrator may reasonably take to act upon such submissions or resubmissions. The Contractor shall not have any right to an Extension of Time on account of delays due to its failure to timely submit requests for the information or approvals.
- D. Certain construction work shall be required, which will be disruptive to the Owner's staff insofar as noise, dirt and dust is concerned. The Contractor, therefore, shall

GENERAL CLAUSES

perform such work during other than normal working hours. Subject to the requirements of law, the Owner imposes no limitation on the Contractor's working hours and whatever overtime work may be necessary or required shall be considered by the Contractor and reflected in its Bid Proposal without the benefit of extra compensation.

46. PROTECTION

- A. The Contractor shall at all times exercise all necessary precautions for the safety of the public, employees performing the work and County personnel. The Contractor shall provide and maintain barricades, danger signals and other safeguards about the work and shall be held responsible for all accidents or damages to persons or property caused by failure to do so throughout the progress of the work, and shall comply with all applicable provisions of Federal, State and County Safety Laws.
- B. The Contractor shall during the performance of its work, protect at all times all adjacent portions of the existing surfaces and existing equipment from damage due to the performance of the construction work.
- C. The Contractor shall furnish temporary facilities and/or temporary dust-proof partitions separating all work areas and access routes from those areas not involved in active alterations, so that this work will not interfere with the Owner's access or normal use of areas not allocated to the Contractor, or any essential service to such areas, when ordered by the Construction Administrator.

47. CLEANUP AND REMOVAL OF DEBRIS

- A. At the end of each working day, the Contractor shall sweep up and collect all the rubbish and place it in appropriate containers, furnished by the Contractor. Containers shall be kept at a location on, or adjacent to the work site, as designated by the Construction Administrator. Wood or cardboard crates and other debris of a similar nature shall be broken up, securely bundled and neatly stacked alongside the containers. Once each week and at the completion of the work, the Contractor shall remove all accumulated debris and rubbish.
- B. At the completion of the work, the Contractor shall clean all equipment, fixtures, surfaces and accessories, removing all dust and other foreign matter, ready for use by the Owner.

48. TEMPORARY SERVICE

- A. Sanitary facilities will be provided by the Owner for the Contractor and its personnel.
- B. The Owner will supply and pay for the cost of all-temporary water and temporary electric power (120 volt, 60 hertz). The Contractor shall furnish and install all temporary electrical and water connections required for work under this Contract, at and to locations as designated by the Construction Administrator.

GENERAL CLAUSES

49. OPERATING TESTS

- A. Where operating tests are specified the Contractor shall test the work as it progresses and shall make satisfactory preliminary tests in all cases before applying to the Engineer for official tests.
- B. Official tests will be made in the manner specified for the different branches of the work, in the presence of the Construction Administrator or Engineer. Should defects appear they shall be corrected by the Contractor and the test repeated until the installation is acceptable to the Construction Administrator or Engineer and to any authorities having jurisdiction.
- C. No work of any kind shall be covered or enclosed before it has been tested and approved.
- D. The Contractor shall furnish all materials and apparatus, make connections and conduct tests, without extra compensation unless noted otherwise.

50. OPERATING INSTRUCTIONS AND PARTS LISTS

- A. Where the Specifications require any Contractor to supply equipment operating and maintenance instructions and spare parts lists prior to the completion of the work it shall provide three copies of the publications for each piece of equipment he has furnished and installed under the Contract, upon receipt of the approved shop drawings.
- B. Publications shall be prepared for the specific equipment furnished and installed, containing the following information, and shall not refer to other sizes, types or models of similar equipment:
 - 1) Clear and concise instructions for the operation, adjustment, lubrication and other maintenance of the equipment, including a complete lubrication chart.
 - 2) A complete listing of all parts for the equipment, with catalog numbers and other data necessary for ordering replacement parts.
- C. Advertising literature will not be acceptable.

51. CUTTING AND PATCHING

Contract with Single Bid:

- A. Where the project does not involve separate bids pursuant to the New York General Municipal Law the following will apply:
 - 1) Where walls, floors, ceilings, roofs or other items require cutting for the installation of new work, all such cutting shall be done by the Contractor with the approval of the Construction Administrator; and the Contractor shall patch the opening to make the cut portions match the adjacent finished surfaces, unless otherwise indicated.
 - 2) The Contractor shall not endanger any existing condition by its operations.
 - 3) The cost of all cutting and patching caused by the Contractor's negligence shall be

GENERAL CLAUSES

borne by the Contractor.

Contract with Separate Bids:

- B. If the project is one where separate bid specifications are required pursuant to the New York General Municipal Law the following will apply:
- 1) A sufficient time in advance of the construction of new floors, walls, ceilings, roofs, or other items, each Contractor shall be responsible for properly locating and providing in place all sleeves, inserts and forms required for their work, and shall furnish the Contractor for General Construction with complete information relative to exact locations and dimensions of all required openings in the General Contractor's work. Other Contractors shall periodically consult the Job Progress Chart of the General Contractor so that they will not be delayed by their work requirements, but the General Contractor shall be obliged to give all other Contractors at least seventy-two hours notice before commencing the previously mentioned new construction work.
 - 2) The cost shall be borne by the responsible Contractor for all cutting, patching, re-waterproofing and re-caulking of new work necessary for reception of the work of a Contractor, caused by the Contractor's failure to timely or properly locate and provide in place all sleeves, inserts and forms required for its own work, or by a Contractor's failure to inform the General Contractor of required openings. The General Contractor shall do all cutting, patching, re-waterproofing and re-caulking of all new work no matter how or by whom such work was caused and shall be reimbursed for such extra work by the responsible Contractor, in accordance with the terms of the Contract. All cutting and patching shall have prior approval of the Construction Administrator.
 - 3) Where sleeves, inserts, forms or openings are required in existing walls, floors, ceilings roofs, or other existing items, all necessary cutting, patching, re-waterproofing and re-caulking required shall be done by the individual responsible Contractor, except for finished surfaces. The responsible Contractor shall do all rough patching to bring the cut areas to the proper surface ready to receive the finished surface. All finishing work required to make the cut portions match the adjacent finished surfaces shall be performed by the General Contractor.
 - 4) Each Contractor shall be responsible for coordinating their work with the work of all other Contractors engaged on the project. If directed, Contractors shall submit coordinated shop drawings showing how the fitting of the various parts of the work will be accomplished, for the Construction Administrator's acceptance.
 - 5) All cutting and patching shall be governed by the applicable divisions of the Specifications with regard to workmanship, materials and methods.
 - 6) No Contractor shall endanger any work by unauthorized cutting, excavating, or other alteration of the work, unless previously authorized by the Construction Administrator.

GENERAL CLAUSES

52. CONFLICTS AMONG CONTRACT DOCUMENTS

In the event of any conflict among the Contract Documents, the Contractor shall notify the Commissioner and comply with the Commissioner's interpretation, according to the following priorities:

<u>Priority Order</u>	<u>Document</u>
1.....	Modification issued after execution of Agreement
2.....	Agreement between Owner and Contractor
3.....	Addenda issued prior to the execution of the Agreement (Later date to take precedence)
4.....	Special Notices
5.....	Technical Specifications
6.....	Construction Drawings:
6A.....	Schedule on Construction Drawings
6B.....	Notes on Construction Drawings
6C.....	Large Scale Details on Construction Drawings
6D.....	Small Scale Details on Construction Drawings
7.....	General Requirements
8.....	Special Clauses
9.....	Information for Bidders and General Clauses

53. RECORD DRAWINGS

- A. The Owner shall furnish, at the first job meeting, one set of "paper" copies of the contract drawing(s) - this is in addition to the five sets of contract drawings as described in the Article "Contract Drawings" of the General Requirements; for the Contractor's use to indicate change(s) as they occur for the duration of the construction work. Upon request from the Contractor, the County will supply the Contractor a copy of the original Contract Drawings in AutoCAD format.
- B. The Contractor shall record neatly and legibly, using reasonable drafting care, all approved change(s) (including minor revisions or corrections of pipes, ducts, electric outlets, circuit panels and other features, as well as invert elevations and locations of underground lines).
- C. When all approved changes are recorded and clearly identified, the Contractor shall prepare a set of "as-built" (record) drawings, in the latest version of AutoCAD, using the approved County format and associated CAD layering guidelines, with 24" x 36" drawing sizes, showing the project as built including all changes in the work made during construction based on marked-up prints, drawings, and other data. These drawings shall be filed on a CD and submitted to the Construction Administrator.
- D. All additional "paper" or reproducible drawings are to be obtained by the Contractor at their own expense.

GENERAL CLAUSES

54. TIME

- A. All time limits (see Article “Required Time For Completion Of The Work” of the General Requirements, and, Article “Time Of Starting” of the Information For Bidders) stated in the specifications are of the essence of the Contract.
- B. The Contractor may perform all necessary labor during other than normal working hours. The Owner imposes no limitation of the Contractor's working hours and whatever overtime work may be necessary or required shall be considered by the Contractor and reflected in its Bid Proposal without the benefit or extra compensation. The Contractor must give a minimum of four (4) hours notice to the Construction Administrator when overtime Work is necessary. The Contractor shall promptly pay to the County the additional cost of the Engineer and Construction Administrator for inspection services during the overtime Work.

55. ACCELERATION OF THE WORK

The Owner may, at its sole discretion and for any reason, require the Contractor to accelerate the schedule of performance by providing overtime, extended day, extra crews, Saturday, Sunday and/or holiday work and/or by having all or any subcontractors designated by the Owner provide overtime, extended day, extra crews, Saturday, Sunday or holiday work by the Contractor's or his subcontractor's own forces, and such requirements is independent of and not related in any way to any apparent inability of the Contractor to comply with the schedule(s), Milestone(s) and/or completion date requirements, the Owner, pursuant to a written change order as signed by the Commissioner shall reimburse the Contractor for the direct cost to the Contractor of the premium time for the labor utilized by the Contractor in such overtime, extended day, extra crews, Saturday, Sunday or holiday work (but not for the straight time costs of such labor) together with any social security and state or federal unemployment insurance taxes in connection with such premium time. However, no overhead, supervision costs, commissions, profit or other costs and expenses of any nature whatsoever, including impact costs or costs associated with lost efficiency or productivity, shall be payable in connection therewith. Anything to the foregoing notwithstanding, in the event that the Contractor has fallen behind schedule or in the Owner's judgment appears likely to fall behind schedule, Owner shall have the absolute right to direct the Contractor to accelerate the performance of its work, including that of its subcontractors, and the full costs for such acceleration shall be borne solely by the Contractor.

56. ULTRA LOW SULFUR DIESEL FUEL

- A. Contractors and Subcontractors operating onroad and nonroad vehicles to perform County work must power those vehicles with ultra low sulfur diesel fuel. Ultra low sulfur diesel fuel is any diesel fuel that has a sulfur content of no more than fifteen parts per million.
- B. In addition, all onroad and nonroad diesel vehicles used to perform County work and equipped with a model year 2003 or older engine shall utilize the best available

GENERAL CLAUSES

technology² in accordance with the following schedule:

- a) effective September 1, 2007 - 35% of all such motor vehicles used on this project;
- b) effective September 1, 2008 - 65% of all such motor vehicles used on this project;
- c) effective September 1, 2009 - 100% of all such motor vehicles used on this project.

- C. All onroad and nonroad diesel vehicles to perform County work having a gross vehicle weight rating of more than 14,000 pounds shall utilize the best available technology or be equipped with an engine certified to the applicable 2007 United States Environmental Protection Agency ("EPA") standard for particulate matter as set forth in Section 86.007-11 of Title 40 of the Code of Federal Regulations or to any subsequent EPA standard for such pollutant that is at least as stringent, in accordance with the following schedule:
 - a) by September 1, 2007 - 35% of all such motor vehicles;
 - b) by September 1, 2008 - 65% of all such motor vehicles;
 - c) by September 1, 2009 - 100% of all such motor vehicles
- D. Any contractor who violates any provision of Section 873.1329 shall be liable for a civil penalty not to exceed ten thousand dollars plus twice the amount of money saved by such contractor for failure to comply with this section.
- E. Any contractor who makes a false claim may be liable for a civil penalty not to exceed twenty thousand dollars, in addition to twice the amount of money saved by such contractor as a result of having made such false claim.
- F. Nothing in this section shall be construed to limit the County's authority to cancel or terminate a contract, deny or withdraw approval to perform a subcontract or provide supplies, issue a non-responsibility finding, issue a non-responsiveness finding, deny a person or entity pre-qualification as a vendor, or otherwise deny a person or entity public entity business.
- G. If sufficient quantities of ultra low sulfur diesel fuel are not available to meet the needs of a contractor to fulfill the requirements of this contract, the Contractor may submit a written request to the Commissioner to use diesel fuel with a sulfur content of no more than thirty parts per million as long as the contractor shall use whatever quantity of ultra low sulfur diesel fuel that is available. Such determination shall be made in writing on a case by case basis upon written application to the Commissioner. If the Commissioner grants such authority it shall expire sixty days thereafter and may be renewed upon written request for additional periods of sixty days.

² Best Available Technology means a system for reducing the emission of pollutants which is based on technology verified by the U.S. Environmental protection Agency or the California Air Resources Board or which has been identified pursuant to NYC's Department of Environmental Protection that (1) reduces diesel particulate matter emissions by at least 85 percent, as compared to a similar engine operating on traditional diesel fuel without emission control technology, or reduces engine emissions to 0.01 grams diesel particulate matter per brake horsepower per hour or less; and 2) achieves the greatest reduction in emissions of nitrogen oxides at a reasonable cost and in no case produces a net increase in nitrogen oxides in excess of 10%.

GENERAL CLAUSES

H. The Contractor, in order to comply with Subsections B & C above, must retrofit its vehicles to include both of the following in order to comply with the Best Available Technology Requirements:

- Diesel Oxidation Catalysts (DOC)
- Crankcase Vent Filters (CVF)

If the Contractor wants to propose an alternative technology it must submit a written request to the Commissioner with sufficient detail to enable the Commissioner to make a determination as to whether to accept the alternative technology. Any approval of alternative technology must be in writing.

57. QUALIFIED TRANSPORTATION FRINGE PROGRAM

EXECUTIVE ORDER NO. 7-2005

Requires that contractors, concessionaires and vendors doing business with the County enroll in a Qualified Transportation Fringe Program as defined in §132(f)(1) of the IRS Tax Code for all contracts for goods or services of \$100,000 or more in any twelve month period during the contract term if such contractor, concessionaire or vendor employs more than 25 individuals who utilize public transportation and/or pay for commuter parking at least 1 day per week regardless of whether those employees are engaged in work pursuant to the contract.

Bidders shall submit the signed statement on Proposal Page 34. Notwithstanding the above, a Bidder may submit a Waiver Application on Proposal Page 35 to the Commissioner.

58. USE OF FLUORESCENT LIGHT BULBS & ENERGY EFFICIENT BULBS

The use of incandescent light bulbs is prohibited in County-owned buildings and facilities. Only fluorescent light bulbs may be installed in County buildings and facilities. Exterior lights must utilize energy-efficient bulbs. For further details see Article 58 of the General Clauses.

59. COUNTY OF WESTCHESTER PHOSPHORUS-FREE LAWN FERTILIZER POLICY

Executive Order 8-2007 limits the use of lawn fertilizers containing phosphorous and other compounds containing phosphorous, such as phosphate on County owned property.

EXECUTIVE ORDER NO.8 OF 2007

WHEREAS, the New York City water supply watershed is a critical drinking water source for approximately eight million New York City consumers and approximately one million upstate consumers. Over eighty-five percent (85%) of Westchester County's residents consume water from the New York City water supply system; and

WHEREAS, eutrophication is a natural aging process of lakes or streams brought on by

GENERAL CLAUSES

nutrient enrichment. Eutrophication can be greatly accelerated by human activities that increase the rate at which nutrients and organic substances enter aquatic ecosystems from their surrounding watersheds; and

WHEREAS, as a result of accelerated eutrophication, enhanced plant growth reduces dissolved oxygen in the water creating severely impaired water bodies with unpleasant water taste and odor, discoloration, release of toxins and increased turbidity that interferes with the health and diversity of indigenous fish, plant, and animal populations and with the recreational use of rivers, lakes and wetlands. Consequently, eutrophication restricts water use for fisheries, recreation, industry, and drinking due to the increased growth of undesirable algae and aquatic weeds and the oxygen shortages caused by their death and decomposition; and

WHEREAS, nutrient pollution due to human activities is one of the leading causes of eutrophication in the NYC Watershed, and is specifically accelerated by the introduction of excessive phosphorus into the environment. In fact, most reservoirs in the East of Hudson portion of the New York City Watershed (5 of the 7 located in Westchester County) are designated as phosphorous-restricted basins in accordance with the New York City Watershed Rules & Regulations due to excessive phosphorous volumes which have not been reduced despite phosphorous reductions mandated by the New York State Department of Environmental Conservation (NYSDEC); and

WHEREAS, one unnecessary source of phosphorus pollution in the watershed is the many pounds of lawn fertilizer applied by residents and businesses in the County of Westchester each year; and

WHEREAS, when phosphorus fertilizer is applied to phosphorus-rich lawns, much of the excess simply runs off of the lawn into the storm drainage systems where it can be carried into rivers, lakes, streams, and wetlands, causing eutrophication; and

WHEREAS, soil tests conducted pursuant to a six-year study by the Cornell Cooperative Extension, an extension of the State's designated Land-Grant University, have shown that approximately 90% of the lawns in Westchester County have medium-to-high levels of phosphorus; and

WHEREAS, the New York City Watershed Pesticide and Fertilizer Technical Working Group, established by the New York City Watershed Memorandum of Agreement, issued a report in 2000, noting the high percentage of phosphorus in regional soils and recommending that phosphorus-based lawn fertilizers be added only when a soil analysis identifies phosphorus deficiencies.

WHEREAS, the proposed Stormwater Phase II regulations recently issued by the New York State Department of Environmental Conservation, and which are expected to go into effect in January of 2008, will allow the use of phosphorus-based lawn fertilizers on municipally-owned land only where soil testing indicates that phosphorus concentrations are inadequate, in order to ensure that municipalities in the New York City Watershed are

GENERAL CLAUSES

taking satisfactory steps to achieve the above-referenced mandatory phosphorous reductions.

WHEREAS, the United States Environmental Protection Agency has also determined that a Nonpoint Source Implementation Plan was necessary in the Croton Watershed because the phosphorus reductions necessary to meet the targeted applicable water quality standards could not be achieved by wastewater treatment plant upgrades alone; and

WHEREAS, Section 110.11 of the Laws of Westchester County places the responsibility to supervise, direct and control, subject to law, the administrative services and departments of the county, upon the County Executive; and

WHEREAS, I have determined that restricting the application and use of lawn fertilizer containing phosphorus on all County-owned property will address one source of unnecessary and preventable phosphorus pollution and will improve water quality in the County; and

WHEREAS, the Department of Planning, after review of the applicable regulations under the State Environmental Quality Review Act, has advised that this Executive Order has been classified as a Type II action, pursuant to 6 N.Y.C.R.R. § 617.5(c)(20), “routine or continuing agency administration and management, not including new programs or major reordering of priorities that may affect the environment,” and 6 N.Y.C.R.R. § 617.5(c)(27), “adoption of regulations, policies, procedures and local legislative decisions in connection with any action on this list.” As such, no further environmental review is required.

GENERAL CLAUSES

NOW THEREFORE, I, _____, County Executive of the County of Westchester, in light of the aforementioned, do hereby order and direct each and every department, board, agency, and commission of the County of Westchester under my jurisdiction to ensure that the policies and procedures set forth in the following Phosphorus-Free Lawn Fertilizer Policy are complied with.

COUNTY OF WESTCHESTER PHOSPHORUS- FREE LAWN FERTILIZER POLICY

I. Definitions:

- (1) "Certified laboratory" means any laboratory certified by the New York State Department of Health pursuant to section five hundred two of the New York State Public Health Law to conduct soil analysis.
- (2) "Commercial fertilizer" means any substances containing one or more recognized plant nutrients which is used for its plant nutrient content, and which is designed for use or claimed to have value in promoting plant growth, except unmanipulated animal or vegetable manures, agricultural liming material, wood ashes, gypsum and other products exempted by regulation of the New York State Commissioner of Agriculture and Markets.
- (3) "Lawn fertilizer" means a commercial fertilizer distributed primarily for non-farm use, such as lawns, shrubbery, flowers, golf courses, municipal parks, cemeteries, greenhouses and nurseries, and such other use as the commissioner may define by regulation. Lawn fertilizer does not include fertilizer products intended primarily for garden and indoor plant application.

II. Use and Application of Lawn Fertilizer:

- (1) Any lawn fertilizer that is labeled as containing more than 0% phosphorus or other compound containing phosphorus, such as phosphate, shall not be applied upon any County-owned property, except as provided in section III. Of this Executive Order.
- (2) No lawn fertilizer shall be applied upon County-owned property when the ground is frozen.
- (3) Lawn fertilizer shall not be applied to any impervious surface upon County-owned property, including parking lots, roadways, and sidewalks. If such application occurs, the fertilizer must be immediately contained and either applied to turf in a manner consistent with this Executive Order or placed in an appropriate container.

III. Exemptions:

The prohibition against the use of lawn fertilizer under section II of this Executive Order shall not apply to:

GENERAL CLAUSES

(1) Newly established turf or lawn areas during their first growing season.

(2) Turf or lawn areas that soil tests, performed within the past three years by a certified laboratory or by the Cornell University Cooperative Extension of Westchester County, confirm the need for additional phosphorus application in accordance with the phosphorus levels established by the Cornell University Cooperative Extension of Westchester County. The lawn fertilizer application shall not contain an amount of phosphorus exceeding the amount and rate of application recommended in the soil test evaluation.

(3) Agricultural uses, vegetable and flower gardens, or application to trees or shrubs.

IV. The transition to phosphorus-free lawn fertilizer shall occur as soon as possible in a manner that avoids wasting of existing inventories; accommodates establishment of supply chains for new products; enables the training of County employees and licensees in appropriate work methods; and allows the phase-out of products and practices inconsistent with this Executive Order. However, in no event shall lawn fertilizer containing phosphorus (i.e., labeled as containing more than 0% phosphorus or other compound containing phosphorus, such as phosphate) be applied upon County-owned property after January 1, 2009, unless an exemption set forth in Section III of this Executive Order applies.

V. This Executive Order shall take effect on the date hereof, and shall remain in effect until otherwise superseded, repealed, modified or revoked.



SAMPLE FORMS

DEPARTMENT OF PUBLIC WORKS

Division of Engineering

SAMPLE FORMS

AFFIRMATIVE ACTION PROGRAM REQUIREMENT- SUBCONTRACTOR(S)

County of Westchester, Department of Public Works

(To Be Completed By Subcontractor and Submitted with Request to Utilize Subcontractor)

Affirmative Action Program

An approved Affirmative Action Plan shall be required for all Subcontractors for public work where the subcontracted work exceeds \$50,000 or more than fourteen (14) persons are employed by the Subcontractor.

Does the Subcontractor participate in an approved Affirmative Action Program? Yes [☐] No [☐]

If Yes, give name of Program: _____

If No, how many employees will the Subcontractor employ on this project? _____

An approved Affirmative Action Program shall mean a plan approved or adopted by Westchester County including but not limited to, the Home-Town Plan, the Recruitment Training Program or any other program approved or meeting the requirements of the State or Federal government.

The "Monthly Employment Utilization Report" of the Sample Forms, shall be filled out by the Contractor and/or Subcontractor(s) who are required to have an Affirmative Action Program, prior to the start of the work.

SAMPLE FORMS

CONTRACTOR'S REPORT OF EMPLOYMENT AND WEEKLY AFFIDAVIT

County of Westchester, Department of Public Works

Contract No. _____

Report No. _____

Week(s) ending _____

Title of Contract and Location _____

Contractor or Subcontractor _____

Address _____

STATE OF _____)
COUNTY OF _____) SS.:

I, _____, being duly sworn, depose and say:

1. I pay or supervise the payment of the persons employed by _____
(Contractor or Subcontractor)
in connection with the above referenced contract;

2. During the payment period commencing on the ____ day of _____,
20____ and ending on the _____ day of _____, 20____, all persons employed by
_____ in connection with such contract have been paid in full
(Contractor or Subcontractor)
weekly wages and supplements earned by such persons except the following: (strikeout, if not
applicable)

3. Such persons have been paid the prevailing rate of wages and the supplements as
determined and required by Section 220 of the New York State Labor Law.

SAMPLE FORMS

4. No rebates or deductions have been deducted from such wages and supplements except as authorized or required by applicable statutes or regulations of the Federal, State and County Governments.

5. The following is a true and accurate summary of wages and supplements paid:

_____ During the week _____ Total to date

Number of names on payroll _____

Hours worked _____

Total wages earned _____

6. I have read the foregoing statement of wages and supplement, know the contents thereof, and the same is true to my own knowledge.

(Signature)

STATE OF NEW YORK)
COUNTY OF WESTCHESTER) ss.:

On this _____ day of _____, 20____, before me personally came _____ to me known, and known to me to be the person who executed the above instrument, and who being duly sworn did say that he executed the same.

Sworn to before me
this _____ day of _____

License No.

Notary Public - State of New York

SAMPLE FORMS

MONTHLY EMPLOYMENT UTILIZATION REPORT
County of Westchester, Department of Public Works

<u>MONTHLY EMPLOYMENT UTILIZATION REPORT</u>										JOB TITLE:		CONTRACT NO.:					
WESTCHESTER COUNTY DEPARTMENT OF PUBLIC WORKS DIVISION OF ENGINEERING										NAME AND LOCATION OF CONTRACTOR:		REPORTING PERIOD: FROM: _____ TO: _____					
CONSTRUCTION TRADE	CLASSIFICATION	TOTAL ALL EMPLOYEES BY TRADE				BLACK (NOT HISPANIC ORIGINAL)		WORK HOURS OF EMPLOYMENT				MINORITY PERCENTAGE %	FEMALE PERCENTAGE %	TOTAL NUMBER OF EMPLOYEES		TOTAL NUMBER OF MINORITY EMPLOYEES	
		M	HRS	F	HRS	M	F	M	F	HISPANIC	ASIAN OR PACIFIC ISLANDERS			AMERICAN INDIAN OR ALASKAN NATIVE	M	F	M
	JOURNEY WORKER																
	APPRENTICE																
	TRAINEE																
	SUB-TOTAL																
	JOURNEY WORKER																
	APPRENTICE																
	TRAINEE																
	SUB-TOTAL																
	JOURNEY WORKER																
	APPRENTICE																
	TRAINEE																
	SUB-TOTAL																
	JOURNEY WORKER																
	APPRENTICE																
	TRAINEE																
	SUB-TOTAL																
	JOURNEY WORKER																
	APPRENTICE																
	TRAINEE																
	SUB-TOTAL																
	TOTAL JOURNEY WORKER																
TOTAL APPRENTICES																	
TOTAL TRAINEES																	
GRAND TOTAL (#HRS & #EMPL)																	
COMPANY OFFICIAL'S SIGNATURE AND TITLE:										TELEPHONE NUMBER (Include Area Code):				DATE SIGNED:		PAGE: _____ OF _____	

This report must be filled out by all contractors (both prime and sub) who are required to have an Affirmative Action Program, and must be filed with the Engineer by the 5th day of each month during the term of the Contract, and shall include the total work hours of each employee classification in each trade in the covered area for the Monthly Reporting Period. The Prime Contractor shall submit a report for its Aggregate Work Force and collect and submit reports for each subcontractor's Aggregate Work Force to the Engineer.

SHOP DRAWING SCHEDULE
County of Westchester, Department of Public Works

Forms Page 5

SAMPLE FORMS

SHOP DRAWING ID

County of Westchester, Department of Public Works

WESTCHESTER COUNTY DRAWING _____ OF _____

NAME OF PROJECT

Date _____

Contract No. _____

Item/Model No. _____

Manufacturer _____

Contract Drawing No. _____

Specification Section _____

This document has been reviewed, coordinated and checked for accuracy of content and for compliance with the Contract Documents. The information contained herein has been coordinated with all other Contract Work.

Contractor _____

Signed _____

REQUEST FOR APPROVAL OF EQUAL
County of Westchester, Department of Public Works

[illegible]

Forms Page 7

REQUEST FOR APPROVAL OF SUBSTITUTIONS

<u>ITEM NO.</u>	<u>ITEM</u>	<u>SUBSTITUTION</u>	<u>COST OF SPECIFIED ITEM</u>	<u>COST OF SUBSTITUTED ITEM</u>	<u>SAVINGS TO COUNTY</u>
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This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

Forms Page 8

SAMPLE FORMS

CONTRACTOR'S ULTRA LOW SULFUR DIESEL FUEL AFFIDAVIT

County of Westchester, Department of Public Works

Contract No. _____ Period Included in this Report: _____, 20__ to _____, 20__

Title of Contract and Location _____

Contractor _____

Address _____

Subcontractor _____

Address _____

STATE OF _____) ss.:
COUNTY OF _____)

I, _____ being duly sworn, depose and say:
(print name) (print title)

1. I certify under penalty of perjury that I agree to comply with the requirements of Chapter 878, Article XIII, Section 873.13.29 of the Laws of Westchester County.
2. During the period _____ through _____, all diesel-powered vehicles, used in the performance of Contract No. _____, were powered by ultra low sulfur diesel fuel (15 ppm Sulfur Maximum).
3. No fuel other than Ultra Low Sulfur Diesel Fuel (15 ppm Sulfur Maximum) was utilized on this project for the above described vehicles.
4. The annexed Ultra Low Sulfur Diesel Fuel Log is a true and accurate summary of the low sulfur diesel fuel (15 ppm Sulfur Maximum) purchased and utilized in the performance of this project.
5. I have read the foregoing statement, have full knowledge of the contents thereof, and it is my intent that the County of Westchester will rely on the statements contained herein.

(Signature)

STATE OF _____) ss.:
COUNTY OF _____)

On this _____ day of _____, 20__, before me personally came _____ to me known, and known to me to be the person who executed the above instrument, and who being duly sworn did say that he/she executed the same.

Sworn to before me this

_____ day of _____, 20__.

Notary Public

The Ultra Low Sulfur Diesel Fuel-Log must be attached.

This Certification also has to be submitted by your subcontractor(s). *Additional copies of this form can be acquired from the Department of Public Work.*

SAMPLE FORMS

ULTRA LOW SULFUR DIESEL FUEL (15 ppm Sulfur Maximum) – LOG

Period of Log: _____ through _____

Contract No. _____

Title of Contract and Location _____

Contractor or Subcontractor _____

Address _____

Date of Purchase	Name and Address of Vendor (Print)	Gallons Purchased

A Separate Copy of this Certification will also have to be signed by each of your subcontractors that utilize diesel powered vehicles, fifty horsepower or greater, on the above project. Additional copies of this form can be acquired from the Department of Public Works.

- ☐ New
☐ Change
☐ No Change

**Electronic Funds Transfer (EFT)
Vendor Direct Payment Authorization Form**

INSTRUCTIONS: Please complete both sections of this Authorization form and attach a voided check. See the reverse for more information and instructions (Forms Page 21). If you previously submitted this form and there is no change to the information previously submitted, ONLY complete lines 1 through 6 of section 1.

Section I - Vendor Information

1. Vendor Name:

2. Taxpayer ID Number or Social Security Number:

--	--	--	--	--	--	--	--	--	--

3. Vendor Primary Address

4. Contact Person Name:

Contact Person Telephone Number:

5. Vendor E-Mail Addresses for Remittance Notification:

6. Vendor Certification: *I have read and understand the Vendor Direct Payment Program and hereby authorize payments to be received by electronic funds transfer into the bank that I designate in Section II. I further understand that in the event that an erroneous electronic payment is sent, Westchester County reserves the right to reverse the electronic payment. In the event that a reversal cannot be implemented, Westchester County will utilize any other lawful means to retrieve payments to which the payee was not entitled.*

Authorized Signature_____
Print Name/Title_____
Date**Section II- Financial Institution Information**

7. Bank Name:

8. Bank Address:

9. Routing Transit Number:

--	--	--	--	--	--	--	--	--	--

10. Account Type:
(check one)☐ Checking☐ Savings

11. Bank Account Number:

12. Bank Account Title:

13. Bank Contact Person Name:

Telephone Number:

14. FINANCIAL INSTITUTION CERTIFICATION (required **ONLY** if directing funds into a Savings Account **OR** if a voided check is not attached to this form): *I certify that the account number and type of account is maintained in the name of the vendor named above. As a representative of the named financial Institution, I certify that this financial Institution is ACH capable and agrees to receive and deposit payments to the account shown.*

Authorized Signature_____
Print Name / Title_____
Date

**(Leave Blank - to be completed by
Westchester County) - Vendor number assigned**

(WC DPW E Version 11/3/08)

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Forms Page 11

Electronic Funds Transfer (EFT) Vendor Direct Payment Authorization Form

GENERAL INSTRUCTIONS

Please complete both sections of the Vendor Direct Payment Authorization Form and forward the completed form (along with a voided check for the account to which you want your payments credited) to: Westchester County Board of Acquisition and Contract, 148 Martine Ave, Room 104, White Plains, NY 10601, Attention: Vendor Direct. Please see item 14 below regarding attachment of a voided check.

Section I - VENDOR INFORMATION

1. Provide the name of the vendor as it appears on the W-9 form.
2. Enter the vendor's Taxpayer ID number or Social Security Number as it appears on the W-9 form.
3. Enter the vendor's complete primary address (not a P.O. Box).
4. Provide the name and telephone number of the vendor's contact person.
5. Enter the business e-mail address for the remittance notification. THIS IS VERY IMPORTANT. This is the e-mail address that we will use to send you notification and remittance information two days prior to the payment being credited to your bank account. We suggest that you provide a group mailbox (if applicable) for your e-mail address. You may also designate multiple e-mail addresses.
6. Please have an authorized Payee/Company official sign and date the form and include his/her title.

Section II - FINANCIAL INSTITUTION INFORMATION

7. Provide bank's name.
8. Provide the complete address of your bank.
9. Enter your bank's 9 digit routing transit number.
10. Indicate the type of account (check one box only).
11. Enter the vendor's bank account number.
12. Enter the title of the vendor's account.
13. Provide the name and telephone number of your bank contact person.
14. If you are directing your payments to a Savings Account OR you can not attach a voided check for your checking account, this line needs to be completed and signed by an authorized bank official. IF YOU DO ATTACH A VOIDED CHECK FOR A CHECKING ACCOUNT, YOU MAY LEAVE THIS LINE BLANK.



SAMPLE CONTRACT AND BOND
FOR CONSTRUCTION

DEPARTMENT OF PUBLIC WORKS

Division of Engineering

WESTCHESTERGOV . COM

**DEPARTMENT OF PUBLIC WORKS
OFFICE OF THE COMMISSIONER**

CONTRACT AND BOND

FOR CONTRACT

NOTE: ONLY PROVIDED AS A SAMPLE IN THESE SPECIFICATIONS FOR INFORMATIONAL PURPOSES AND NOT TO BE EXECUTED WHEN SUBMITTING THE BID PROPOSAL. THE SUCCESSFUL BIDDER WILL BE REQUIRED TO EXECUTE THESE DOCUMENTS, AS MORE FULLY DESCRIBED IN THE PROPOSAL REQUIREMENTS.

CONTRACT NO.

Amount of Contract \$

THIS AGREEMENT made this ____ day of _____, 200__, by and between the COUNTY OF WESTCHESTER, a municipal corporation of the State of New York, hereinafter, "County", and

hereinafter called the "Contractor", WITNESSETH as follows:

WHEREAS, the Commissioner of Public Works, hereinafter called "Commissioner", by virtue of the power and authority in him vested did advertise for proposals and bids for:

Westchester County, New York, to furnish all labor, tools, implements and materials that may be requisite and necessary to the execution and completion of the work according to the plans, specifications, profiles and other drawings relating to such work, as approved by the County of Westchester and now on file in the Office of the Commissioner, and

WHEREAS, the Contractor did bid for said work in the manner and form as required by said plans and specifications and, being the lowest responsible bidder therefore, was duly awarded the Contract for such work at prices named in the itemized proposal by a resolution of the Board of Acquisition and Contract of the said County of Westchester.

NOW THEREFORE, the Contractor, in consideration of the prices so named for the various items of work to be paid for as hereinafter provided, does for itself, its representatives, agents, executors, administrators, successors or assigns, covenant and agree with the County that it, the said Contractor, shall and will at its own proper costs and charges and in conformity with said plans and specifications which are made a part of this Contract without setting forth same herein, provide all manner and kind of materials, molds, models, cartage, appliances and appurtenances required and of every description necessary for the due and proper performance of this Contract and the completion of said work to be done under the supervision and direction of the Commissioner, in a good workmanlike manner and in conformity with said plans and specifications without any alteration, deviation, additions, or omissions therefrom except upon due request and under the written direction of said Commissioner.

The Contractor acknowledges receipt of the "Information for Bidders, General and Special Clauses, Specification, Proposal and Plans" relating to this Contract, as well as all issued Addenda thereto, all of which are expressly incorporated in this Contract as if fully set forth herein.

IT IS FURTHER UNDERSTOOD AND AGREED by and between the parties to this Contract that if in the opinion of the said Commissioner of the County of Westchester it shall become necessary to make any change in the work called by the plans and specifications which are a part of this Contract, whereby, consistent with the Information for Bidders, the work contemplated by said plans and specifications is modified and reduced and the costs and expenses of such work lessened, that then and in that event the Contractor will do the work as changed and modified and the said Commissioner shall estimate the difference between the original estimate of quantities therefor and the amount that should be paid by reason of the modification and change and the difference shall be deducted from the original estimate of quantities therefore of said Contract and said Contractor shall be paid accordingly. The estimate of said Commissioner shall be final and conclusive upon the parties hereto and may not be challenged except in a proceeding commenced pursuant to Article 78 of the Civil Practice Law and Rules. Any changes, modifications or deductions shall in no way invalidate this Contract and said Contractor agrees that in the event of any such change or modification reducing the original, estimated quantities therefore, it will not make any claim for any profit, or loss of profit by reason thereof. Notwithstanding any dispute or disagreement arising hereunder, Contractor agrees that the Work shall not be delayed nor disrupted by reason thereof.

The County hereby covenants and agrees with the said Contractor, in consideration of the covenants and agreements herein being strictly and in all respects complied with by the said Contractor as specified, that it will well and truly pay unto the said Contractor the unit prices set forth in the Proposal for the various items included in the Contract.

All partial payments will be made in accordance with the provisions set forth in the "Information for Bidders" and especially that part thereof which relates to "Estimates and Payments".

Furthermore, all partial payments will be made on the claim voucher and verified certificate of the Commissioner, both of which shall be filed in the Office of the Commissioner of Finance of the County of Westchester. The said claim voucher shall show the value of the work completed and the verified certificate shall show the said work was done in accordance with the plans and specifications.

With the final estimate the Contractor shall furnish to the Construction Administrator a sworn statement listing all unpaid bills and liabilities incurred under this Contract up to and including the date of the estimate. Where there are any bills or liabilities in excess of moneys due under any estimate under this Contract, the Construction Administrator may withhold payment of the estimate pending a satisfactory proof of settlement or adjustment of any excess claims. No final estimate will be approved or passed for payment unless and until the Contractor furnishes satisfactory proof that all bills and liabilities incurred under the Contract are paid in full and complies with the requirements of Section 220-a of the Labor Law.

Acceptance shall be effected as follows: whenever, in the opinion of the Commissioner, the Contractor shall have completely performed the Contract on his part to be performed, the Commissioner shall so certify in writing to the Board of Acquisition and Contract of the County and file such certificate with the said Board, stating therein, in substance that the work has been duly examined by him and that the same has been fully performed and completed in accordance

with the terms of the Contract therefor, and recommending the acceptance thereof. When the Board of Acquisition and Contract by resolution duly adopts, approves and ratifies, the said acceptance shall be complete. No final payment shall be made under this Contract until such certificate of completion and recommendation of acceptance have been approved and ratified by a resolution of said Board of Acquisition and Contract.

Unless otherwise provided for in the contract documents, the Commissioner may take over, use, occupy or operate any part of the Work at any time prior to Final Acceptance upon written notification to the Contractor. The Engineer shall inspect the part of the Work to be taken over, used, occupied or operated, and will furnish the Contractor with a written statement of the Work, if any, that remains to be performed on such part. The Contractor shall not object to, nor interfere with, the Commissioner's decision to exercise the rights granted herein. In the event the Commissioner takes over, uses, occupies or operates any part of the work: (i) the Commissioner shall issue a written determination of Substantial Completion with respect to such part of the Work; and (ii) the Contractor shall be relieved of its absolute obligation to protect such part of the unfinished work in accordance with Article 20 of the General Clauses.

The Commissioner will approve a final estimate for final payment consistent with the authorization of final acceptance from the Board of Acquisition and Contract less previous payments and any and all deductions authorized to be made by the Commissioner under the Contract or law. Payment pursuant to such final estimate less any additional deductions authorized to be made by the Commissioner of Finance under the Contract or law shall constitute the final payment and shall be made by the Commissioner of Finance. If the contract is terminated prior to final acceptance the Commissioner is authorized to prepare a final payment as otherwise authorized by the Board of Acquisition and Contract subject to the above noted adjustments.

Upon the completion and acceptance of this Contract by the Board of Acquisition and Contract, as aforesaid, the Commissioner shall proceed with all reasonable diligence to ascertain from actual measurements the whole amount of work done by the Contractor, and also the value of such work under and according to the terms of this Contract, and thereupon make out in writing a final estimate therefor.

After the completion and acceptance as herein above-mentioned, the Commissioner of Public Works shall file with the Commissioner of Finance of the County of Westchester the original verified certificate, claim voucher and the certification required by Section 220-a of the Labor Law, together with a certified copy of the resolution of approval and ratification of the Board of Acquisition and Contract of the said verified certificate and claim voucher and the resolution of acceptance of completion.

IT IS FURTHER UNDERSTOOD AND AGREED by and between the parties to this Contract that the Contractor will accept the unit prices named in the proposal for all additions to or deductions from the original quantities as given in the specifications. It is agreed that the Commissioner will make estimates of the value for the work completed as provided in the specifications and the final estimate will be made accordingly.

The Contractor further agrees that if at any time before or within thirty days after the whole of the work herein agreed to be performed has been completed and accepted any person or persons claiming to have performed any labor or furnished any material towards the performance and completion of this contract shall file with the proper officials any such notice as is described in the Lien Law, or any other act of the Legislature of the State of New York, the Contractor shall cause such Lien to be discharged of record. Otherwise and in every case and until the Lien is discharge of record the County shall retain, anything herein to the contrary notwithstanding, from the moneys under its control and due or to grow due under this Contract the sum of one hundred fifty (150%) percent of the amount of such Lien, unless otherwise authorized to withhold a larger amount. The Contractor further agrees to pay the County upon demand the costs, including but not limited to attorney's fees, incurred by the County in any action(s) brought to foreclose or otherwise enforce said Lien.

The Contractor covenants and agrees to commence the work embraced in this Contract within Ten [10] calendar days after service upon him, by the Commissioner, of written notice instructing him to begin the work and shall complete the same in all respects within _____ consecutive calendar days computed from the date of such Notice to Commence.

It is further understood and agreed by the parties hereto that the time of completion is of the essence of this Contract.

It is further understood and agreed by the Contractor that before entering upon the performance of this Contract it shall have approved by the County Attorney the Bond required to be furnished by it in the sum of-----
[\$ _____] conditioned for the faithful performance of the work.

The Contractor hereby covenants and agrees to observe the plans, specifications and directions of the Commissioner in the doing of the work provided for under this Contract and to furnish the necessary materials and implements required therefore and to remove condemned material and rubbish as provided by plans and specifications and to employ a competent and sufficient force of workmen to complete the work of this improvement within the time specified. Should the Contractor at any time become insolvent, make an assignment for the benefit of creditors, abandon the Work, reduce its working force to a number which, if maintained, would be insufficient, in the sole opinion of the Commissioner, to complete the Work in accordance with the approved progress schedule; sublet, assign or otherwise dispose of this Contract other than as permitted elsewhere herein, refuse or neglect to supply a sufficiency of properly skilled workmen, or of material of the proper quantity or fail in any respect to prosecute the work with promptness and diligence, or fail in any other way in the performance of any of the agreements herein contained; all the foregoing being deemed acts of default, and such default being certified by the Commissioner, the County of Westchester, acting by the Board of Acquisition and Contract, shall be at liberty after five days written notice to the Contractor to provide any such labor or materials, use any and all sums due or to become due to the Contractor under this Contract, to pay for such labor and material, and if the Commissioner shall certify that such default is sufficient ground for such action, the County of Westchester acting by the Board of Acquisition and Contract, shall also be at liberty to terminate the employment of the Contractor for the said work and to enter upon the premises and take possession for the purpose of completing the work included under this Contract of all materials, tools and appliances thereon

and to employ any other person or persons to finish the work and provide the materials therefore. Upon the Contractor's receipt of a notice from the County the Contractor shall immediately discontinue all further operations under this Contract. In case of such termination, the Contractor shall not be entitled to receive any further payment under this Contract until the said work shall be wholly finished, at which time if the unpaid balance of the amount to be paid under this Contract shall exceed the reasonable value of the work performed and the material furnished or the total costs therefor, whichever is greater, in finishing the work, such excess shall be paid by the County of Westchester to the Contractor, but if such expense shall exceed such unpaid balance, the Contractor shall pay the difference to the County.

The expense incurred by the County and the total costs as herein provided either for furnishing materials or for finishing the work and any damage incurred through such default shall be certified by the Commissioner whose certificate thereof shall be final and conclusive upon the parties and may not be challenged except in a proceeding commenced pursuant to Article 78 of the Civil Practice Law and Rules.

In case the County shall declare the Contractor in default as to a part of the work only, the Contractor shall immediately discontinue such part, shall continue performing the remainder of the Work in strict conformity with the terms of the Contract.

In completing the whole or any part of the Work under the provisions of this Contract, the Commissioner shall have the power to depart from or change or vary the terms and provisions of this Contract. Such departure, change or variation, even to the extent of accepting a lesser or different performance, shall not affect the conclusiveness of the Commissioner's certification of the cost of completion referred to above, nor shall it constitute a defense to an action to recover the amount by which such certificate exceeds the amount which would have been payable to the Contractor hereunder but for his default or partial default.

In addition to termination as provided for above, the County may terminate this Contract for the convenience of the County by written notice to the Contractor from the Commissioner. In such event and upon receipt of such notice the Contractor shall stop work on the date specified in the notice; take such actions as may be necessary to protect and preserve the County's materials and property; cancel all cancelable orders for material and equipment; assign to the County and deliver to the jobsite or any other location designated by the Commissioner any non-cancelable orders for material and equipment that is not capable of use except in the performance of this Contract and which has been specifically fabricated for the sole purpose of this Contract and not incorporated in the Work; and take no action that will increase the amounts payable by the County under this Contract.

In the event the contract is cancelled for the convenience of the County the following provisions shall apply:

- (a) For Work completed prior to the notice of termination, the Contractor shall be paid the fair and reasonable value of its work determined by the pro rata portion of the lump sum bid amount based upon the percent completion of the Work as of the date of termination as determined by the Commissioner, plus work completed pursuant to approved change orders, less amounts

previously paid. For purposes of determining the pro rata portion of the lump sum bid amount to which the Contractor is entitled, the Contractor's approved bid breakdown pursuant to Article 21 of the Information for Bidders shall be considered but shall not be dispositive as to the fair and reasonable value.

- (b) For non-cancelable material and equipment that is not capable of use except in the performance of this Contract and which has been specifically fabricated for the sole purpose of this Contract, but not yet incorporated in the Work, the Contractor shall be paid the fair and reasonable value thereof as determined by the Commissioner, but not more than the Contractor's cost for such material and equipment, plus an additional sum of two (2%) percent of such fair and reasonable value.
- (c) In the event the County terminates a lump sum Contract for convenience within thirty (30) days after the Contractor has received the Notice of Award from the County, the Contractor shall be paid one (1%) percent of the difference between the total lump sum bid amount and the total of all payments made prior to the notice of termination plus all payments allowed pursuant to (a) and (b).
- (d) On all unit price Contracts, or on unit price items in a Contract, the County will pay the Contractor the sum of (e) and (f) below, less all payments previously made pursuant to this Contract:
- (e) For all completed units, the unit price stated in the Contract, and
- (f) For units that have been ordered but are only partially completed, the Contractor will be paid (i) a pro rata portion of the unit price as stated in the Contract based upon the percent completion of the unit as determined by the Commissioner and (ii) for non-cancelable material and equipment, payment will be made pursuant to (b), above.
- (g) The Commissioner's determination(s) hereunder shall be final, binding and conclusive and subject to review only pursuant to Article 78 of the New York Civil Practice Law and Rules.
- (h) The County shall not be liable to the Contractor for any payment or claim if the termination for convenience results in a reduction of thirty (30%) percent or less of the original contract price as bid.

On all Contracts or items in a Contract where time and material records are specified as the basis for payment of the Work, the Contractor shall be paid in accordance with Article 29 of the General Clauses, less all payments previously made pursuant to this Contract.

In no event shall any payments made pursuant to a termination for convenience exceed the Contract price for such items, either individually or collectively.

All payments made pursuant to a termination for convenience shall be in the nature of liquidated damages and shall be accepted by the Contractor in full satisfaction of all claims against the County.

The County may deduct or set off against any sums due and payable arising from a termination for convenience, any claims it may have against the Contractor.

In the event the County terminates the Contractor for default and it is subsequently determined that the Contractor was not in default, said termination shall automatically be converted for all purposes into a termination for convenience.

It is further understood and agreed between the parties hereto that no certificate given or payment made under this Contract, except the final certificate or final payment shall be conclusive evidence of the performance of this Contract either wholly or in part and that no payment shall be construed to be an acceptance of defective work or improper materials. If the Contractor shall fail to replace any defective work or materials, the County may cause such defective materials to be removed and defective work to be replaced and the expense thereof shall be deducted from the amount to be paid the Contractor.

Anything to the contrary in the preceding paragraph notwithstanding, the Contractor is responsible for the repair of defects in materials and workmanship for a period of one year from the date of final acceptance of the work by the Board of Acquisition and Contract, unless a longer term is specified in the specifications.

The Contractor further agrees not to assign, transfer, convey, sublet or otherwise dispose of this Contract, or its right, title or interest in or to the same, or any part hereof without the previous consent in writing of the Board of Acquisition and Contract of the County. Before a Subcontractor shall proceed with any work, the Commissioner must first recommend and the Board of Acquisition and Contract must approve the use of the Subcontractor on this Contract. If a Subcontractor is not approved it may not work on this Contract. The Contractor specifically waives any claim due to the failure or refusal of the Commissioner or the Board of Acquisition and Contract to approve said Subcontractor.

The Contractor agrees to hold himself responsible for any claims made against the County for any infringement of patents by the use of patented articles in the construction and completion of the work or any process connected with the work agreed to be performed under this Contract or of any material used upon the said work, and shall indemnify and save harmless the County for the costs, expenses and damages which the County may be obligated to pay by reason of any infringement of patents used in the construction and completion of the work.

The parties hereto agree that no laborer, workman or mechanic in the employ of the Contractor, Subcontractor or other person doing or contracting to do the whole or part of the work contemplated by the Contract shall be permitted or required to work more than eight hours in any one calendar day or more than five days in any one week except in cases of extraordinary emergency including fire, flood or danger to life or property. No such person shall be so employed more than eight hours in any day or more than five days in any one week except in such emergency. Time lost in any week because of inclement weather by employees engaged in

the construction, reconstruction and maintenance of highways outside of the limits of cities and villages may be made up during that week and/or the succeeding three weeks.

The Contractor further agrees to erect and maintain during construction all necessary guards, rails and signals to prevent accidents to persons, vehicles or to the adjoining property and also agrees to use all necessary precautions in blasting and that he will indemnify and save the County of Westchester harmless from all suits and actions of any kind and nature whatsoever from or on account of the construction of said work.

It is further understood and agreed by the parties hereto that should any dispute arise respecting the true construction, interpretation or meaning of the Contract plans, specifications or conditions herein, or the measurements for the payment thereunder, same shall be referred to and decided by the said Commissioner and his decision thereon shall be final and conclusive upon the parties thereto and may not be challenged except in a proceeding commenced pursuant to Article 78 of the Civil Practice Law and Rules. This provision shall also apply to the true value of and duly authorized extra work or any work permitted by agreement in case any work shall be ordered performed, or any work called for shall be so omitted under and upon the direction of said Commissioner.

The Contractor by the submitting of bids and execution of this Contract hereby covenants and agrees that he has examined the plans, specifications and the site work, as to local conditions, difficulties and accuracy of approximate estimate of quantities and does hereby further covenant and agree that he will not make any claim for damages by reason of any such local conditions, difficulties or variation of approximate estimate of quantities.

The Contractor represents and warrants to the County with the knowledge and expectation that this warranty will be relied upon by the County that it is not now participating and has not at any time participated, either directly or through any substantially owned or affiliated person, firm, partnership or corporation, in an international boycott in violation of the provisions of United States Export Administration Act of 1969, 50 USC 2401 et seq. or the regulations promulgated thereunder.

The Contractor further warrants and represents that it is financially solvent, and sufficiently experienced and competent to perform the work and that the facts provided by it to the County in its bid and supporting documents, and contract documents are true and correct in all respects.

This Contract shall become void and any rights of the Contractor hereunder shall be forfeited if, subsequent to the execution hereof, the Contractor is convicted of a violation of the provision of the United States Export Administration Act of 1969, 50 USC 2401 et seq. as amended or has been found upon the final determination of the United States Commerce Department or any other appropriate agency of the United States or the State of New York to have violated such act or regulations.

If the Contractor, any officer, director, or any party holding a controlling interest (defined as five (5%) percent or more, or in the case of a corporation, any stockholder owning five (5%) percent or more of the outstanding shares) is convicted of a crime (excluding Class B and

Unclassified Misdemeanors as defined under the New York State Penal Law and their equivalent in any city, state or under Federal law related to the type of services or activities which are the subject matter of this Contract) or if a related or affiliated company, partnership or corporation is convicted of a crime (excluding Class B and Unclassified Misdemeanors as defined above) after this Contract is fully executed, the County shall have the right to terminate this Agreement immediately and without penalty. An "affiliated company" as used herein means any affiliate which is a partnership, corporation, proprietorship, association or other entity (i) in which a 50% or greater ownership interest (as defined below) is directly or indirectly held by the Contractor or any of its management personnel (as defined below) or directors, (ii) which directly or indirectly holds 50% or more of the ownership interest in the Contractor, (iii) in which an aggregate 20% or greater ownership interest is directly or indirectly held by one or more shareholders (or partners or proprietors, in the case of a partnership or proprietorship) which or who in the aggregate hold a 20% or greater ownership interest in the Contractor, or (iv) which, whether by Contract or otherwise, directly or indirectly controls, is controlled by or is under common control with the Contractor. An "ownership interest" means the ownership, whether legally or beneficially, of the stock of or assets employed by a corporation, of a partnership interest in or assets employed by a partnership or of a similar interest in or assets employed by any other entity. "Management personnel" means executive officers and all other persons, whether or not officers or employees, who perform policy-making functions similar to those of executive officers.

The Contractor represents that at the time of execution of this Contract, no individual or entity, as described above, has been convicted of a crime during the five (5) year period preceding the execution of this Contract.

The parties hereto recognize that it is the goal of Westchester County to use its best efforts to encourage, promote and increase participation of business enterprises owned and controlled by persons of color or women (MBE/WBE) in contracts or projects funded by all Departments of the County and to effectively and efficiently monitor such participation. Therefore, the Contractor agrees to complete the MBE/WBE Questionnaire, which is attached hereto as Schedule "A," in furtherance of this goal and in accordance with Local Law No. 27-1997.

It is recognized and understood by the parties that this Contract is subject to appropriation by the Westchester County Board of Legislators. The County shall have no liability under this Contract beyond the funds, if any, that are appropriated and available for payment of the amounts due under this Contract. Notwithstanding the foregoing, the County will do all things lawfully within its power to obtain, maintain and properly request and pursue funds from which payments under this Contract may be made.

The parties hereto for themselves, their legal representatives, successors and assigns, expressly agree that any legal action or proceeding that may arise out of or relating to this Contract shall be brought and maintained only in the courts of the State of New York ("New York State Court") located in the County of Westchester. With respect to any action between the County and Contractor in New York State Court, the Contractor hereby expressly waives and relinquishes any rights it may otherwise have (i) to move to dismiss on grounds of *forum non*

conveniens; (ii) to remove to Federal Court; and (iii) to move for a change of venue to a New York State Court outside of Westchester County.

This Contract and its terms, covenants, obligations, conditions and provisions shall be binding upon all the parties hereto, their legal representatives, successors and assigns.

SAMPLE

This Contract shall not be enforceable until it is signed by all parties and approved by the Office of the County Attorney.

IN WITNESS WHEREOF, the parties hereto have executed this agreement, THE COUNTY OF WESTCHESTER pursuant to law by:

_____ its **Commissioner** _____

and the CONTRACTOR:

By: _____ its _____
(Type or Print Name) (Title)

THE COUNTY OF WESTCHESTER:

By: _____
Commissioner

CONTRACTOR:

By: _____
(Signature)

ATTEST:

(SEAL)

By: _____
(Signature)

Recommended:

Deputy Commissioner of Public Works

Approved as to form and manner of execution
this ____ day of _____, 200__

County Attorney

CONTRACTOR'S ACKNOWLEDGMENT
(If Corporation)

STATE OF NEW YORK)
) ss.:
COUNTY OF)

On this _____ day of _____, 200__, before me personally came _____ to me known, and known to me to be the _____ of _____, the Corporation described in and which executed the within instrument, who being by me duly sworn did depose and say that the said _____ resides at _____ and that he/she is the _____ of said Corporation and that he/she signed his/her name thereto by order of the Board of Directors of said Corporation and, if operating under any trade name, that the certificate required by the New York State General Business Law Section 130 has been filed with the Secretary of State of the State of New York.

Notary Public

CONTRACTOR'S ACKNOWLEDGMENT
(If Individual)

STATE OF NEW YORK)
) ss.:
COUNTY OF)

On this _____ day of _____, 200__, before me personally came _____ to me known, and known to me to be the same person described in and who executed the within instrument and duly acknowledged to me that he/she executed the same for the purpose herein mentioned and, if operating under any trade name, that the certificate required by the New York State General Business Law Section 130 has been filed with the County Clerk of Westchester County.

Notary Public

CONTRACTOR'S ACKNOWLEDGMENT
(If Co-Partnership)

STATE OF NEW YORK)
) ss.:
COUNTY OF)

On this _____ day of _____, 200__, before me personally came _____ to me known, and known to me to be a member of the firm of _____ and the person described in, and who executed the within instrument in behalf of said firm, and he/she acknowledged to me that he/she executed the same in behalf of, and as the act of said firm for the purposes herein mentioned and, if operating under any trade name, that the certificate required by the New York State General Business Law Section 130 has been filed with the County Clerk of Westchester County.

Notary Public

CERTIFICATE OF AUTHORITY

I, _____
(Officer other than officer signing contract)

certify that I am _____ of
(Title)

the _____
(Name of Corporation)

organized and in good standing under the _____
(Law under which organized)

named in the foregoing agreement; that _____
(Person executing agreement)

who signed said agreement on behalf of the Contractor was, at the time of execution the
_____ of the Corporation; that said agreement was duly
(Title of such person)

signed for and on behalf of said Corporation by authority of its Board of Directors, thereunto
duly authorized and is in full force and effect at the date hereof.

(Signature)

(SEAL)

STATE OF NEW YORK)
) ss.:
COUNTY OF)

On this ____ day of _____, 200__, before me personally came
_____ to me known, and known to me to be the
_____ of _____,
the Corporation described in and which executed the above certificate, who being by me duly
sworn did depose and say that the said _____ resides at
_____ and that he/she is
_____ of said Corporation and knows the Corporate Seal of the said
Corporation; that the seal affixed to the above certificate is such Corporate Seal and was so
affixed by order of the Board of Directors of said Corporation, and that he/she signed his/her
name thereto by like order.

Notary Public

STATE OF NEW YORK)
) ss.:
COUNTY OF)

Notary Public

PERFORMANCE AND PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS, that we

(hereinafter called the "Principal"), and the _____

_____ a Corporation created and existing under the laws of the State of _____

and having its principal office at _____
in the City of _____ (hereinafter called the "Surety"), are held and
firmly bound unto The County of Westchester (hereinafter called the "Obligee") in the penal sum
of-----**DOLLARS**-----**AND**-----/100-----
--[\$]

lawful money of the United States of America, for the payment of which, well and truly
to be made, the said Principal binds itself, (himself, themselves) and its (his, their) successors
and assigns, and the said Surety binds itself and its successors and assigns, all jointly and
severally, firmly by these presents. Said penal sum shall apply separately and independently, in
its total amount, to the payment provision and the performance provision of this Bond shall not
reduce or limit the right of the Obligee to recover under the other said provision.

Signed, sealed and dated this _____ day of _____, 200__.

WHEREAS, said Principal has entered into a certain written contract with said Obligee, dated
this _____ day of _____, 200__, (hereinafter called the "Contract")

For ----**CONTRACT #** _____ a copy of which Contract is hereto annexed and
hereby made a part of this bond as if herein set forth in full.

NOW THEREFORE, THE CONDITIONS OF THE ABOVE OBLIGATIONS ARE SUCH THAT, if the said Principal, and its (his, their) successors or assigns, or any or either of them shall,

(1) well and truly and in good, sufficient and workmanlike manner, perform or cause to be performed such Contract, and any amendment or extension of or addition thereto, and each and every of the covenants, promises, agreements and provisions therein stipulated and contained to be performed by said Principal, and complete the same within the period therein mentioned, and in each and every respect, comply with the conditions therein mentioned to be complied with by said Principal, and fully indemnify and save harmless the Obligee from all costs and damages which it may suffer by reason of failure so to do and fully reimburse and repay the Obligee all outlay and expense which it may incur in making good any such default, and

(2) also pay or cause to be paid the wages and compensation for labor performed and services rendered of all persons engaged in the prosecution of the work provided for therein, whether such persons by agents, servants or employees of the Principal, and of its (his, their) successors or assigns, or any Subcontractor or of any assignee thereof, including all persons so engaged who perform the work of laborers or of mechanics regardless of any contractual relationship between the Principal, or its (his, their) successors or assigns, or any Subcontractor or any designee thereof, and such laborers or mechanics, but not including office employees not regularly stationed at the site of the work, and further, shall pay or cause to be paid all lawful claims of Subcontractors and of materialmen and other third persons out of or in connection with said Contract and the work, labor, services, supplies and material furnished in and about the performance and completion thereof, then these obligations shall be null and void, otherwise they shall remain in full force and effect.

PROVIDED, however, that this bond is subject to the following additional conditions and limitations:

- (a) All persons who have performed labor or rendered services, as aforesaid, all Subcontractors, and all persons, firms, corporations, including materialmen and third persons, as aforesaid, furnishing work, labor, services, supplies and material under or in connection with said Contract or in or about the performance and completion thereof, shall have a direct right of action (subject to the prior right of the Obligee under any claim which it may assert against the Principal or its (his, their) successors and assigns, and/or the Surety and its successors and assigns) against the Principal and its (his, their) successors and assigns on this bond, which right of action shall be asserted in proceedings instituted in the State in which such work, labor, services, supplies or material was performed, rendered or furnished or where work, labor, services, supplies or material has been performed, rendered or furnished, as aforesaid, in more than one State, than in any such State. Insofar as permitted by the laws of such State, said right of action shall be asserted in a proceeding instituted in the name of Obligee to the use and benefit of the person, firm or corporation instituting such action and of all other persons, firms and corporations having claims hereunder, and any other person, firm or corporation having a claim hereunder shall have the

right to be made a party to such proceedings (but not later than twelve months after the performance of said Contract and final settlement thereof) and to have such claim adjudicated in such action and judgment rendered thereon. Prior to the institution of such a proceeding by a person, firm or corporation in the name of the Obligee, as aforesaid, such person, firm or corporation shall furnish the Obligee with a Bond of Indemnity for costs, which Bond shall be in an amount satisfactory to the Obligee.

- (b) The Surety or its successors or assigns shall not be liable hereunder for any damages or compensation recoverable under any worker's compensation or employer's liability statute.
- (c) In no event shall the Surety or its successors or assigns be liable under either the foregoing clause (1) or the foregoing clause (2) for a greater sum than the penalty of this Bond provided; however, that said penalty is separately applicable, in its total amount to each of the foregoing clauses (1) and (2), or subject to any suit, action or proceeding hereon that is instituted by any person, firm or corporation under the provisions of the above section (a) later than twelve months after the complete performance of said Contract and final settlement thereof.

The Principal, for itself (himself, themselves) and its (his, their) successors and assigns, and the Surety, for itself and its successors and assigns, do hereby expressly waive any objections that might be interposed as to the right of the Obligee to require a Bond containing the foregoing provisions, and they do hereby further expressly waive any defense which they or either of them might interpose to an action brought hereon by any person, firm or corporation, including Subcontractors, materialmen, and third persons, for work, labor, services, supplies or material performed, rendered or furnished as aforesaid, upon the ground that there is no law authorizing the said Obligee to require the foregoing provision to be placed in this Bond.

And Surety, for value received, for itself and its successors and assigns, hereby stipulates and agrees that the obligations of said Surety and of its successors and assigns and this Bond shall in no way be impaired or affected by an extension of time, modification, omission, addition or change in or to the said Contract or the work to be performed thereunder, or by any payment thereunder, before the time required therein, or by any waiver of any provision thereof, or by an assignment, subletting or other transfer thereof, or of any part thereof, or of any work to be performed, or of any moneys due or to become due thereunder; and the said Surety, for itself and its successors and assigns, does hereby waive notice of any and all of such extensions, modifications, omissions, additions, changes, payments, waivers, assignments, subcontracts and transfers, and hereby stipulates and agrees that any and all things done and omitted to be done by and in relation to (executors, administrators), successors, assigns, Subcontractors, and other transferees, shall have the same effect as to said Surety and its successors and assigns, as though done or omitted to be done by and in relation to said Principal.

And Surety, for value received, hereby stipulates and agrees, if requested to do so by Obligee, to fully perform and complete the work to be performed under the Contract, pursuant to the terms, conditions and covenants thereof, if for any cause, the Principal fails or neglects to so

fully perform and complete such Work. The Surety further agrees to commence such Work of Completion within twenty-five (25) calendar days after written notice thereof from the Oblige, and to complete such Work within twenty-five (25) calendar days from the expiration of the time allowed the Principal in the Contract for the completion of such Work.

WITNESSETH our hands and seals this ____ day of _____, 200__.

PRINCIPAL:

By: _____

(Signature)

(SEAL)

ATTEST:

(Surety)

By: _____

(Signature)

(SEAL)

ATTEST:

If the Contractor (Principal) is a partnership, the Bond should be signed by each of the individuals who are partners.

If the Contractor (Principal) is a Corporation, the Bond should be signed in its correct corporate name by a duly authorized officer, agent, or attorney-in-fact.

There should be executed an appropriate number of counterparts of the Bond corresponding to the number of counterparts of the Contract.

Each executed Bond should be accompanied by:

- (a) appropriate acknowledgments of the respective parties;
- (b) appropriate duly certified copy of Power of Attorney or other Certificate of Authority where Bond is executed by agent, officer or other representative of Principal or Surety;
- (c) a duly certified extract from By-laws or resolutions of Surety under which Power of Attorney or other Certificate of Authority of its agent, officer or representative was issued, and
- (d) duly certified copy of latest published financial statement of assets and liabilities of Surety.

BOND

BOND

CONTRACTOR'S ACKNOWLEDGMENT
(If Corporation)

STATE OF NEW YORK)
) ss.:
COUNTY OF)

On this ____ day of _____, 200__, before me personally came _____ to me known, and known to me to be the _____ of _____, the Corporation described in and which executed the within instrument, who being by me duly sworn did depose and say that the said _____ resides at _____ and that he/she is the _____ of said Corporation and knows the Corporate Seal of the said Corporation; that the seal affixed to the within instrument is such Corporate Seal and that it was so affixed by order of the Board of Directors of said Corporation and that he/she signed his/her name thereto by like order.

Notary Public

CONTRACTOR'S ACKNOWLEDGMENT
(If Individual)

STATE OF NEW YORK)
) ss.:
COUNTY OF)

On this ____ day of _____, 200__, before me personally came _____ to me known, and known to me to be the same person described in and who executed the within instrument and he/she duly acknowledged to me that he/she executed the same for the purpose herein mentioned.

Notary Public

CONTRACTOR'S ACKNOWLEDGMENT
(If Co-Partnership)

STATE OF NEW YORK)
) ss.:
COUNTY OF)

On this ____ day of _____, 200__, before me personally came _____ to me known, and known to me to be a member of the firm of _____ and the person described in, and who executed the within instrument in behalf of said firm, and acknowledged to me that he/she executed the same in behalf of, and as the act of said firm for the purposes herein mentioned.

Notary Public



SCHEDULE OF HOURLY RATES
AND SUPPLEMENTS

DEPARTMENT OF PUBLIC WORKS

Division of Engineering



Kathy Hochul, Governor

Roberta Reardon, Commissioner

Westchester County DPWT

Yolanda Spraggins, Secretary II
Michaelian Office Building
148 Martine Avenue - Room 518
White Plains NY 10601

Schedule Year 2021 through 2022
Date Requested 09/10/2021
PRC# 2021009525

Location Crotonville Pumping Station
Project ID# 17-529
Project Type Rehab/replace various equipment & systems incl. pumps, motors, drives, controls, valves, piping, electrical, heating, ventilation, chemical feed & security systems, emergency generator, bar screen &

PREVAILING WAGE SCHEDULE FOR ARTICLE 8 PUBLIC WORK PROJECT

Attached is the current schedule(s) of the prevailing wage rates and prevailing hourly supplements for the project referenced above. A unique Prevailing Wage Case Number (PRC#) has been assigned to the schedule(s) for your project.

The schedule is effective from July 2021 through June 2022. All updates, corrections, posted on the 1st business day of each month, and future copies of the annual determination are available on the Department's website www.labor.ny.gov. Updated PDF copies of your schedule can be accessed by entering your assigned PRC# at the proper location on the website.

It is the responsibility of the contracting agency or its agent to annex and make part, the attached schedule, to the specifications for this project, when it is advertised for bids and /or to forward said schedules to the successful bidder(s), immediately upon receipt, in order to insure the proper payment of wages.

Please refer to the "General Provisions of Laws Covering Workers on Public Work Contracts" provided with this schedule, for the specific details relating to other responsibilities of the Department of Jurisdiction.

Upon completion or cancellation of this project, enter the required information and mail **OR** fax this form to the office shown at the bottom of this notice, **OR** fill out the electronic version via the NYSDOL website.

NOTICE OF COMPLETION / CANCELLATION OF PROJECT

Date Completed: _____ Date Cancelled: _____

Name & Title of Representative: _____

Phone: (518) 457-5589 Fax: (518) 485-1870
W. Averell Harriman State Office Campus, Bldg. 12, Room 130, Albany, NY 12240

General Provisions of Laws Covering Workers on Article 8 Public Work Contracts

Introduction

The Labor Law requires public work contractors and subcontractors to pay laborers, workers, or mechanics employed in the performance of a public work contract not less than the prevailing rate of wage and supplements (fringe benefits) in the locality where the work is performed.

Responsibilities of the Department of Jurisdiction

A Department of Jurisdiction (Contracting Agency) includes a state department, agency, board or commission; a county, city, town or village; a school district, board of education or board of cooperative educational services; a sewer, water, fire, improvement and other district corporation; a public benefit corporation; and a public authority awarding a public work contract.

The Department of Jurisdiction (Contracting Agency) awarding a public work contract MUST obtain a Prevailing Rate Schedule listing the hourly rates of wages and supplements due the workers to be employed on a public work project. This schedule may be obtained by completing and forwarding a "Request for wage and Supplement Information" form (PW 39) to the Bureau of Public Work. The Prevailing Rate Schedule MUST be included in the specifications for the contract to be awarded and is deemed part of the public work contract.

Upon the awarding of the contract, the law requires that the Department of Jurisdiction (Contracting Agency) furnish the following information to the Bureau: the name and address of the contractor, the date the contract was let and the approximate dollar value of the contract. To facilitate compliance with this provision of the Labor Law, a copy of the Department's "Notice of Contract Award" form (PW 16) is provided with the original Prevailing Rate Schedule.

The Department of Jurisdiction (Contracting Agency) is required to notify the Bureau of the completion or cancellation of any public work project. The Department's PW 200 form is provided for that purpose.

Both the PW 16 and PW 200 forms are available for completion [online](#).

Hours

No laborer, worker, or mechanic in the employ of a contractor or subcontractor engaged in the performance of any public work project shall be permitted to work more than eight hours in any day or more than five days in any week, except in cases of extraordinary emergency. The contractor and the Department of Jurisdiction (Contracting Agency) may apply to the Bureau of Public Work for a dispensation permitting workers to work additional hours or days per week on a particular public work project.

There are very few exceptions to this rule. Complete information regarding these exceptions is available on the ["Request for a dispensation to work overtime" form \(PW30\)](#) and ["4 Day / 10 Hour Work Schedule" form \(PW 30.1\)](#).

Wages and Supplements

The wages and supplements to be paid and/or provided to laborers, workers, and mechanics employed on a public work project shall be not less than those listed in the current Prevailing Rate Schedule for the locality where the work is performed. If a prime contractor on a public work project has not been provided with a Prevailing Rate Schedule, the contractor must notify the Department of Jurisdiction (Contracting Agency) who in turn must request an original Prevailing Rate Schedule form the Bureau of Public Work. Requests may be submitted by: mail to NYSDOL, Bureau of Public Work, State Office Bldg. Campus, Bldg. 12, Rm. 130, Albany, NY 12240; Fax to Bureau of Public Work (518) 485-1870; or electronically at the NYSDOL website www.labor.ny.gov.

Upon receiving the original schedule, the Department of Jurisdiction (Contracting Agency) is REQUIRED to provide complete copies to all prime contractors who in turn MUST, by law, provide copies of all applicable county schedules to each subcontractor and obtain from each subcontractor, an affidavit certifying such schedules were received. If the original schedule expired, the contractor may obtain a copy of the new annual determination from the NYSDOL website www.labor.ny.gov.

The Commissioner of Labor makes an annual determination of the prevailing rates. This determination is in effect from July 1st through June 30th of the following year. The annual determination is available on the NYSDOL website www.labor.ny.gov.

Payrolls and Payroll Records

Every contractor and subcontractor MUST keep original payrolls or transcripts subscribed and affirmed as true under penalty of perjury. As per Article 6 of the Labor law, contractors and subcontractors are required to establish, maintain, and preserve for not less than six (6) years, contemporaneous, true, and accurate payroll records. At a minimum, payrolls must show the following information for each person employed on a public work project: Name, Address, Last 4 Digits of Social Security Number, Classification(s) in which the worker was employed, Hourly wage rate(s) paid, Supplements paid

or provided, and Daily and weekly number of hours worked in each classification.

The filing of payrolls to the Department of Jurisdiction is a condition of payment. Every contractor and subcontractor shall submit to the Department of Jurisdiction (Contracting Agency), within thirty (30) days after issuance of its first payroll and every thirty (30) days thereafter, a transcript of the original payrolls, subscribed and affirmed as true under penalty of perjury. The Department of Jurisdiction (Contracting Agency) shall collect, review for facial validity, and maintain such payrolls.

In addition, the Commissioner of Labor may require contractors to furnish, with ten (10) days of a request, payroll records sworn to as their validity and accuracy for public work and private work. Payroll records include, but are not limited to time cards, work description sheets, proof that supplements were provided, cancelled payroll checks and payrolls. Failure to provide the requested information within the allotted ten (10) days will result in the withholding of up to 25% of the contract, not to exceed \$100,000.00. If the contractor or subcontractor does not maintain a place of business in New York State and the amount of the contract exceeds \$25,000.00, payroll records and certifications must be kept on the project worksite.

The prime contractor is responsible for any underpayments of prevailing wages or supplements by any subcontractor.

All contractors or their subcontractors shall provide to their subcontractors a copy of the Prevailing Rate Schedule specified in the public work contract as well as any subsequently issued schedules. A failure to provide these schedules by a contractor or subcontractor is a violation of Article 8, Section 220-a of the Labor Law.

All subcontractors engaged by a public work project contractor or its subcontractor, upon receipt of the original schedule and any subsequently issued schedules, shall provide to such contractor a verified statement attesting that the subcontractor has received the Prevailing Rate Schedule and will pay or provide the applicable rates of wages and supplements specified therein. (See NYS Labor Laws, Article 8 . Section 220-a).

Determination of Prevailing Wage and Supplement Rate Updates Applicable to All Counties

The wages and supplements contained in the annual determination become effective July 1st whether or not the new determination has been received by a given contractor. Care should be taken to review the rates for obvious errors. Any corrections should be brought to the Department's attention immediately. It is the responsibility of the public work contractor to use the proper rates. If there is a question on the proper classification to be used, please call the district office located nearest the project. Any errors in the annual determination will be corrected and posted to the NYSDOL website on the first business day of each month. Contractors are responsible for paying these updated rates as well, retroactive to July 1st.

When you review the schedule for a particular occupation, your attention should be directed to the dates above the column of rates. These are the dates for which a given set of rates is effective. To the extent possible, the Department posts rates in its possession that cover periods of time beyond the July 1st to June 30th time frame covered by a particular annual determination. Rates that extend beyond that instant time period are informational ONLY and may be updated in future annual determinations that actually cover the then appropriate July 1st to June 30th time period.

Withholding of Payments

When a complaint is filed with the Commissioner of Labor alleging the failure of a contractor or subcontractor to pay or provide the prevailing wages or supplements, or when the Commissioner of Labor believes that unpaid wages or supplements may be due, payments on the public work contract shall be withheld from the prime contractor in a sufficient amount to satisfy the alleged unpaid wages and supplements, including interest and civil penalty, pending a final determination.

When the Bureau of Public Work finds that a contractor or subcontractor on a public work project failed to pay or provide the requisite prevailing wages or supplements, the Bureau is authorized by Sections 220-b and 235.2 of the Labor Law to so notify the financial officer of the Department of Jurisdiction (Contracting Agency) that awarded the public work contract. Such officer MUST then withhold or cause to be withheld from any payment due the prime contractor on account of such contract the amount indicated by the Bureau as sufficient to satisfy the unpaid wages and supplements, including interest and any civil penalty that may be assessed by the Commissioner of Labor. The withholding continues until there is a final determination of the underpayment by the Commissioner of Labor or by the court in the event a legal proceeding is instituted for review of the determination of the Commissioner of Labor.

The Department of Jurisdiction (Contracting Agency) shall comply with this order of the Commissioner of Labor or of the court with respect to the release of the funds so withheld.

Summary of Notice Posting Requirements

The current Prevailing Rate Schedule must be posted in a prominent and accessible place on the site of the public work project. The prevailing wage schedule must be encased in, or constructed of, materials capable of withstanding adverse weather conditions and be titled "PREVAILING RATE OF WAGES" in letters no smaller than two (2) inches by two (2) inches.

The "Public Work Project" notice must be posted at the beginning of the performance of every public work contract, on each job site.

Every employer providing workers' compensation insurance and disability benefits must post notices of such coverage in the format prescribed by the Workers' Compensation Board in a conspicuous place on the jobsite.

Every employer subject to the NYS Human Rights Law must conspicuously post at its offices, places of employment, or employment training centers, notices furnished by the State Division of Human Rights.

Employers liable for contributions under the Unemployment Insurance Law must conspicuously post on the jobsite notices furnished by the NYS Department of Labor.

Apprentices

Employees cannot be paid apprentice rates unless they are individually registered in a program registered with the NYS Commissioner of Labor. The allowable ratio of apprentices to journeyworkers in any craft classification can be no greater than the statewide building trade ratios promulgated by the Department of Labor and included with the Prevailing Rate Schedule. An employee listed on a payroll as an apprentice who is not registered as above or is performing work outside the classification of work for which the apprentice is indentured, must be paid the prevailing journeyworker's wage rate for the classification of work the employee is actually performing.

NYSDOL Labor Law, Article 8, Section 220-3, require that only apprentices individually registered with the NYS Department of Labor may be paid apprenticeship rates on a public work project. No other Federal or State Agency of office registers apprentices in New York State.

Persons wishing to verify the apprentice registration of any person must do so in writing by mail, to the NYSDOL Office of Employability Development / Apprenticeship Training, State Office Bldg. Campus, Bldg. 12, Albany, NY 12240 or by Fax to NYSDOL Apprenticeship Training (518) 457-7154. All requests for verification must include the name and social security number of the person for whom the information is requested.

The only conclusive proof of individual apprentice registration is written verification from the NYSDOL Apprenticeship Training Albany Central office. Neither Federal nor State Apprenticeship Training offices outside of Albany can provide conclusive registration information.

It should be noted that the existence of a registered apprenticeship program is not conclusive proof that any person is registered in that program. Furthermore, the existence or possession of wallet cards, identification cards, or copies of state forms is not conclusive proof of the registration of any person as an apprentice.

Interest and Penalties

In the event that an underpayment of wages and/or supplements is found:

- Interest shall be assessed at the rate then in effect as prescribed by the Superintendent of Banks pursuant to section 14-a of the Banking Law, per annum from the date of underpayment to the date restitution is made.
- A Civil Penalty may also be assessed, not to exceed 25% of the total of wages, supplements, and interest due.

Debarment

Any contractor or subcontractor and/or its successor shall be ineligible to submit a bid on or be awarded any public work contract or subcontract with any state, municipal corporation or public body for a period of five (5) years when:

- Two (2) willful determinations have been rendered against that contractor or subcontractor and/or its successor within any consecutive six (6) year period.
- There is any willful determination that involves the falsification of payroll records or the kickback of wages or supplements.

Criminal Sanctions

Willful violations of the Prevailing Wage Law (Article 8 of the Labor Law) may be a felony punishable by fine or imprisonment of up to 15 years, or both.

Discrimination

No employee or applicant for employment may be discriminated against on account of age, race, creed, color, national origin, sex, disability or marital status.

No contractor, subcontractor nor any person acting on its behalf, shall by reason of race, creed, color, disability, sex or national origin discriminate against any citizen of the State of New York who is qualified and available to perform the work to which the employment relates (NYS Labor Law, Article 8, Section 220-e(a)).

No contractor, subcontractor, nor any person acting on its behalf, shall in any manner, discriminate against or intimidate any employee on account of race, creed, color, disability, sex, or national origin (NYS Labor Law, Article 8, Section 220-e(b)).

The Human Rights Law also prohibits discrimination in employment because of age, marital status, or religion.

There may be deducted from the amount payable to the contractor under the contract a penalty of \$50.00 for each calendar day during which such person was discriminated against or intimidated in violation of the provision of the contract (NYS Labor Law, Article 8, Section 220-e(c)).

The contract may be cancelled or terminated by the State or municipality. All monies due or to become due thereunder may be forfeited for a second or any subsequent violation of the terms or conditions of the anti-discrimination sections of the contract (NYS Labor Law, Article 8, Section 220-e(d)).

Every employer subject to the New York State Human Rights Law must conspicuously post at its offices, places of employment, or employment training centers notices furnished by the State Division of Human Rights.

Workers' Compensation

In accordance with Section 142 of the State Finance Law, the contractor shall maintain coverage during the life of the contract for the benefit of such employees as required by the provisions of the New York State Workers' Compensation Law.

A contractor who is awarded a public work contract must provide proof of workers' compensation coverage prior to being allowed to begin work.

The insurance policy must be issued by a company authorized to provide workers' compensation coverage in New York State. Proof of coverage must be on form C-105.2 (Certificate of Workers' Compensation Insurance) and must name this agency as a certificate holder.

If New York State coverage is added to an existing out-of-state policy, it can only be added to a policy from a company authorized to write workers' compensation coverage in this state. The coverage must be listed under item 3A of the information page.

The contractor must maintain proof that subcontractors doing work covered under this contract secured and maintained a workers' compensation policy for all employees working in New York State.

Every employer providing worker's compensation insurance and disability benefits must post notices of such coverage in the format prescribed by the Workers' Compensation Board in a conspicuous place on the jobsite.

Unemployment Insurance

Employers liable for contributions under the Unemployment Insurance Law must conspicuously post on the jobsite notices furnished by the New York State Department of Labor.



Kathy Hochul, Governor

Roberta Reardon, Commissioner

Westchester County DPWT

Yolanda Spraggins, Secretary II
Michaelian Office Building
148 Martine Avenue - Room 518
White Plains NY 10601

Schedule Year 2021 through 2022
Date Requested 09/10/2021
PRC# 2021009525

Location Crotonville Pumping Station
Project ID# 17-529
Project Type Rehab/replace various equipment & systems incl. pumps, motors, drives, controls, valves, piping, electrical, heating, ventilation, chemical feed & security systems, emergency generator, bar screen &

Notice of Contract Award

New York State Labor Law, Article 8, Section 220.3a requires that certain information regarding the awarding of public work contracts, be furnished to the Commissioner of Labor. One "Notice of Contract Award" (PW 16, which may be photocopied), **MUST** be completed for **EACH** prime contractor on the above referenced project.

Upon notifying the successful bidder(s) of this contract, enter the required information and mail **OR** fax this form to the office shown at the bottom of this notice, **OR** fill out the electronic version via the NYSDOL website.

Contractor Information

All information must be supplied

Federal Employer Identification Number: _____		
Name: _____		
Address: _____ _____		
City: _____	State: _____	Zip: _____
Amount of Contract: \$ _____	Contract Type:	
Approximate Starting Date: ____/____/____	<input type="checkbox"/> (01) General Construction	
Approximate Completion Date: ____/____/____	<input type="checkbox"/> (02) Heating/Ventilation	
	<input type="checkbox"/> (03) Electrical	
	<input type="checkbox"/> (04) Plumbing	
	<input type="checkbox"/> (05) Other : _____	

Phone: (518) 457-5589 Fax: (518) 485-1870
W. Averell Harriman State Office Campus, Bldg. 12, Room 130, Albany, NY 12240

Social Security Numbers on Certified Payrolls:

The Department of Labor is cognizant of the concerns of the potential for misuse or inadvertent disclosure of social security numbers. Identity theft is a growing problem and we are sympathetic to contractors' concern regarding inclusion of this information on payrolls if another identifier will suffice.

For these reasons, the substitution of the use of the last four digits of the social security number on certified payrolls submitted to contracting agencies on public work projects is now acceptable to the Department of Labor. This change does not affect the Department's ability to request and receive the entire social security number from employers during its public work/ prevailing wage investigations.

Construction Industry Fair Play Act: Required Posting for Labor Law Article 25-B § 861-d

Construction industry employers must post the "Construction Industry Fair Play Act" notice in a prominent and accessible place on the job site. Failure to post the notice can result in penalties of up to \$1,500 for a first offense and up to \$5,000 for a second offense. The posting is included as part of this wage schedule. Additional copies may be obtained from the NYS DOL website, www.labor.ny.gov. <https://labor.ny.gov/formsdocs/ui/IA999.pdf>

If you have any questions concerning the Fair Play Act, please call the State Labor Department toll-free at 1-866-435-1499 or email us at: dol.misclassified@labor.ny.gov .

Worker Notification: (Labor Law §220, paragraph a of subdivision 3-a)

Effective June 23, 2020

This provision is an addition to the existing wage rate law, Labor Law §220, paragraph a of subdivision 3-a. It requires contractors and subcontractors to provide written notice to all laborers, workers or mechanics of the *prevailing wage and supplement rate* for their particular job classification *on each pay stub**. It also requires contractors and subcontractors to *post a notice* at the beginning of the performance of every public work contract *on each job site* that includes the telephone number and address for the Department of Labor and a statement informing laborers, workers or mechanics of their right to contact the Department of Labor if he/she is not receiving the proper prevailing rate of wages and/or supplements for his/her job classification. The required notification will be provided with each wage schedule, may be downloaded from our website www.labor.ny.gov or be made available upon request by contacting the Bureau of Public Work at 518-457-5589. *In the event the required information will not fit on the pay stub, an accompanying sheet or attachment of the information will suffice.

(12.20)

**To all State Departments, Agency Heads and Public Benefit Corporations
IMPORTANT NOTICE REGARDING PUBLIC WORK ENFORCEMENT FUND**

Budget Policy & Reporting Manual

B-610

Public Work Enforcement Fund

effective date December 7, 2005

1. Purpose and Scope:

This Item describes the Public Work Enforcement Fund (the Fund, PWEF) and its relevance to State agencies and public benefit corporations engaged in construction or reconstruction contracts, maintenance and repair, and announces the recently-enacted increase to the percentage of the dollar value of such contracts that must be deposited into the Fund. This item also describes the roles of the following entities with respect to the Fund:

- New York State Department of Labor (DOL),
- The Office of the State of Comptroller (OSC), and
- State agencies and public benefit corporations.

2. Background and Statutory References:

DOL uses the Fund to enforce the State's Labor Law as it relates to contracts for construction or reconstruction, maintenance and repair, as defined in subdivision two of Section 220 of the Labor Law. State agencies and public benefit corporations participating in such contracts are required to make payments to the Fund.

Chapter 511 of the Laws of 1995 (as amended by Chapter 513 of the Laws of 1997, Chapter 655 of the Laws of 1999, Chapter 376 of the Laws of 2003 and Chapter 407 of the Laws of 2005) established the Fund.

3. Procedures and Agency Responsibilities:

The Fund is supported by transfers and deposits based on the value of contracts for construction and reconstruction, maintenance and repair, as defined in subdivision two of Section 220 of the Labor Law, into which all State agencies and public benefit corporations enter.

Chapter 407 of the Laws of 2005 increased the amount required to be provided to this fund to .10 of one-percent of the total cost of each such contract, to be calculated at the time agencies or public benefit corporations enter into a new contract or if a contract is amended. The provisions of this bill became effective August 2, 2005.

To all State Departments, Agency Heads and Public Benefit Corporations
IMPORTANT NOTICE REGARDING PUBLIC WORK ENFORCEMENT FUND

OSC will report to DOL on all construction-related ("D") contracts approved during the month, including contract amendments, and then DOL will bill agencies the appropriate assessment monthly. An agency may then make a determination if any of the billed contracts are exempt and so note on the bill submitted back to DOL. For any instance where an agency is unsure if a contract is or is not exempt, they can call the Bureau of Public Work at the number noted below for a determination. Payment by check or journal voucher is due to DOL within thirty days from the date of the billing. DOL will verify the amounts and forward them to OSC for processing.

For those contracts which are not approved or administered by the Comptroller, monthly reports and payments for deposit into the Public Work Enforcement Fund must be provided to the Administrative Finance Bureau at the DOL within 30 days of the end of each month or on a payment schedule mutually agreed upon with DOL.

Reports should contain the following information:

- Name and billing address of State agency or public benefit corporation;
- State agency or public benefit corporation contact and phone number;
- Name and address of contractor receiving the award;
- Contract number and effective dates;
- Contract amount and PWEF assessment charge (if contract amount has been amended, reflect increase or decrease to original contract and the adjustment in the PWEF charge); and
- Brief description of the work to be performed under each contract.

Checks and Journal Vouchers, payable to the "New York State Department of Labor" should be sent to:

Department of Labor
Administrative Finance Bureau-PWEF Unit
Building 12, Room 464
State Office Campus
Albany, NY 12240

Any questions regarding billing should be directed to NYSDOL's Administrative Finance Bureau-PWEF Unit at (518) 457-3624 and any questions regarding Public Work Contracts should be directed to the Bureau of Public Work at (518) 457-5589.



Required Notice under Article 25-B of the Labor Law

Attention All Employees, Contractors and Subcontractors: You are Covered by the Construction Industry Fair Play Act

The law says that you are an employee unless:

- You are free from direction and control in performing your job, **and**
- You perform work that is not part of the usual work done by the business that hired you, **and**
- You have an independently established business.

Your employer cannot consider you to be an independent contractor unless all three of these facts apply to your work.

It is against the law for an employer to misclassify employees as independent contractors or pay employees off the books.

Employee Rights: If you are an employee, you are entitled to state and federal worker protections. These include:

- Unemployment Insurance benefits, if you are unemployed through no fault of your own, able to work, and otherwise qualified,
- Workers' compensation benefits for on-the-job injuries,
- Payment for wages earned, minimum wage, and overtime (under certain conditions),
- Prevailing wages on public work projects,
- The provisions of the National Labor Relations Act, and
- A safe work environment.

It is a violation of this law for employers to retaliate against anyone who asserts their rights under the law. Retaliation subjects an employer to civil penalties, a private lawsuit or both.

Independent Contractors: If you are an independent contractor, **you must pay all taxes and Unemployment Insurance contributions required by New York State and Federal Law.**

Penalties for paying workers off the books or improperly treating employees as independent contractors:

- **Civil Penalty**
 - First offense: Up to \$2,500 per employee
 - Subsequent offense(s): Up to \$5,000 per employee
- **Criminal Penalty**
 - First offense: Misdemeanor - up to 30 days in jail, up to a \$25,000 fine and debarment from performing public work for up to one year.
 - Subsequent offense(s): Misdemeanor - up to 60 days in jail or up to a \$50,000 fine and debarment from performing public work for up to 5 years.

If you have questions about your employment status or believe that your employer may have violated your rights and you want to file a complaint, call the Department of Labor at (866) 435-1499 or send an email to dol.misclassified@labor.ny.gov. All complaints of fraud and violations are taken seriously. You can remain anonymous.

Employer Name:

IA 999 (09/16)

Attention Employees

THIS IS A: **PUBLIC WORK PROJECT**

If you are employed on this project as a **worker, laborer, or mechanic** you are entitled to receive the **prevailing wage and supplements rate** for the classification at which you are working.

Chapter 629 of
the Labor Laws
of 2007:

**These wages are set by law and must be posted
at the work site. They can also be found at:**
www.labor.ny.gov

If you feel that you have not received proper wages or benefits,
please call our nearest office.*

Albany	(518) 457-2744	Patchogue	(631) 687-4882
Binghamton	(607) 721-8005	Rochester	(585) 258-4505
Buffalo	(716) 847-7159	Syracuse	(315) 428-4056
Garden City	(516) 228-3915	Utica	(315) 793-2314
New York City	(212) 932-2419	White Plains	(914) 997-9507
Newburgh	(845) 568-5156		

* For New York City government agency construction projects, please
contact the Office of the NYC Comptroller at (212) 669-4443, or
www.comptroller.nyc.gov – click on Bureau of Labor Law.

Contractor Name: _____

Project Location: _____

Requirements for OSHA 10 Compliance

Article 8 §220-h requires that when the advertised specifications, for every contract for public work, is \$250,000.00 or more the contract must contain a provision requiring that every worker employed in the performance of a public work contract shall be certified as having completed an OSHA 10 safety training course. The clear intent of this provision is to require that all employees of public work contractors, required to be paid prevailing rates, receive such training "prior to the performing any work on the project."

The Bureau will enforce the statute as follows:

All contractors and sub contractors must attach a copy of proof of completion of the OSHA 10 course to the first certified payroll submitted to the contracting agency and on each succeeding payroll where any new or additional employee is first listed.

Proof of completion may include but is not limited to:

- Copies of bona fide course completion card (*Note: Completion cards do not have an expiration date.*)
- Training roster, attendance record or other documentation from the certified trainer pending the issuance of the card.
- Other valid proof

**A certification by the employer attesting that all employees have completed such a course is not sufficient proof that the course has been completed.

Any questions regarding this statute may be directed to the New York State Department of Labor, Bureau of Public Work at 518-457-5589.

WICKS

Public work projects are subject to the Wicks Law requiring separate specifications and bidding for the plumbing, heating and electrical work, when the total project's threshold is \$3 million in Bronx, Kings, New York, Queens and, Richmond counties; \$1.5 million in Nassau, Suffolk and Westchester counties; and \$500,000 in all other counties.

For projects below the monetary threshold, bidders must submit a sealed list naming each subcontractor for the plumbing, HVAC and electrical and the amount to be paid to each. The list may not be changed unless the public owner finds a legitimate construction need, including a change in specifications or costs or the use of a Project Labor Agreement (PLA), and must be open to public inspection.

Allows the state and local agencies and authorities to waive the Wicks Law and use a PLA if it will provide the best work at the lowest possible price. If a PLA is used, all contractors shall participate in apprentice training programs in the trades of work it employs that have been approved by the Department of Labor (DOL) for not less than three years. They shall also have at least one graduate in the last three years and use affirmative efforts to retain minority apprentices. PLA's would be exempt from Wicks, but deemed to be public work subject to prevailing wage enforcement.

The Commissioner of Labor shall have the power to enforce separate specification requirements on projects, and may issue stop-bid orders against public owners for non-compliance.

Other new monetary thresholds, and similar sealed bidding for non-Wicks projects, would apply to certain public authorities including municipal housing authorities, NYC Construction Fund, Yonkers Educational Construction Fund, NYC Municipal Water Finance Authority, Buffalo Municipal Water Finance Authority, Westchester County Health Care Association, Nassau County Health Care Corp., Clifton-Fine Health Care Corp., Erie County Medical Center Corp., NYC Solid Waste Management Facilities, and the Dormitory Authority.

Contractors must pay subcontractors within a 7 days period.

(07.19)

Introduction to the Prevailing Rate Schedule

Information About Prevailing Rate Schedule

This information is provided to assist you in the interpretation of particular requirements for each classification of worker contained in the attached Schedule of Prevailing Rates.

Classification

It is the duty of the Commissioner of Labor to make the proper classification of workers taking into account whether the work is heavy and highway, building, sewer and water, tunnel work, or residential, and to make a determination of wages and supplements to be paid or provided. It is the responsibility of the public work contractor to use the proper rate. If there is a question on the proper classification to be used, please call the district office located nearest the project. District office locations and phone numbers are listed below.

Prevailing Wage Schedules are issued separately for "General Construction Projects" and "Residential Construction Projects" on a county-by-county basis.

General Construction Rates apply to projects such as: Buildings, Heavy & Highway, and Tunnel and Water & Sewer rates.

Residential Construction Rates generally apply to construction, reconstruction, repair, alteration, or demolition of one family, two family, row housing, or rental type units intended for residential use.

Some rates listed in the Residential Construction Rate Schedule have a very limited applicability listed along with the rate. Rates for occupations or locations not shown on the residential schedule must be obtained from the General Construction Rate Schedule. Please contact the local Bureau of Public Work office before using Residential Rate Schedules, to ensure that the project meets the required criteria.

Payrolls and Payroll Records

Contractors and subcontractors are required to establish, maintain, and preserve for not less than six (6) years, contemporaneous, true, and accurate payroll records.

Every contractor and subcontractor shall submit to the Department of Jurisdiction (Contracting Agency), within thirty (30) days after issuance of its first payroll and every thirty (30) days thereafter, a transcript of the original payrolls, subscribed and affirmed as true under penalty of perjury.

Paid Holidays

Paid Holidays are days for which an eligible employee receives a regular day's pay, but is not required to perform work. If an employee works on a day listed as a paid holiday, this remuneration is in addition to payment of the required prevailing rate for the work actually performed.

Overtime

At a minimum, all work performed on a public work project in excess of eight hours in any one day or more than five days in any workweek is overtime. However, the specific overtime requirements for each trade or occupation on a public work project may differ. Specific overtime requirements for each trade or occupation are contained in the prevailing rate schedules.

Overtime holiday pay is the premium pay that is required for work performed on specified holidays. It is only required where the employee actually performs work on such holidays.

The applicable holidays are listed under HOLIDAYS: OVERTIME. The required rate of pay for these covered holidays can be found in the OVERTIME PAY section listings for each classification.

Supplemental Benefits

Particular attention should be given to the supplemental benefit requirements. Although in most cases the payment or provision of supplements is straight time for all hours worked, some classifications require the payment or provision of supplements, or a portion of the supplements, to be paid or provided at a premium rate for premium hours worked. Supplements may also be required to be paid or provided on paid holidays, regardless of whether the day is worked. The Overtime Codes and Notes listed on the particular wage classification will indicate these conditions as required.

Effective Dates

When you review the schedule for a particular occupation, your attention should be directed to the dates above the column of rates. These are the dates for which a given set of rates is effective. The rate listed is valid until the next effective rate change or until the new annual determination which takes effect on July 1 of each year. All contractors and subcontractors are required to pay the current prevailing rates of wages and supplements. If you have any questions please contact the Bureau of Public Work or visit the New York State Department of Labor website (www.labor.ny.gov) for current wage rate information.

Apprentice Training Ratios

The following are the allowable ratios of registered Apprentices to Journey-workers.

For example, the ratio 1:1,1:3 indicates the allowable initial ratio is one Apprentice to one Journeyworker. The Journeyworker must be in place on the project before an Apprentice is allowed. Then three additional Journeyworkers are needed before a second Apprentice is allowed. The last ratio repeats indefinitely. Therefore, three more Journeyworkers must be present before a third Apprentice can be hired, and so on.

Please call Apprentice Training Central Office at (518) 457-6820 if you have any questions.

Title (Trade)	Ratio
Boilermaker (Construction)	1:1,1:4
Boilermaker (Shop)	1:1,1:3
Carpenter (Bldg.,H&H, Pile Driver/Dockbuilder)	1:1,1:4
Carpenter (Residential)	1:1,1:3
Electrical (Outside) Lineman	1:1,1:2
Electrician (Inside)	1:1,1:3
Elevator/Escalator Construction & Modernizer	1:1,1:2
Glazier	1:1,1:3
Insulation & Asbestos Worker	1:1,1:3
Iron Worker	1:1,1:4
Laborer	1:1,1:3
Mason	1:1,1:4
Millwright	1:1,1:4
Op Engineer	1:1,1:5
Painter	1:1,1:3
Plumber & Steamfitter	1:1,1:3
Roofer	1:1,1:2
Sheet Metal Worker	1:1,1:3
Sprinkler Fitter	1:1,1:2

If you have any questions concerning the attached schedule or would like additional information, please contact the nearest BUREAU of PUBLIC WORK District Office or write to:

New York State Department of Labor
Bureau of Public Work
State Office Campus, Bldg. 12
Albany, NY 12240

District Office Locations:	Telephone #	FAX #
Bureau of Public Work - Albany	518-457-2744	518-485-0240
Bureau of Public Work - Binghamton	607-721-8005	607-721-8004
Bureau of Public Work - Buffalo	716-847-7159	716-847-7650
Bureau of Public Work - Garden City	516-228-3915	516-794-3518
Bureau of Public Work - Newburgh	845-568-5287	845-568-5332
Bureau of Public Work - New York City	212-932-2419	212-775-3579
Bureau of Public Work - Patchogue	631-687-4882	631-687-4902
Bureau of Public Work - Rochester	585-258-4505	585-258-4708
Bureau of Public Work - Syracuse	315-428-4056	315-428-4671
Bureau of Public Work - Utica	315-793-2314	315-793-2514
Bureau of Public Work - White Plains	914-997-9507	914-997-9523
Bureau of Public Work - Central Office	518-457-5589	518-485-1870

Westchester County General Construction

Boilermaker

09/01/2021

JOB DESCRIPTION Boilermaker

DISTRICT 4

ENTIRE COUNTIES

Bronx, Dutchess, Kings, Nassau, New York, Orange, Putnam, Queens, Richmond, Rockland, Suffolk, Sullivan, Ulster, Westchester

WAGES

Per Hour: 07/01/2021

Boilermaker	\$ 63.38
Repairs & Renovations	63.38

SUPPLEMENTAL BENEFITS

Per Hour: 07/01/2021

Boilermaker	32% of hourly
Repair & Renovations	Wage Paid
	+ \$ 25.38

NOTE: "Hourly Wage Paid" shall include any and all premium(s) pay.

Repairs & Renovation Includes replacement of parts and repairs & renovation of existing unit.

OVERTIME PAY

See (D, O) on OVERTIME PAGE

Repairs & Renovation see (B,E,Q)

HOLIDAY

Paid: See (8, 16, 23, 24) on HOLIDAY PAGE

Overtime: See (5, 6, 8, 11, 12, 15, 16, 22, 23, 24, 25) on HOLIDAY PAGE

NOTE: *Employee must work in pay week to receive Holiday Pay.

**Employee gets 4 times the hourly wage rate for working Labor Day.

REGISTERED APPRENTICES

Wage per hour:

(1/2) Year Terms at the following percentage of Boilermaker's Wage

1st	2nd	3rd	4th	5th	6th	7th
65%	70%	75%	80%	85%	90%	95%

Supplemental Benefits Per Hour:

	07/01/2021
Apprentice(s)	32% of Hourly
	Wage Paid Plus
	Amount Below

1st Term	\$ 19.41
2nd Term	20.26
3rd Term	21.11
4th Term	21.96
5th Term	22.82
6th Term	23.68
7th Term	24.52

NOTE: "Hourly Wage Paid" shall include any and all premium(s)

4-5

Carpenter

09/01/2021

JOB DESCRIPTION Carpenter

DISTRICT 8

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Putnam, Queens, Richmond, Rockland, Suffolk, Westchester

WAGES

Per hour: 07/01/2021

Piledriver	\$ 56.93
Dockbuilder	\$ 56.93

SUPPLEMENTAL BENEFITS

Per hour:

Journeyworker \$ 53.33

OVERTIME PAY

See (B, E2, O) on OVERTIME PAGE

HOLIDAY

Paid: See (1) on HOLIDAY PAGE.

Paid: for 1st & 2nd yr.

Apprentices See (5,6,11,13,25)

Overtime: See (5,6,11,13,25) on HOLIDAY PAGE.

REGISTERED APPRENTICES

Wages per hour

(1)year terms:

1st	2nd	3rd	4th
\$23.37	\$28.97	\$37.35	\$45.74

Supplemental benefits per hour:

All Terms: \$ 35.33

8-1556 Db

Carpenter

09/01/2021

JOB DESCRIPTION Carpenter

DISTRICT 8

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Rockland, Suffolk, Westchester

WAGES

Per hour: 07/01/2021

Carpet/Resilient

Floor Coverer \$ 54.75

INCLUDES HANDLING & INSTALLATION OF ARTIFICIAL TURF AND SIMILAR TURF INDOORS/OUTDOORS.

SUPPLEMENTAL BENEFITS

Per hour:

\$ 46.97

OVERTIME PAY

See (B, E, Q) on OVERTIME PAGE

HOLIDAY

Paid: See (18, 19) on HOLIDAY PAGE.

Paid for 1st & 2nd yr.

Apprentices See (5,6,11,13,16,18,19,25)

Overtime: See (5,6,11,13,16,18,19,25) on HOLIDAY PAGE.

REGISTERED APPRENTICES

Wage per hour - (1) year terms:

1st	2nd	3rd	4th
\$ 24.55	\$ 27.55	\$ 31.80	\$ 39.68

Supplemental benefits per hour:

1st	2nd	3rd	4th
\$ 16.19	\$ 17.69	\$ 21.29	\$ 23.29

8-2287

Carpenter

09/01/2021

JOB DESCRIPTION Carpenter

DISTRICT 8

ENTIRE COUNTIES

Bronx, Dutchess, Kings, Nassau, New York, Orange, Putnam, Queens, Richmond, Rockland, Suffolk, Westchester

WAGES

Per Hour: 07/01/2021

Marine Construction:

Marine Diver	\$ 71.80
Marine Tender	51.34

SUPPLEMENTAL BENEFITS

Per Hour:

Journeyworker \$ 53.33

OVERTIME PAY

See (B, E, E2, Q) on OVERTIME PAGE

HOLIDAY

Paid: See (18, 19) on HOLIDAY PAGE

Overtime: See (5, 6, 10, 11, 13, 16, 18, 19) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wages per hour:

One (1) year terms.

1st year	\$ 23.37
2nd year	28.97
3rd year	37.35
4th year	45.74

Supplemental Benefits

Per Hour:

All terms \$ 35.33

8-1456MC

Carpenter

09/01/2021

JOB DESCRIPTION Carpenter

DISTRICT 8

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Putnam, Queens, Richmond, Rockland, Suffolk, Westchester

WAGES

Per hour: 07/01/2021

Building	
Millwright	\$ 57.00

SUPPLEMENTAL BENEFITS

Per hour:

Millwright \$ 54.60

OVERTIME PAY

See (B, E, Q) on OVERTIME PAGE

HOLIDAY

Paid: See (18,19) on HOLIDAY PAGE.

Overtime See (5,6,8,11,13,18,19,25) on HOLIDAY PAGE.

REGISTERED APPRENTICES

Wages per hour:

One (1) year terms:

1st.	2nd.	3rd.	4th.
\$30.74	\$36.19	\$41.64	\$52.54

Supplemental benefits per hour:

One (1) year terms:

1st.	2nd.	3rd.	4th.
------	------	------	------

\$35.03 \$38.73 \$43.08 \$49.84

8-740.1

Carpenter

09/01/2021

JOB DESCRIPTION Carpenter

DISTRICT 8

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

WAGES

Per Hour:

07/01/2021

Timberman

\$ 52.05

SUPPLEMENTAL BENEFITS

Per Hour:

07/01/2021

\$ 52.78

OVERTIME PAY

See (B, E, E2, Q) on OVERTIME PAGE

HOLIDAY

Paid: See (1) on HOLIDAY PAGE.

Paid: for 1st & 2nd yr.

Apprentices See (5,6,11,13,25)

Overtime: See (5,6,11,13,25) on HOLIDAY PAGE.

REGISTERED APPRENTICES

Wages per hour:

One (1) year terms:

1st	2nd	3rd	4th
\$21.42	\$26.53	\$34.18	\$41.84

Supplemental benefits per hour:

All terms \$ 35.06

8-1556 Tm

Carpenter

09/01/2021

JOB DESCRIPTION Carpenter

DISTRICT 8

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Rockland, Westchester

PARTIAL COUNTIES

Orange: South of but including the following, Waterloo Mills, Slate Hill, New Hampton, Goshen, Blooming Grove, Mountainville, east to the Hudson River.

Putnam: South of but including the following, Cold Spring, TompkinsCorner, Mahopac, Croton Falls, east to Connecticut border.

Suffolk: West of Port Jefferson and Patchogue Road to Route 112 to the Atlantic Ocean.

WAGES

Per hour: 07/01/2021 10/18/2021

Core Drilling:

Driller \$ 41.74 \$ 42.27

Driller Helper 32.92 33.47

Note: Hazardous Waste Pay Differential:

For Level C, an additional 10% above wage rate per hour

For Level B, an additional 10% above wage rate per hour

For Level A, an additional 10% above wage rate per hour

Note: When required to work on water: an additional \$ 0.50 per hour.

SUPPLEMENTAL BENEFITS

Per hour:

Driller and Helper \$ 29.40 \$ 30.60

OVERTIME PAY

OVERTIME: See (B,E,K*,P,R**) on OVERTIME PAGE.

HOLIDAY

Paid: See (5,6) on HOLIDAY PAGE.

Overtime: * See (5,6) on HOLIDAY PAGE.

** See (8,10,11,13) on HOLIDAY PAGE.

8-1536-CoreDriller

Carpenter - Building / Heavy&Highway

09/01/2021

JOB DESCRIPTION Carpenter - Building / Heavy&Highway

DISTRICT 11

ENTIRE COUNTIES

Putnam, Rockland, Westchester

WAGES

WAGES:(per hour)

07/01/2021

BUILDING/HEAVY & HIGHWAY/TUNNEL:

Carpenter

Base Wage

\$ 37.69

+ \$7.63*

*For all hours paid straight or premium.

SHIFT DIFFERENTIAL: When it is mandated by a Government Agency irregular or off shift can be worked. The Carpenter shall receive an additional fifteen percent (15%) of wage plus applicable benefits.

NOTE:Carpenters employed in the removal or abatement of asbestos or any toxic or hazardous material or required to work near asbestos or any toxic or hazardous material and required to wear protective equipment shall receive two (2) hours extra pay per day, plus applicable supplemental benefits.

SUPPLEMENTAL BENEFITS

Per hour:

Journeyworker

\$ 31.91

OVERTIME PAY

BUILDING:

See (B, E, Q) on OVERTIME PAGE.

HEAVY&HIGHWAY/TUNNEL:

See (B, E, P, *R, **T, X) on OVERTIME PAGE.

*R applies to Heavy&Highway/Tunnel Overtime Holiday Code 25 with benefits at straight time rate.

**T applies to Heavy&Highway/Tunnel Overtime Holiday Codes 5 & 6 with benefits at straight time rate.

HOLIDAY

BUILDING:

Paid: See (1) on HOLIDAY PAGE.

Overtime: See (5, 6, 16, 25) on HOLIDAY PAGE.

Holidays that fall on Sunday will be observed Monday.

HEAVY&HIGHWAY/TUNNEL:

Paid: See (5, 6, 25) on HOLIDAY PAGE including benefits.

Overtime: See (5, 6, 25) on HOLIDAY PAGE.

REGISTERED APPRENTICES

1 year terms at the following wage rates:

Indentured before July 1 2016

1st	2nd	3rd	4th
\$ 18.85	\$ 22.61	\$ 26.38	\$ 30.15
+3.57*	+3.57*	+3.57*	+3.57*

Indentured after July 1 2016

1st	2nd	3rd	4th	5th
\$ 18.85	\$ 22.61	\$ 24.50	\$ 26.38	\$ 30.15
+3.57*	+3.57*	+3.57*	+3.57*	+3.57*

*For all hours paid straight or premium

SUPPLEMENTAL BENEFITS per hour:

All terms \$ 16.28

11-279.1B/HH

Electrician

09/01/2021

JOB DESCRIPTION Electrician

DISTRICT 9

ENTIRE COUNTIES

Bronx, Kings, New York, Queens, Richmond, Westchester

WAGES

Per hour: 07/01/2021

Service Technician \$ 34.40

Service and Maintenance on Alarm and Security Systems.

Maintenance, repair and /or replacement of defective (or damaged) equipment on, but not limited to, Burglar - Fire - Security - CCTV - Card Access - Life Safety Systems and associated devices. (Whether by service contract of T&M by customer request.)

SUPPLEMENTAL BENEFITS

Per hour:

Journeyworker: \$ 19.32

OVERTIME PAY

See (B, E, Q) on OVERTIME PAGE

HOLIDAY

Paid: See (5, 6, 11, 15, 16, 17, 25, 26) on HOLIDAY PAGE

Overtime: See (5, 6, 11, 15, 16, 17, 25, 26) on HOLIDAY PAGE

9-3H

Electrician

09/01/2021

JOB DESCRIPTION Electrician

DISTRICT 8

ENTIRE COUNTIES

Westchester

WAGES

Per hour: 07/01/2021 04/21/2022

*Electrician/A-Technician \$ 53.75 \$ 53.75

Teledata 53.75 53.75

*All new installations of wiring, conduit, junction boxes and light fixtures for projects with a base bid of more than \$325,000. For projects with a base bid of \$325,000 or less, see Maintenance and Repair rates.

Note: On a job where employees are required to work on bridges over navigable waters, transmission towers, light poles, bosun chairs, swinging scaffolds, etc. 40 feet or more above the water or ground or under compressed air, or tunnel projects under construction or where assisted breathing apparatus is required, they will be paid at the rate of time and one-half for such work except on normal pole line or building construction work.

SUPPLEMENTAL BENEFITS

Per hour:

Journeyworker \$ 52.73 \$ 54.39

OVERTIME PAY

See (A, G, *J, P) on OVERTIME PAGE

*NOTE: Emergency work on Sunday and Holidays is at the time and one-half overtime rate.

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6, 8, 11, 15, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES

(1) year terms at the following wage rates:

	07/01/2021	01/01/2022	04/21/2022
1st term	\$ 14.00	\$ 15.00	\$ 15.00
2nd term	16.00	16.00	16.00
3rd term	18.00	18.00	18.00
4th term	20.00	20.00	20.00
MIJ 1-12 months	24.00	24.00	25.00
MIJ 13-18 months	27.50	27.50	28.50

Supplemental Benefits per hour:

	07/01/2021	04/21/2022
1st term	\$ 10.15	\$ 10.82
2nd term	13.05	13.05
3rd term	14.39	14.39
4th term	15.72	15.72
MIJ 1-12 months	13.39	13.49
MIJ 13-18 months	13.76	13.87

8-3/W

Electrician

09/01/2021

JOB DESCRIPTION Electrician

DISTRICT 8

ENTIRE COUNTIES

Westchester

WAGES

	07/01/2021	04/21/2022
Electrician -M	\$ 27.50	\$28.50
H - Telephone	\$ 27.50	\$28.50

All work with a base bid amount of \$325,000 or less. Including repairs and /or replacement of defective electrical and teledata equipment, all work necessary to retrofit, service, maintain and repair all kinds of lighting fixtures and local lighting controls, and washing and cleaning of foregoing fixtures.

*If the project exceeds \$375,000 due to changes in the scope of work, an Electrician/A Technician must be part of the labor ratio.

SUPPLEMENTAL BENEFITS

	07/01/2021	04/21/2022
Electrician &		
H - Telephone	\$ 13.76	\$13.87

OVERTIME PAY

See (B, G, *J, P) on OVERTIME PAGE

*Note: Emergency work on Sunday and Holidays is at the time and one-half overtime rate.

HOLIDAY

Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 11, 15, 16, 25) on HOLIDAY PAGE

8-3m

Elevator Constructor

09/01/2021

JOB DESCRIPTION Elevator Constructor

DISTRICT 4

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk

PARTIAL COUNTIES

Rockland: Entire County except for the Township of Stony Point

Westchester: Entire County except for the Townships of Bedford, Lewisboro, Cortland, Mt. Kisco, North Salem, Pound Ridge, Somers and Yorktown.

WAGES

Per hour:	07/01/2021	03/17/2022
Elevator Constructor	\$ 72.29	\$ 75.14
Modernization & Service/Repair	56.77	59.09

Four(4), ten(10) hour days may be worked at straight time during a week, Monday thru Friday.

NOTE- In order to use the '4 Day/10 Hour Work Schedule', as your normal schedule, you must submit an 'Employer Registration for Use of 4 Day/10 Hour Work Schedule' form PW30.1; and there must be a dispensation of hours in place on the project. If the PW30.1 IS NOT SUBMITTED you will be liable for overtime payments for work over the allotted hours per day listed.

SUPPLEMENTAL BENEFITS

Per Hour:

Elevator Constructor	\$ 41.92	\$ 43.914
Modernization & Service/Repairs	41.082	42.787

OVERTIME PAY

Constructor See (D, M, T) on OVERTIME PAGE.

Modern/Service See (B, F, S) on OVERTIME PAGE.

HOLIDAY

Paid: See (5, 6, 8, 11, 15, 16, 25) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 11, 15, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES

WAGES PER HOUR:

*Note: 1st Term is based on Average wage of Constructor & Modernization.
Terms 2 thru 4 Based on Journeymans wage of classification Working in.

1 YEAR TERMS:

1st Term*	2nd Term	3rd Term	4th Term
50%	55%	65%	75%

SUPPLEMENTAL BENEFITS

Elevator Constructor		
1st Term	\$ 34.05	\$ 34.772
2nd Term	34.91	35.606
3rd Term	36.30	37.052
4th Term	37.70	38.497

Modernization & Service/Repair

1st Term	\$ 34.00	\$ 34.672
2nd Term	34.50	35.195
3rd Term	35.83	36.571
4th Term	37.15	37.938

4-1

Elevator Constructor

09/01/2021

JOB DESCRIPTION Elevator Constructor

DISTRICT 1

ENTIRE COUNTIES

Columbia, Dutchess, Greene, Orange, Putnam, Sullivan, Ulster

PARTIAL COUNTIES

Delaware: Towns of Andes, Bovina, Colchester, Davenport, Delhi, Harpersfield, Hemdon, Kortright, Meredith, Middletown, Roxbury, Hancock & Stamford

Rockland: Only the Township of Stony Point.

Westchester: Only the Townships of Bedford, Lewisboro, Cortland, Mt. Kisco, North Salem, Pound Ridge, Somers and Yorktown.

WAGES

Per Hour	07/01/2021	01/01/2022
Mechanic	\$ 62.51	\$ 64.63
Helper	70% of Mechanic Wage Rate	70% of Mechanic Wage Rate

Four (4), ten (10) hour days may be worked for New Construction and Modernization Work at straight time during a week, Monday thru Thursday or Tuesday thru Friday.

***Four (4), ten (10) hour days are not permitted for Contract Work/Repair Work

NOTE - In order to use the '4 Day/10 Hour Work Schedule' as your normal schedule, you must submit an 'Employer Registration for Use of 4 Day/10 Hour Work Schedule', form PW30.1; and there must be a dispensation of hours in place on the project. If the PW30.1 is not submitted you may be liable for overtime payments for work over 8 hours per day.

SUPPLEMENTAL BENEFITS

Per hour	07/01/2021	01/01/2022
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Journeyman/Helper	\$ 35.825*	\$ 36.885*
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(*)Plus 6% of regular hourly if less than 5 years of service. Plus 8% of regular hourly rate if more than 5 years of service.

OVERTIME PAY

See (D, O) on OVERTIME PAGE

HOLIDAY

Paid: See (5, 6, 15, 16) on HOLIDAY PAGE

Overtime: See (5, 6, 15, 16) on HOLIDAY PAGE

Note: When a paid holiday falls on Saturday, it shall be observed on Friday. When a paid holiday falls on Sunday, it shall be observed on Monday.

REGISTERED APPRENTICES

Wages per hour:

0-6 mo*	6-12 mo	2nd yr	3rd yr	4th yr
50 %	55 %	65 %	70 %	80 %

(*)Plus 6% of the hourly rate, no additional supplemental benefits.

Supplemental Benefits per hour worked:

Same as Journeyman/Helper

1-138

Glazier

09/01/2021

JOB DESCRIPTION Glazier

DISTRICT 8

ENTIRE COUNTIES

Bronx, Dutchess, Kings, Nassau, New York, Orange, Putnam, Queens, Richmond, Rockland, Suffolk, Sullivan, Ulster, Westchester

WAGES

Per hour:	7/01/2021	11/01/2021
Glazier	\$ 58.60	+ \$1.25
*Scaffolding	59.55	
Glass Tinting & Window Film	29.60	
**Repair & Maintenance	29.60	

*Scaffolding includes swing scaffold, mechanical equipment, scissor jacks, man lifts, booms & buckets 24' or more, but not pipe scaffolding.

**Repair & Maintenance- All repair & maintenance work on a particular building, whenever performed, where the total cumulative contract value is under \$148,837. All Glass tinting, window film, regardless of material or intended use, and all affixing of decals to windows or glass.

SUPPLEMENTAL BENEFITS

Per hour:	7/01/2021
Journeyworker	\$ 36.04
Glass tinting & Window Film	21.19
Repair & Maintenance	21.19

OVERTIME PAY

See (B,H,V) on OVERTIME PAGE.

For 'Repair & Maintenance' and 'Glass Tinting & Window Film' see (B, B2, I, S) on overtime page.

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (4, 6, 16, 25) on HOLIDAY PAGE

For 'Repair & Maintenance' and 'Glass Tinting & Window Film' Only

Paid: See(5, 6, 16, 25)

Overtime: See(5, 6, 16, 25)

REGISTERED APPRENTICES

Wage per hour:

(1) year terms at the following wage rates:

	7/01/2021
1st term	\$ 20.72

2nd term	28.66
3rd term	34.67
4th term	46.62

Supplemental Benefits:

(Per hour)

1st term	\$ 16.58
2nd term	23.57
3rd term	26.09
4th term	30.91

8-1087 (DC9 NYC)

Insulator - Heat & Frost

09/01/2021

JOB DESCRIPTION Insulator - Heat & Frost

DISTRICT 8

ENTIRE COUNTIES

Dutchess, Orange, Putnam, Rockland, Westchester

WAGES

Per hour:	07/01/2021	05/31/2022
Insulator	\$ 56.25	+ \$ 2.00
Discomfort & Additional Training**	59.22	+ \$ 2.00
Fire Stop Work*	30.07	+ \$ 2.00

* Applies on all exclusive Fire Stop Work (When contract is for Fire Stop work only). No apprentices on these contracts only.

**Applies to work requiring: garb or equipment worn against the body not customarily worn by insulators; psychological evaluation; special training, including but not limited to "Yellow Badge" radiation training

Note: Additional \$0.50 per hour for work 30 feet or more above floor or ground level.

SUPPLEMENTAL BENEFITS

Per hour:

Journeyworker	\$ 35.10
Discomfort & Additional Training	37.06
Fire Stop Work:	
Journeyworker	17.90

OVERTIME PAY

See (B, E, E2, Q, *T) on OVERTIME PAGE

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Note: Last working day preceding Christmas and New Years day, workers shall work no later than 12:00 noon and shall receive 8 hrs pay.

Overtime: See (2*, 4, 6, 16, 25) on HOLIDAY PAGE.

*Note: Labor Day triple time if worked.

REGISTERED APPRENTICES

(1) year terms:

Insulator Apprentices:

1st	2nd	3rd	4th
\$ 30.07	\$ 35.30	\$ 40.54	\$ 45.78

Discomfort & Additional Training Apprentices:

1st	2nd	3rd	4th
\$ 31.55	\$ 37.08	\$ 42.61	\$ 48.16

Supplemental Benefits paid per hour:

Insulator Apprentices:

1st term	\$ 17.90
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2nd term	21.35
3rd term	24.79
4th term	28.23

Discomfort & Additional Training Apprentices:

1st term	\$ 18.89
2nd term	22.52
3rd term	26.16
4th term	29.80

8-91

Ironworker

09/01/2021

JOB DESCRIPTION Ironworker

DISTRICT 9

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

WAGES

Per Hour: 07/01/2021

Ironworker Rigger \$ 67.99

Ironworker Stone
Derrickman \$ 67.99

SUPPLEMENTAL BENEFITS

Per hour: \$ 41.44

OVERTIME PAY

See (B, D1, *E, Q, **V) on OVERTIME PAGE

*Time and one-half shall be paid for all work on Saturday up to eight (8) hours and double time shall be paid for all work thereafter.

** Benefits same premium as wages on Holidays only

HOLIDAY

Paid: See (18) on HOLIDAY PAGE

Overtime: See (5, 6, 8, 25) on HOLIDAY PAGE

*Work stops at schedule lunch break with full day's pay.

REGISTERED APPRENTICES

Wage per hour:

1/2 year terms at the following hourly wage rate:

	1st	2nd	3rd	4th
07/01/2021	\$33.55	\$47.94	\$53.34	\$58.74

Supplemental benefits:

Per hour:				
07/01/2021	\$21.18	\$31.45	\$31.45	\$31.45

9-197D/R

Ironworker

09/01/2021

JOB DESCRIPTION Ironworker

DISTRICT 4

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

WAGES

Per Hour:	07/01/2021	01/01/2022
		Additional
		\$ 1.25

Ornamental	\$ 46.15
Chain Link Fence	46.15
Guide Rail	46.15

SUPPLEMENTAL BENEFITS

Per hour:	
Journeyworker:	\$ 60.05

OVERTIME PAY

See (B, B1, Q, V) on OVERTIME PAGE

HOLIDAY

Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES

Apprentices hired before 8/31/2018:

(1/2) year terms at the following percentage of Journeyman's wage.
5th Term 80%

Supplemental Benefits per hour:

5th Term 54.03

Apprentices Hired after 9/1/18:

1 year terms

1st Term	\$ 20.63
2nd Term	24.22
3rd Term	27.80
4th Term	31.38

Supplemental Benefits per hour:

1st Term	\$ 17.89
2nd Term	19.14
3rd Term	20.40
4th Term	21.66

4-580-Or

Ironworker

09/01/2021

JOB DESCRIPTION Ironworker

DISTRICT 4

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

WAGES

PER HOUR:

07/01/2021	01/01/2022
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Ironworker:

Structural	\$ 54.20	Additional \$ 1.75/Hr.
Bridges		
Machinery		

SUPPLEMENTAL BENEFITS

PER HOUR PAID:

Journeyman \$ 82.35

OVERTIME PAY

See (B, B1, Q, *V) on OVERTIME PAGE

*NOTE: Benefits are calculated for every hour paid

HOLIDAY

Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 18, 19) on HOLIDAY PAGE

REGISTERED APPRENTICES

WAGES PER HOUR:

6 month terms at the following rate:

1st	\$28.21
2nd	\$28.81
3rd - 6th	\$29.42

Supplemental Benefits

PER HOUR PAID:

All Terms \$56.90

4-40/361-Str

Ironworker

09/01/2021

JOB DESCRIPTION Ironworker

DISTRICT 4

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

PARTIAL COUNTIES

Rockland: Southern section - south of Convent Road and east of Blue Hills Road.

WAGES

Per hour: 07/01/2021

Reinforcing &
Metal Lathing \$ 56.25

"Base" Wage \$ 54.70
plus \$ 1.55

"Base" Wage is used to calculate overtime hours only.

SUPPLEMENTAL BENEFITS

Per hour:
Reinforcing & Metal Lathing \$ 38.30

OVERTIME PAY

See (B, E, Q, *X) on OVERTIME PAGE

*Only \$22.00 per Hour for non worked hours

Supplemental Benefit Premiums for Overtime Hours worked:

Time & One Half \$ 45.08
Double Time \$ 51.33

HOLIDAY

Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 11, 13, 18, 19, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES

(1) year terms at the following wage rates:

1st term	2nd term	3rd term	4th Term
Wage Per Hour: \$ 22.55	\$ 28.38	\$ 34.68	\$ 37.18
"Base" Wage \$ 21.00 plus \$1.55	\$ 26.80 plus \$1.58	\$ 33.10 plus \$1.58	\$ 35.60 plus \$1.58

"Base" Wage is used to calculate overtime hours ONLY.

SUPPLEMENTAL BENEFITS

Per Hour:

1st term	2nd term	3rd term	4th Term
\$ 18.17	\$ 21.34	\$ 22.00	\$ 20.50

4-46Reinf

Laborer - Building

09/01/2021

JOB DESCRIPTION Laborer - Building

DISTRICT 8

ENTIRE COUNTIES

Putnam, Westchester

WAGES

07/01/2021

Laborer \$ 36.40
plus \$5.05**

Laborer - Asbestos & Hazardous
Materials Removal \$ 43.10*

* Abatement/Removal of:

- Lead based or lead containing paint on materials to be repainted is classified as Painter.
- Asbestos containing roofs and roofing material is classified as Roofer.

** This portion is not subject to overtime premium.

NOTE: Upgrade/Material condition work plan for work performed during non-outage under a wage formula of 90% wage/100% fringe benefits at nuclear power plants.

SUPPLEMENTAL BENEFITS

Per hour: 07/01/2021

Journeyworker \$ 27.50

OVERTIME PAY

See (B, E, E2, Q, *V) on OVERTIME PAGE

*Note: For Sundays and Holidays worked benefits are at the same premium as wages.

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES

LABORER ONLY

Hourly terms at the following wage:

Level A	Level B	Level C	Level D
0-1000	1001-2000	2001-3000	3001-4000
\$ 21.04	\$ 24.86	\$ 28.69	\$ 32.51

Supplemental Benefits per hour:

Apprentices
All terms \$ 21.15

8-235/B

Laborer - Heavy&Highway

09/01/2021

JOB DESCRIPTION Laborer - Heavy&Highway

DISTRICT 8

ENTIRE COUNTIES

Putnam, Westchester

WAGES

PUTNAM: APPLIES TO ALL HEAVY & HIGHWAY WORK EXCLUDING HIGHWAYS, STREETS, AND BRIDGES

GROUP I: Blaster, Quarry Master, Curbs/Asphalt Screedman, Pipe Jacking and Boring Operations Operator, Qualified Dead Condition Pipe Fuser (B Mechanic)

GROUP II: Burner, Drillers(jumbo, joy, wagon, air track, hydraulic), Drill Operator, Self Contained Rotary Drill, Curbs, Raker, Bar Person, Concrete Finisher.

GROUP III: Pavement Breakers, Jeep Operator, Jack Hammer, Pneumatic Tools (all), Gas Driller, Guniting, Railroad Spike Puller, Pipelayer, Chain Saw, Deck winches on scows, Power Buggy Operator, Power Wheelbarrow Operator, Bar Person Helper, Compressed Air lance, Water Jet Lance.

GROUP IV: Concrete Laborers, Asph. Worker, Rock Scaler, Vibrator Oper., Bit Grinder, Air Tamper, Pumps, Epoxy (adhesives, fillers and troweled on), Barco Rammer, Concrete Grinder, Crack Router Operator, Guide Rail-digging holes and placing concrete and demolition when not to be replaced, distribution of materials and tightening of bolts.

GROUP V: Drillers Helpers, Common Laborer, Mason Tenders, Signal Person, Pit Person, Truck Spotter, Powder Person, Landscape/Nursery Person, Dump Person, Temp. Heat.

GROUP VIA: Asbestos/Toxic Waste Laborer-All removal (Roads, Tunnels, Landfills, etc.) Confined space laborer, Bio-remediation, Phyto-remediation, Lead or Hazardous material, Abatement Laborer.

Wages:(per hour) 07/01/2021

GROUP I	\$45.65*
GROUP II	44.30*
GROUP III	43.90*
GROUP IV	43.55*

GROUP V	43.20*
GROUP VIA	45.20*
Operator Qualified	
Gas Mechanic(A Mech)	55.65*
Flagperson	36.85*

*NOTE: To calculate overtime premiums, deduct \$0.10 from above wages

SHIFT WORK: A shift premium will be paid on Public Work contracts for off-shift or irregular shift work when mandated by the NYS D.O.T. or other Governmental Agency contracts. Employees shall receive an additional 15% per hour above current rate for all regular and irregular shift work. Premium pay shall be calculated using the 15% per hour differential as base rate.

SUPPLEMENTAL BENEFITS

Per hour:

Journeyworker:

First 40 Hours

Per Hour \$26.10

Over 40 Hours

Per Hour 19.85

OVERTIME PAY

See (B, E, P, R, S) on OVERTIME PAGE

HOLIDAY

Paid: See (5, 6, 8, 15, 25, 26) on HOLIDAY PAGE

Overtime: See (5, 6, 8, 15, 25, 26) on HOLIDAY PAGE

NOTE: For Holiday Overtime: 5, 6 - Code 'S' applies

For Holiday Overtime: 8, 15, 25, 26 - Code 'R' applies

REGISTERED APPRENTICES

	1st term	2nd term	3rd term	4th term
	1-1000hrs	1001-2000hrs	2001-3000hrs	3001-4000hrs
07/01/2021	\$ 24.56	\$ 28.98	\$ 33.40	\$ 37.72

Supplemental Benefits per hour:

1st term	\$ 4.70 - After 40 hours: \$ 4.45
2nd term	\$ 4.80 - After 40 hours: \$ 4.45
3rd term	\$ 5.30 - After 40 hours: \$ 4.85
4th term	\$ 5.85 - After 40 hours: \$ 5.35

8-60H/H

Laborer - Tunnel

09/01/2021

JOB DESCRIPTION Laborer - Tunnel

DISTRICT 11

ENTIRE COUNTIES

Columbia, Dutchess, Greene, Orange, Otsego, Putnam, Rockland, Sullivan, Ulster, Westchester

PARTIAL COUNTIES

Chenango: Townships of Columbus, Sherburne and New Berlin.

Delaware: Townships of Andes, Bovina, Middletown, Roxbury, Franklin, Hamden, Stamford, Delhi, Kortright, Harpersfield, Merideth and Davenport.

WAGES

Class 1: All support laborers/sandhogs working above the shaft or tunnel.

Class 2: All laborers/sandhogs working in the shaft or tunnel.

Class 4: Safety Miners

Class 5: Site work related to Shaft/Tunnel

WAGES: (per hour)

	07/01/2021	07/01/2022
Class 1	\$ 51.95	\$ 53.45
Class 2	54.10	55.60
Class 4	60.50	62.00
Class 5	43.50	44.80

Toxic and hazardous waste, lead abatement and asbestos abatement work will be paid an additional \$ 3.00 an hour.

SHIFT DIFFERENTIAL...On all Government mandated irregular shift work:

- Employee shall be paid at time and one half the regular rate Monday through Friday.
- Saturday shall be paid at 1.65 times the regular rate.
- Sunday shall be paid at 2.15 times the regular rate.

SUPPLEMENTAL BENEFITS

Per hour:

Benefit 1	\$ 33.25	\$ 34.45
Benefit 2	49.81	51.60
Benefit 3	66.35	68.75

Benefit 1 applies to straight time hours, paid holidays not worked.

Benefit 2 applies to over 8 hours in a day (M-F), irregular shift work hours worked, and Saturday hours worked.

Benefit 3 applies to Sunday and Holiday hours worked.

OVERTIME PAY

See (B, E, Q, X) on OVERTIME PAGE

HOLIDAY

Paid: See (5, 6, 15, 25) on HOLIDAY PAGE

Overtime: See (5, 6, 15, 16, 25) on HOLIDAY PAGE

When a recognized Holidays falls on Saturday or Sunday, holidays falling on Saturday shall be recognized or observed on Friday and holidays falling on Sunday shall be recognized or observed on Monday. Employees ordered to work on the Saturday or Sunday of the holiday or on the recognized or the observed Friday or Monday for those holidays falling on Saturday or Sunday shall receive double time the established rate and benefits for the holiday.

REGISTERED APPRENTICES

FOR APPRENTICE RATES, refer to the appropriate Laborer Heavy & Highway wage rate contained in the wage schedule for the County and location where the work is to be performed.

11-17/60/235/754Tun

Lineman Electrician

09/01/2021

JOB DESCRIPTION Lineman Electrician

DISTRICT 6

ENTIRE COUNTIES

Westchester

WAGES

Below rates apply to electrical overhead and underground distribution and maintenance work and overhead and underground transmission line work, electrical substations, switching structures, continuous pipe-type underground fluid or gas filled transmission conduit and cable installations, maintenance jobs or projects, railroad catenary installations and maintenance, third rail installations, the bonding of rails and the installation of fiber optic cable. (Ref #14.04.01)

Includes Teledata Work performed within ten (10) feet of high voltage (600 volts or over) transmission lines.

Per hour:	07/01/2021	05/02/2022	05/01/2023	05/06/2024
Lineman, Tech, Welder	\$ 57.71	\$ 59.01	\$ 60.41	\$ 61.91
Crane, Crawler Backhoe	57.71	59.01	60.41	61.91
Cable Splicer-Pipe Type	63.48	64.91	66.45	68.10
Digging Mach Operator	51.94	53.11	54.37	55.72
Cert. Welder-Pipe Type	60.60	61.96	63.43	65.01
Tractor Trailer Driver	49.05	50.16	51.35	52.62
Groundman, Truck Driver	46.17	47.21	48.33	49.53
Equipment Mechanic	46.17	47.21	48.33	49.53
Flagman	34.63	35.41	36.25	37.15

Additional \$1.00 per hour for entire crew when a helicopter is used.

NOTE: THE FOLLOWING RATES WILL APPLY ON ALL CONTRACTING AGENCY MANDATED MULTIPLE SHIFTS OF AT LEAST FIVE (5) DAYS DURATION WORKED BETWEEN THE HOURS LISTED BELOW:

1ST SHIFT	8:00 AM TO 4:30 PM REGULAR RATE
2ND SHIFT	4:30 PM TO 1:00 AM REGULAR RATE PLUS 17.3%
3RD SHIFT	12:30 AM TO 9:00 AM REGULAR RATE PLUS 31.4%

Four (4), ten (10) hour days may be worked at straight time during a week, Monday thru Thursday. Friday may be used as a make-up day. Tuesday thru Friday may be worked with no make-up day.

NOTE - In order to use the '4 Day/10 Hour Work schedule', as your normal schedule, you must submit an 'Employer Registration for Use of 4 Day/10 Hour Work Schedule,' form PW30.1; and there must be a dispensation of hours in place on the project. If the PW30.1 is not submitted you may be liable for overtime payments for work over 8 hours per day.

SUPPLEMENTAL BENEFITS

Per hour worked (but also required on non-worked holidays):

	\$25.40 *plus 7% of hourly Wage	\$ 25.90 *plus 7% of hourly wage	\$ 26.40 *plus 7% of hourly wage	\$ 26.90 *plus 7% of hourly wage
Journeyman Lineman or Equipment Operators with Crane License	\$ 26.40 *plus 7% of hourly wage	\$ 27.90 *plus 7% of hourly wage	\$ 29.40 *plus 7% of hourly wage	\$ 30.90 *plus 7% of hourly wage

*The 7% is based on the hourly wage paid, straight time or premium time.

OVERTIME PAY

See (B, E, Q,) on OVERTIME PAGE. *Note* Double time for emergency work designated by the Dept of Jurisdiction.

NOTE: WAGE CAP - Double the straight time hourly base wage shall be the maximum hourly wage compensation for any hour worked.
Contractor is still responsible to pay the hourly benefit amount for each hour worked.

HOLIDAY

Paid See (5, 6, 8, 13, 25) on HOLIDAY PAGE plus Governor of NYS Election Day.
Overtime See (5, 6, 8, 13, 25) on HOLIDAY PAGE plus Governor of NYS Election Day.

NOTE: All paid holidays falling on Saturday shall be observed on the preceding Friday. All paid holidays falling on Sunday shall be observed on the following Monday. Supplements for holidays paid at straight time.

REGISTERED APPRENTICES

WAGES per hour: 1000 hour terms at the following percentage of the applicable Journeyman Lineman wage.

1st	2nd	3rd	4th	5th	6th	7th
60%	65%	70%	75%	80%	85%	90%

SUPPLEMENTAL BENEFITS per hour:

07/01/2021	05/02/2022	05/01/2023	05/06/2024
\$25.40 *plus 7% of hourly Wage	\$ 25.90 *plus 7% of hourly wage	\$ 26.40 *plus 7% of hourly wage	\$ 26.90 *plus 7% of hourly wage

*The 7% is based on the hourly wage paid, straight time or premium time.

6-1249aWest

Lineman Electrician - Teledata

09/01/2021

JOB DESCRIPTION Lineman Electrician - Teledata

DISTRICT 6

ENTIRE COUNTIES

Albany, Allegany, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Delaware, Dutchess, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Lewis, Livingston, Madison, Monroe, Montgomery, Niagara, Oneida, Onondaga, Ontario, Orange, Orleans, Oswego, Otsego, Putnam, Rensselaer, Rockland, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Wayne, Westchester, Wyoming, Yates

WAGES

Per hour:

For outside work, stopping at first point of attachment (demarcation).

07/01/2021

Cable Splicer	\$ 34.78
Installer, Repairman	\$ 33.01
Teledata Lineman	\$ 33.01
Tech., Equip. Operator	\$ 33.01
Groundman	\$ 17.50

NOTE: EXCLUDES Teledata work within ten (10) feet of High Voltage (600 volts and over) transmission lines. For this work please see LINEMAN.

NOTE: THE FOLLOWING RATES WILL APPLY ON ALL CONTRACTING AGENCY MANDATED MULTIPLE SHIFTS OF AT LEAST FIVE (5) DAYS DURATION WORKED:

1ST SHIFT

REGULAR RATE

2ND SHIFT REGULAR RATE PLUS 10%
3RD SHIFT REGULAR RATE PLUS 15%

SUPPLEMENTAL BENEFITS

Per hour:

Journeyman \$ 5.14
*plus 3% of
wage paid

*The 3% is based on the hourly wage paid, straight time rate or premium rate.

OVERTIME PAY

See (B, E, Q) on OVERTIME PAGE

NOTE: WAGE CAP - Double the straight time hourly base wage shall be the maximum hourly wage compensation for any hour worked.
Contractor is still responsible to pay the hourly benefit amount for each hour worked.

HOLIDAY

Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 16) on HOLIDAY PAGE

6-1249LT - Teledata

Lineman Electrician - Traffic Signal, Lighting

09/01/2021

JOB DESCRIPTION Lineman Electrician - Traffic Signal, Lighting

DISTRICT 6

ENTIRE COUNTIES

Westchester

WAGES

Lineman/Technician shall perform all overhead aerial work. A Lineman/Technician on the ground will install all electrical panels, connect all grounds, install and connect all electrical conductors which includes, but is not limited to road loop wires; conduit and plastic or other type pipes that carry conductors, flex cables and connectors, and to oversee the encasement or burial of such conduits or pipes.

A Groundman/Groundman Truck Driver shall: Build and set concrete forms, handle steel mesh, set footer cages, transport concrete in a wheelbarrow, hand or machine concrete vibrator, finish concrete footers, mix mortar, grout pole bases, cover and maintain footers while curing in cold weather, operate jack hammer, operate hand pavement breaker, tamper, concrete and other motorized saws, as a drill helper, operate and maintain generators, water pumps, chainsaws, sand blasting, operate mulching and seeding machine, air tools, electric tools, gas tools, load and unload materials, hand shovel and/or broom, prepare and pour mastic and other fillers, assist digger operator equipment operator in ground excavation and restoration, landscape work and painting. Only when assisting a lineman technician, a groundman/truck driver may assist in installing conduit, pipe, cables and equipment.

A flagger's duties shall consist of traffic control only.
(Ref #14.01.03)

Per hour:	07/01/2021	05/02/2022	05/01/2023	05/06/2024
Lineman, Technician	\$ 52.56	\$ 53.60	\$ 54.73	\$ 55.95
Crane, Crawler Backhoe	52.56	53.60	54.73	55.95
Certified Welder	55.19	56.28	57.47	58.75
Digging Machine	47.30	48.24	49.26	50.36
Tractor Trailer Driver	44.68	45.56	46.52	47.56
Groundman, Truck Driver	42.05	42.88	43.78	44.76
Equipment Mechanic	42.05	42.88	43.78	44.76
Flagman	31.54	32.16	32.84	33.57

Above rates are applicable for installation, testing, operation, maintenance and repair on all Traffic Control (Signal) and Illumination (Lighting) projects, Traffic Monitoring Systems, and Road Weather Information Systems. Includes digging of holes for poles, anchors, footer foundations for electrical equipment; assembly of all electrical materials or raceway; placing of fish wire; pulling of cables, wires or fiber optic cable through such raceways; splicing of conductors; dismantling of such structures, lines or equipment.

NOTE: THE FOLLOWING RATES WILL APPLY ON ALL CONTRACTING AGENCY MANDATED MULTIPLE SHIFTS OF AT LEAST FIVE (5) DAYS DURATION WORKED BETWEEN THE HOURS LISTED BELOW:

1ST SHIFT 8:00 AM TO 4:30 PM REGULAR RATE
2ND SHIFT 4:30 PM TO 1:00 AM REGULAR RATE PLUS 17.3%
3RD SHIFT 12:30 AM TO 9:00 AM REGULAR RATE PLUS 31.4%

Four (4), ten (10) hour days may be worked at straight time during a week, Monday thru Thursday. Friday may be used as a make-up day. Tuesday thru Friday may be worked with no make-up day.

NOTE - In order to use the '4 Day/10 Hour Work schedule', as your normal schedule, you must submit an 'Employer Registration for Use of 4 Day/10 Hour Work Schedule,' form PW30.1; and there must be a dispensation of hours in place on the project. If the PW30.1 is not submitted you may be liable for overtime payments for work over 8 hours per day.

SUPPLEMENTAL BENEFITS

Per hour worked (but also required on non-worked holidays):

	\$25.40 *plus 7% of hourly Wage	\$ 25.90 *plus 7% of hourly wage	\$ 26.40 *plus 7% of hourly wage	\$ 26.90 *plus 7% of hourly wage
Journeyman Lineman or Equipment Operators with Crane License	\$ 26.40 *plus 7% of hourly wage	\$ 27.90 *plus 7% of hourly wage	\$ 29.40 *plus 7% of hourly wage	\$ 30.90 *plus 7% of hourly wage

*The 7% is based on the hourly wage paid, straight time or premium time.

OVERTIME PAY

See (B, E, Q) on OVERTIME PAGE. *Note* Double time for emergency work designated by the Dept. of Jurisdiction.

NOTE: WAGE CAP - Double the straight time hourly base wage shall be the maximum hourly wage compensation for any hour worked.

Contractor is still responsible to pay the hourly benefit amount for each hour worked.

HOLIDAY

Paid: See (5, 6, 8, 13, 25) on HOLIDAY PAGE and Governor of NYS Election Day.

Overtime: See (5, 6, 8, 13, 25) on HOLIDAY PAGE and Governor of NYS Election Day.

NOTE: All paid holidays falling on Saturday shall be observed on the preceding Friday. All paid holidays falling on Sunday shall be observed on the following Monday. Supplements for holidays paid at straight time.

REGISTERED APPRENTICES

WAGES per hour: 1000 hour terms at the following percentage of the applicable Journeyman Lineman wage.

1st	2nd	3rd	4th	5th	6th	7th
60%	65%	70%	75%	80%	85%	90%

SUPPLEMENTAL BENEFITS per hour:

07/01/2021	05/02/2022	05/01/2023	05/06/2024
\$25.40 *plus 7% of hourly Wage	\$ 25.90 *plus 7% of hourly wage	\$ 26.40 *plus 7% of hourly wage	\$ 26.90 *plus 7% of hourly wage

*The 7% is based on the hourly wage paid, straight time or premium time.

6-1249aWestLT

Mason - Building

09/01/2021

JOB DESCRIPTION Mason - Building

DISTRICT 9

ENTIRE COUNTIES

Nassau, Rockland, Suffolk, Westchester

WAGES

Per hour:	07/01/2021	12/06/2021	06/06/2022
		Additional	Additional
Tile Setters	\$ 61.07	\$ 0.48	\$ 0.72

SUPPLEMENTAL BENEFITS

Per Hour:	\$ 24.91*
	+ \$10.01

* This portion of benefits subject to same premium rate as shown for overtime wages.

OVERTIME PAY

See (B, E, Q, V) on OVERTIME PAGE

Work beyond 10 hours on Saturday shall be paid at double the hourly wage rate.

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6, 11, 15, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wage per hour:

Tile Setters:
(750 hour) term at the following wage rate:

Term:	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
	1-750	751-1500	1501-2250	2251-3000	3001-3750	3751-4500	4501-5250	5251-6000	6001-6750	6501-7000
07/01/2021	\$20.84	\$25.66	\$32.68	\$37.50	\$40.99	\$44.30	\$47.82	\$52.63	\$55.35	\$59.34

Supplemental Benefits per hour:

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
\$12.55* +\$0.66	\$12.55* +\$0.71	\$15.16* +\$0.81	\$15.16* +\$0.85	\$16.16* +\$1.23	\$17.66* +\$1.28	\$18.66* +\$1.63	\$18.66* +\$1.68	\$16.66* +\$5.83	\$21.91* +\$6.32

* This portion of benefits subject to same premium rate as shown for overtime wages.

9-7/52A

Mason - Building	09/01/2021
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JOB DESCRIPTION Mason - Building

DISTRICT 11

ENTIRE COUNTIES

Putnam, Rockland, Westchester

PARTIAL COUNTIES

Orange: Only the Township of Tuxedo.

WAGES

Per hour:

	07/01/2021	06/01/2022 Additional	06/01/2023 Additional
Bricklayer	\$ 43.35	\$ 2.39	\$ 2.05
Cement Mason	43.35	2.39	2.05
Plasterer/Stone Mason	43.35	2.39	2.05
Pointer/Caulker	43.35	2.39	2.05

Additional \$1.00 per hour for power saw work

Additional \$0.50 per hour for swing scaffold or staging work

SHIFT WORK: When shift work or an irregular work day is mandated or required by state, federal, county, local or other governmental agency contracts, the following premiums apply:

Irregular work day requires 15% premium

Second shift an additional 15% of wage plus benefits to be paid

Third shift an additional 25% of wage plus benefits to be paid

SUPPLEMENTAL BENEFITS

Per hour:

Journeyman \$ 36.05.

OVERTIME PAY

OVERTIME:

Cement Mason See (B, E, Q, W) on OVERTIME PAGE.

All Others See (B, E, Q) on OVERTIME PAGE.

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6, 16, 25) on HOLIDAY PAGE

Whenever any of the above holidays fall on Sunday, they will be observed on Monday. Whenever any of the above holidays fall on Saturday, they will be observed on Friday.

REGISTERED APPRENTICES

Wages per hour:

750 hour terms at the following percentage of Journeyman's wage

1st	2nd	3rd	4th	5th	6th	7th	8th
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50% 55% 60% 65% 70% 75% 80% 85%

Supplemental Benefits per hour

750 hour terms at the following percentage of journeyman supplements

1st	2nd	3rd	4th	5th	6th	7th	8th
50%	55%	60%	65%	70%	75%	80%	85%

Apprentices indentured before June 1st, 2011 receive full journeyman benefits

11-5wp-b

Mason - Building

09/01/2021

JOB DESCRIPTION Mason - Building

DISTRICT 9

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

WAGES

Building

07/01/2021

01/01/2022

Wages per hour:

Mosaic & Terrazzo Mechanic

\$ 58.46

Additional
\$ 0.85

Mosaic & Terrazzo Finisher

\$ 56.86

SUPPLEMENTAL BENEFITS

Per hour:

Mosaic & Terrazzo Mechanic

\$ 26.11*
+ \$11.73

Mosaic & Terrazzo Finisher

\$ 26.11*
+ \$11.71

*This portion of benefits subject to same premium rate as shown for overtime wages.

OVERTIME PAY

See (A, E, Q) on OVERTIME PAGE

Deduct \$6.80 from hourly wages before calculating overtime.

HOLIDAY

Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 11, 15, 16, 25) on HOLIDAY PAGE
Easter Sunday is an observed holiday. Holidays falling on a Saturday will be observed on that Saturday. Holidays falling on a Sunday will be celebrated on the Monday.

REGISTERED APPRENTICES

Wages per hour:

(750 Hour) terms at the following wage rate.

	1st	2nd	3rd	4th	5th	6th	7th	8th
07/01/2021	\$ 25.82	\$ 28.40	\$ 31.00	\$ 33.58	\$ 36.16	\$ 38.74	\$ 43.91	\$ 49.08

Supplemental benefits per hour:

	1st	2nd	3rd	4th	5th	6th	7th	8th
07/01/2021	\$13.06* +\$9.27	\$14.37* +\$10.19	\$15.67* +\$11.12	\$16.98* +\$12.04	\$18.28* +\$12.97	\$19.59* +\$13.90	\$22.20* +\$15.75	\$24.81* +\$17.60

Apprentices hired after 07/01/2017:

Wages Per hour:

1st	2nd	3rd	4th	5th	6th
0- 1500	1501- 3000	3001- 3750	3751- 4500	4501- 5250	5251- 6000

07/01/2021	\$ 22.63	\$ 29.10	\$ 31.00	\$ 36.16	\$ 41.32	\$ 46.48
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Supplemental Benefits per hour:

	1st	2nd	3rd	4th	5th	6th
07/01/2021	\$4.59*	\$5.90*	\$15.67*	\$18.28*	\$20.89*	\$23.50*
	+\$6.49	+\$8.34	+\$11.12	+\$12.97	+\$14.83	+\$16.67

*This portion of benefits subject to same premium rate as shown for overtime wages.

9-7/3

Mason - Building	09/01/2021
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JOB DESCRIPTION Mason - Building **DISTRICT 9**

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

WAGES

Per hour:	07/01/2021	01/01/2022
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Building-Marble Restoration:	Additional
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Marble, Stone & Terrazzo Polisher, etc	\$ 46.16	\$ 1.10
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SUPPLEMENTAL BENEFITS

Per Hour:

Journeyworker:

Building-Marble Restoration:

Marble, Stone & Polisher	\$ 29.11
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OVERTIME PAY

See (B, *E, Q, V) on OVERTIME PAGE

*ON SATURDAYS, 8TH HOUR AND SUCCESSIVE HOURS PAID AT DOUBLE HOURLY RATE.

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6, 8, 11, 15, 25) on HOLIDAY PAGE

1ST TERM APPRENTICE GETS PAID FOR ALL OBSERVED HOLIDAYS.

REGISTERED APPRENTICES

WAGES per hour:

900 hour term at the following wage:

	1st 1- 900	2nd 901- 1800	3rd 1801- 2700	4th 2701
07/01/2021	\$32.28	\$36.91	\$41.51	\$46.16

Supplemental Benefits Per Hour:

07/01/2021	\$26.47	\$27.34	\$28.29	\$29.11
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9-7/24-MP

Mason - Building	09/01/2021
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JOB DESCRIPTION Mason - Building **DISTRICT 9**

ENTIRE COUNTIES

Bronx, Dutchess, Kings, Nassau, New York, Orange, Putnam, Queens, Richmond, Rockland, Suffolk, Sullivan, Ulster, Westchester

WAGES

Wages:	07/01/2021	01/03/2022
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Marble Cutters & Setters	\$ 61.73	Additional \$ 0.95
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SUPPLEMENTAL BENEFITS

Per Hour:

Journeyworker \$ 37.76

OVERTIME PAY

See (B, E, Q, V) on OVERTIME PAGE

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6, 8, 11, 15, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wage Per Hour:

750 hour terms at the following wage.

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
1-750	751-1500	1501-2250	2251-3000	3001-3750	3751-4500	4501-5250	5251-6000	6001-6751	6751-7500
\$ 24.70	\$ 27.77	\$ 30.87	\$ 33.94	\$ 37.03	\$ 40.11	\$ 43.20	\$ 46.29	\$ 52.46	\$ 58.64

Supplemental Benefits per hour:

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
\$ 20.01	\$ 21.43	\$ 22.83	\$ 24.25	\$ 25.65	\$ 27.07	\$ 28.47	\$ 29.88	\$ 32.70	\$ 35.51

9-7/4

Mason - Building 09/01/2021

JOB DESCRIPTION Mason - Building

DISTRICT 9

ENTIRE COUNTIES

Nassau, Rockland, Suffolk, Westchester

WAGES

Per hour:	07/01/2021	12/06/2021	06/06/2022
Tile Finisher	\$ 46.89	Additional \$ 0.39	Additional \$ 0.58

SUPPLEMENTAL BENEFITS

Per Hour:

\$ 21.91*
+ \$9.84

*This portion of benefits subject to same premium rate as shown for overtime wages

OVERTIME PAY

See (B, E, Q, *V) on OVERTIME PAGE

Work beyond 10 hours on a Saturday shall be paid at double the hourly wage rate.

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6, 11, 15, 16, 25) on HOLIDAY PAGE

9-7/88A-tf

Mason - Building 09/01/2021

JOB DESCRIPTION Mason - Building

DISTRICT 9

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

WAGES

Per hour:	07/01/2021	01/01/2022
Marble, Stone, etc. Maintenance Finishers:	\$ 26.73	Additional \$ 0.68

Note 1: An additional \$2.00 per hour
for time spent grinding floor using
"60 grit" and below.

Note 2: Flaming equipment operator
shall be paid an additional \$25.00 per day.

SUPPLEMENTAL BENEFITS

Per Hour:

Marble, Stone, etc
Maintenance Finishers: \$ 14.00

OVERTIME PAY

See (B, *E, Q, V) on OVERTIME PAGE

*Double hourly rate after 8 hours on Saturday

HOLIDAY

Paid: See (5, 6, 8, 11, 15, 25) on HOLIDAY PAGE

Overtime: See (5, 6, 8, 11, 15, 25) on HOLIDAY PAGE

1st term apprentice gets paid for all observed holidays.

REGISTERED APPRENTICES

WAGES per hour:

07/01/2021

0-750	\$21.37
751-1500	\$22.09
1501-2250	\$22.81
2251-3000	\$23.52
3001-3750	\$24.61
3751-4500	\$26.04
4501+	\$26.73

Supplemental Benefits:

Per hour:

0-750	\$ 11.24
751-1500	\$ 11.60
1501-2250	\$ 11.97
2251-3000	\$ 12.35
3001-3750	\$ 12.84
3751-4500	\$ 13.63
4501+	\$ 14.00

9-7/24M-MF

Mason - Building / Heavy&Highway

09/01/2021

JOB DESCRIPTION Mason - Building / Heavy&Highway

DISTRICT 9

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

WAGES

Per hour: 07/01/2021 01/03/2022

Marble-Finisher	\$ 48.87	Additional \$ 0.61
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SUPPLEMENTAL BENEFITS

Journeyworker:
per hour

Marble- Finisher \$ 35.25

OVERTIME PAY

See (B, E, Q, V) on OVERTIME PAGE

HOLIDAY

Overtime: See (5, 6, 8, 11, 15, 16, 25) on HOLIDAY PAGE

* Work beyond 8 hours on a Saturday shall be paid at double the rate.

** When an observed holiday falls on a Sunday, it will be observed the next day.

9-7/20-MF

Mason - Heavy&Highway

09/01/2021

JOB DESCRIPTION Mason - Heavy&Highway

DISTRICT 11

ENTIRE COUNTIES

Putnam, Rockland, Westchester

PARTIAL COUNTIES

Orange: Only the Township of Tuxedo.

WAGES

Per hour:

	07/01/2021	06/01/2022 Additional	06/01/2023 Additional
Bricklayer	\$ 43.85	\$ 2.39	\$ 2.05
Cement Mason	43.85	2.39	2.05
Marble/Stone Mason	43.85	2.39	2.05
Plasterer	43.85	2.39	2.05
Pointer/Caulker	43.85	2.39	2.05

Additional \$1.00 per hour for power saw work

Additional \$0.50 per hour for swing scaffold or staging work

SHIFT WORK: When shift work or an irregular work day is mandated or required by state, federal, county, local or other governmental contracts, the following rates apply:

Irregular work day requires 15% premium

Second shift an additional 15% of wage plus benefits to be paid

Third shift an additional 25% of wage plus benefits to be paid

SUPPLEMENTAL BENEFITS

Per hour:

Journeyman \$ 36.05

OVERTIME PAY

Cement Mason See (B, E, Q, W, X)

All Others See (B, E, Q, X)

HOLIDAY

Paid: See (5, 6, 16, 25) on HOLIDAY PAGE

Overtime: See (5, 6, 16, 25) on HOLIDAY PAGE

Whenever any of the above holidays fall on Sunday, they will be observed on Monday. Whenever any of the above holidays fall on Saturday, they will be observed on Friday.

REGISTERED APPRENTICES

Wages per hour:

750 hour terms at the following percentage of Journeyman's wage

1st	2nd	3rd	4th	5th	6th	7th	8th
50%	55%	60%	65%	70%	75%	80%	85%

Supplemental Benefits per hour

750 hour terms at the following percentage of journeyman supplements

1st	2nd	3rd	4th	5th	6th	7th	8th
50%	55%	60%	65%	70%	75%	80%	85%

Apprentices indentured before June 1st, 2011 receive full journeyman benefits

11-5WP-H/H

Operating Engineer - Building

09/01/2021

JOB DESCRIPTION Operating Engineer - Building

DISTRICT 9

ENTIRE COUNTIES

Bronx, Kings, New York, Putnam, Queens, Richmond, Westchester

PARTIAL COUNTIES

Dutchess: that part of Dutchess County lying south of the North City Line of the City of Poughkeepsie.

WAGES

NOTE:Construction surveying

Party Chief--One who directs a survey party

Instrument Man--One who runs the instrument and assists Party Chief.

Rodman--One who holds the rod and assists the Survey Crew

Wages:(Per Hour)

07/01/2021

Building Construction:

Party Chief	\$ 76.09
Instrument Man	\$ 60.41
Rodman	\$ 41.11

Steel Erection:

Party Chief	\$ 79.02
Instrument Man	\$ 62.89
Rodman	\$ 44.03

**Heavy Construction-NYC counties only:
(Foundation, Excavation.)**

Party Chief	\$ 84.60
Instrument man	\$ 63.79
Rodman	\$ 54.52

SUPPLEMENTAL BENEFITS

Per Hour:	07/01/2021
Building Construction	\$ 24.40* +\$ 7.15
Steel Erection	\$ 25.00* +\$ 7.15
Heavy Construction	\$ 25.25* +\$ 7.15

* This portion subject to same premium as wages

Non-Worked Holiday Supplemental Benefit:	\$ 16.45
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OVERTIME PAY

See (A, B, E, Q) on OVERTIME PAGE

Code "A" applies to Building Construction and has double the rate after 7 hours on Saturdays.

Code "B" applies to Heavy Construction and Steel Erection and had double the rate after 8 hours on Saturdays.

HOLIDAY

Paid:	See (5, 6, 9, 11, 15, 16, 25) on HOLIDAY PAGE
Overtime:	See (5, 6, 9, 11, 15, 16, 25) on HOLIDAY PAGE

9-15Db

Operating Engineer - Building

09/01/2021

JOB DESCRIPTION Operating Engineer - Building

DISTRICT 8

ENTIRE COUNTIES

Putnam, Westchester

PARTIAL COUNTIES

Dutchess: All the counties of Westchester and Putnam and the southern part of Dutchess County defined by the northern boundary line of the City of Poughkeepsie, then due east to Route 115, then north along Route 115 to Bedell Road, then east along Bedell Road to Van Wagner Road, then north along Van Wagner Road to Bower Road, then east along Bower Road to Route 44 and along Route 44 east to Route 343, then along Route 343 east to the northern boundary of Town of Dover Plains and east along the northern boundary of Town of Dover Plains to the border line of the State of Connecticut and bordered on the west by the middle of the Hudson River.

WAGES

GROUP I:

Cranes (All Types up to 49 tons), Boom Trucks, Cherry Pickers (All Types), Clamshell Crane, Derrick (Stone and Steel), Dragline, Franki Pile Rig or similar, High Lift (Lull or similar) with crane attachment and winch used for hoisting or lifting, Hydraulic Cranes, Pile Drivers, Potain and similar.

Cranes (All types 50-99 tons), Drill Rig Casa Grande (CAT or similar), Franki Pile Rig or similar, Hydraulic Cranes (All types including Crawler Cranes- No specific boom length).

Cranes (All types 100 tons and over), All Tower Cranes, All Climbing Cranes irrespective of manufacturer and regardless of how the same is rigged, Franki Pile Rig or similar, Conventional Cranes (All types including Crawler Cranes-No specific boom length), Hydraulic Cranes.

GROUP I-A: Barber Green Loader-Euclid Loader, Bulldozer, Carrier-Trailer Horse, Concrete Cleaning Decontamination Machine Operator, Concrete-Portable Hoist, Conway or Similar Mucking Machines, Elevator & Cage, Excavators all types, Front End Loaders, Gradall, Shovel, Backhoe, etc. (Crawler or Truck), Heavy Equipment Robotics Operator/Mechanic, Hoist Engineer-Material, Hoist Portable Mobile Unit, Hoist (Single, Double or Triple Drum), Horizontal Directional Drill Locator, Horizontal Directional Drill Operator and Jersey Spreader, Letourneau or Tournapull (Scrapers over 20 yards Struck), Lift Slab Console, etc., Lull HiLift or Similar, Master Environmental Maintenance Mechanics, Mucking Machines Operator/Mechanic or Similar Type, Overhead Crane, Pavement Breaker (Air Ram), Paver (Concrete), Post Hole Digger, Power House Plant, Road Boring Machine, Road Mix Machine, Ross Carrier and Similar Machines, Rubber tire double end backhoes and similar machines, Scoopmobile Tractor-Shovel Over 1.5 yards, Shovel (Tunnels), Spreader (Asphalt) Telephie (Cableway), Tractor Type Demolition Equipment, Trenching Machines-Vermeer Concrete Saw Trencher and Similar, Ultra High Pressure Waterjet Cutting Tool System, Vacuum Blasting Machine operator/mechanic, Winch Truck A Frame.

GROUP I-B: Compressor (Steel Erection), Mechanic (Outside All Types), Negative Air Machine (Asbestos Removal), Push Button (Buzz Box) Elevator.

GROUP II: Compactor Self-Propelled, Concrete Pump, Crane Operator in Training (Over 100 Tons), Grader, Machines Pulling Sheep's Foot Roller, Roller (4 ton and over), Scrapers (20 yards Struck and Under), Vibratory Rollers, Welder.

GROUP III-A: Asphalt Plant, Concrete Mixing Plants, Forklift (All power sources), Joy Drill or similar, Tractor Drilling Machine, Loader (1 1/2 yards and under), Portable Asphalt Plant, Portable Batch Plant, Portable Crusher, Skid Steer (Bobcat or similar), Stone Crusher, Well Drilling Machine, Well Point System.

GROUP III-B: Compressor Over 125 cu. Feet, Conveyor Belt Machine regardless of size, Compressor Plant, Ladder Hoist, Stud Machine.

GROUP IV-A: Batch Plant, Concrete Breaker, Concrete Spreader, Curb Cutter Machine, Finishing Machine-Concrete, Fine Grading Machine, Hepa Vac Clean Air Machine, Material Hopper (sand, stone, cement), Mulching Grass Spreader, Pump Gypsum etc, Pump-Plaster-Grout-Fireproofing. Roller (Under 4 Ton), Spreading and Fine Grading Machine, Steel Cutting Machine, Siphon Pump, Tar Joint Machine, Television Cameras for Water, Sewer, Gas etc. Turbo Jet Burner or Similar Equipment, Vibrator (1 to 5).

GROUP IV-B: Compressor (all types), Heater (All Types), Fire Watchman, Lighting Unit (Portable & Generator) Pump, Pump Station (Water, Sewer, Portable, Temporary), Welding Machine (Steel Erection & Excavation).

GROUP V: Mechanics Helper, Motorized Roller (walk behind), Stock Attendant, Welder's Helper, Maintenance Engineer Crane (75 ton and over).

Group VI-A: Welder Certified

GROUP VI-B: Utility Man, Warehouse Man.

WAGES: (per hour)

	07/01/2021	3/7/2022	3/6/2023
GROUP I			
Cranes- up to 49 tons	\$ 63.86	\$ 65.03	\$ 66.23
Cranes- 50 tons to 99 tons	66.07	67.28	68.53
Cranes- 100 tons and over	75.37	76.77	78.21
GROUP I-A	55.96	56.97	58.01
GROUP I-B	51.60	52.52	53.48
GROUP II	54.00	54.98	55.70
GROUP III-A	52.04	52.97	53.94
GROUP III-B	49.56	50.44	51.35
GROUP IV-A	51.52	52.44	53.40
GROUP IV-B	43.62	44.38	45.17
GROUP V	47.00	47.83	48.69
Group VI-A	54.94	55.93	56.96
GROUP VI-B			
Utility Man	44.61	45.39	46.21
Warehouse Man	46.74	47.57	48.42

An additional 20% to wage when required to wear protective equipment on hazardous/toxic waste projects.

Engineers operating cranes with booms 100 feet but less than 149 feet in length will be paid an additional \$2.00 per hour.

Engineers operating cranes with booms 149 feet or over in length will be paid an additional \$3.00 per hour.

Loader operators over 5 cubic yard capacity additional .50 per hour.

Shovel operators over 4 cubic yard capacity additional \$1.00 per hour.

SUPPLEMENTAL BENEFITS

Per hour:

	07/01/2021	03/07/2022	03/06/2023
Journeyworker	\$ 29.17	\$ 29.87	\$ 30.57

OVERTIME PAY

See (B, E, Q, *V) on OVERTIME PAGE

HOLIDAY

Paid: See (5, 6, 8, 15, 25, 26) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 15, 25, 26) on HOLIDAY PAGE

8-137B

Operating Engineer - Heavy&Highway

09/01/2021

JOB DESCRIPTION Operating Engineer - Heavy&Highway

DISTRICT 8

ENTIRE COUNTIES

Putnam, Westchester

PARTIAL COUNTIES

Dutchess: All the counties of Westchester and Putnam and the southern part of Dutchess County defined by the northern boundary line of the City of Poughkeepsie, then due east to Route 115, then north along Route 115 to Bedell Road, then east along Bedell Road to Van Wagner Road, then north along Van Wagner Road to Bower Road, then east along Bower Road to Route 44 and along Route 44 east to Route 343, then along Route 343 east to the northern boundary of Town of Dover Plains and east along the northern boundary of Town of Dover Plains to the border line of the State of Connecticut and bordered on the west by the middle of the Hudson River.

WAGES

GROUP I: Boom Truck, Cherry Picker, Clamshell, Crane, (Crawler, Truck),
Dragline, Drill Rig (Casa Grande, Cat, or Similar), Floating Crane (Crane on Barges) under 100 tons, Gin Pole, Hoist Engineer-Concrete (Crane-Derrick-Mine Hoist), Knuckle Boom Crane, Rough Terrain Crane.

GROUP I-A: Auger (Truck or Truck Mounted), Boat Captain, Bulldozer-All Sizes, Central Mix Plant Operator, Chipper (all types), Close Circuit T.V., Combination Loader/Backhoe, Compactor with Blade, Concrete Finishing Machine, Gradall, Grader (Motor Grader), Elevator & Cage (Materials or Passenger), Excavator (and all attachments), Front End Loaders (1 1/2 yards and over), High Lift Lull and similar, Hoist (Single, Double, Triple Drum), Hoist Portable Mobile Unit, Hoist Engineer (Material), Jack and Bore Machine, Log Skidders, Mill Machines, Mucking Machines, Overhead Crane, Paver (concrete), Post Pounder (of any type), Push Cats, Road Reclaimer, Robot Hammer (Brokk or similar), Robotic Equipment (Scope of Engineer Schedule), Ross Carrier and similar, Scrapers (20 yard struck and over), Side Boom, Slip Form Machine, Spreader (Asphalt), Trenching Machines (Telephies-Vermeer Concrete Saw), Tractor Type Demolition Equipment, Vacuum Truck. Vibratory Roller(Riding) or Roller used in mainline paving operations.

GROUP I-B: Asphalt Mobile Conveyor/Transfer Machine, Road Paver (Asphalt).

GROUP II-A: Ballast Regulators, Compactor Self Propelled, Fusion Machine, Rail Anchor Machines, Roller (4 ton and over), Scrapers (20 yard struck and under).

GROUP II-B: Mechanic (Outside) All Types, Shop Mechanic.

GROUP III: Air Tractor Drill, Asphalt Plant, Batch Plant, Boiler (High Pressure), Concrete Breaker (Track or Rubber Tire), Concrete Pump, Concrete Spreader, Excavator Drill, Farm Tractor, Forklift (all types), Gas Tapping (Live), Hydroseeder, Loader (1 1/2 yards and under), Locomotive (all sizes), Machine Pulling Sheeps Foot Roller, Portable Asphalt Plant, Portable Batch Plant, Portable Crusher (Apprentice), Powerhouse Plant, Roller (under 4 ton), Sheer Excavator, Skid Steer/Bobcat, Stone Crusher, Sweeper (with seat), Well Drilling Machine.

GROUP IV: Service Person (Grease Truck), Deckhand.

GROUP IV-B: Conveyor Belt Machine (Truck Mounted), Heater (all types), Lighting Unit (Portable), Maintenance Engineer (For Crane Only), Mechanics Helper, Pump (Fireproofing), Pumps-Pump Station/Water/Sewer/Gypsum/Plaster, etc., Pump Truck (Sewer Jet or Similar), Welders Helper, Welding Machine (Steel Erection), Well Point System.

GROUP V: All Tower Cranes-All Climbing Cranes and all cranes of 100-ton capacity or greater (3900 Manitowac or similar) irrespective of manufacturer and regardless of how the same is rigged, Hoist Engineer (Steel), Engineer-Pile Driver, Jersey Spreader, Pavement Breaker/Post Hole Digger.

WAGES: Per hour:	07/01/2021	03/07/2022	03/06/2023
Group I	\$ 64.63	\$ 65.97	\$ 67.27
Group I-A	57.02	58.16	59.26
Group I-B	60.06	61.28	62.46
Group II-A	54.61	55.70	56.74
Group II-B	56.31	57.44	58.52
Group III	53.66	54.72	55.74
Group IV	48.80	49.74	50.63
Group IV-B	41.94	42.71	43.43
Group V			
Engineer All Tower, Climbing and			
Cranes of 100 Tons	73.18	74.73	76.24
Hoist Engineer(Steel)	66.29	67.67	69.01

Engineer(Pile Driver)	70.67	72.16	73.61
Jersey Spreader,Pavement Breaker (Air Ram)Post Hole Digger	55.87	56.99	58.06

SHIFT DIFFERENTIAL:

A 15% premium on all hours paid, including overtime hours for 2nd, 3rd shifts on all government mandated off-shift work

Engineers operating cranes with booms 100 feet but less than 149 feet in length will be paid an additional \$2.00 per hour over the rate listed in the Wage Schedule. Engineers operating cranes with booms 149 feet or over in length will be paid an additional \$3.00 per hour over the rate listed in the Wage Schedule. Loader and Excavator Operators: over 5 cubic yards capacity \$0.50 per hour over the rate listed in the Wage Schedule. Shovel Operators: over 4 cubic yards capacity \$1.00 per hour over the rate listed in the Wage Schedule.

Four (4), ten (10) hour days may be worked at straight time during a week, Monday thru Thursday; Friday may be used as a make-up day.

NOTE - In order to use the 4 Day/10 Hour Work schedule Registration for Use of 4 Day/10 Hour Work Schedule,form PW30.1; and there must be a dispensation of hours in place on the project. If the PW30.1 is not submitted you may be liable for overtime payments for work over 8 hours per day.

SUPPLEMENTAL BENEFITS

Per hour:

Journeyworker:	07/01/2021	03/07/2022	03/06/2023
	\$ 31.60 up to 40 Hours	\$ 32.60 up to 40 hours	\$ 33.75 up to 40 hours
	After 40 hours \$ 22.40* PLUS \$ 1.20 on all hours worked	After 40 hours \$ 23.40* PLUS \$ 1.20 on all hours worked	After 40 hours \$ 24.50* PLUS \$ 1.25 on all hours worked

*This amount is subject to premium

OVERTIME PAY

See (B, E, E2, P, *R, **U) on OVERTIME PAGE

HOLIDAY

Paid:..... See (5, 6, 8, 15, 25, 26) on HOLIDAY PAGE

Overtime..... See (5, 6, 8, 15, 25, 26) on OVERTIME PAGE

* For Holiday codes 8,15,25,26 code R applies

** For Holiday Codes 5 & 6 code U applies

Note: If employees are required to work on Easter Sunday they shall be paid at the rate of triple time.

REGISTERED APPRENTICES

(1)year terms at the following rate.

	07/01/2021	03/07/2022	03/06/2023
1st term	\$ 28.51	\$ 29.08	\$ 29.63
2nd term	34.21	34.90	35.56
3rd term	39.91	40.71	41.48
4th term	45.61	46.53	47.41
Supplemental Benefits per hour:			
	23.60	24.55	25.70

8-137HH

Operating Engineer - Heavy&Highway

09/01/2021

JOB DESCRIPTION Operating Engineer - Heavy&Highway

DISTRICT 9

ENTIRE COUNTIES

Putnam, Westchester

PARTIAL COUNTIES

Dutchess: South of the North city line of Poughkeepsie

WAGES

Party Chief - One who directs a survey party

Instrument Man - One who runs the instrument and assists Party Chief

Rodman - One who holds the rod and in general, assists the Survey Crew

Catogories cover GPS & Underground Surveying

Per Hour: 07/01/2021

Party Chief \$ 81.72

Instrument Man 61.43
Rodman 52.40

SUPPLEMENTAL BENEFITS

Per Hour: 07/01/2021

All Catogories
Straight Time: \$ 25.25* plus \$7.15

Premium:
Time & 1/2 \$ 37.88* plus \$7.15

Double Time \$ 50.50* plus \$7.15

Non-Worked Holiday Supplemental Benefits:
\$ 16.45

OVERTIME PAY

See (B, *E, Q) on OVERTIME PAGE

* Doubletime paid on all hours in excess of 8 hours on Saturday

HOLIDAY

Paid: See (5, 6, 7, 11, 12) on HOLIDAY PAGE
Overtime: See (5, 6, 7, 11, 12) on HOLIDAY PAGE

9-15Dh

Operating Engineer - Heavy&Highway - Tunnel

09/01/2021

JOB DESCRIPTION Operating Engineer - Heavy&Highway - Tunnel

DISTRICT 8

ENTIRE COUNTIES

Putnam, Westchester

PARTIAL COUNTIES

Dutchess: All the counties of Westchester and Putnam and the southern part of Dutchess County defined by the northern boundary line of the City of Poughkeepsie, then due east to Route 115, then north along Route 115 to Bedell Road, then east along Bedell Road to Van Wagner Road, then north along Van Wagner Road to Bower Road, then east along Bower Road to Route 44 and along Route 44 east to Route 343, then along Route 343 east to the northern boundary of Town of Dover Plains and east along the northern boundary of Town of Dover Plains to the border line of the State of Connecticut and bordered on the west by the middle of the Hudson River.

WAGES

GROUP I: Boom Truck, Cherry Picker, Clamshell, Crane(Crawler,Truck), Dragline, Drill Rig Casa Grande(Cat or Similar), Floating Crane(Crane on Barge-Under 100 Tons), Hoist Engineer(Concrete/Crane-Derrick-Mine Hoist), Knuckle Boom Crane, Rough Terrain Crane.

GROUP I-A: Auger(Truck or Truck Mounted), Boat Captain, Bull Dozer-all sizes, Central Mix Plant Operator, Chipper-all types, Close Circuit T.V., Combination Loader/Backhoe, Compactor with Blade, Concrete Finishing Machine, Gradall, Grader(Motor Grader), Elevator & Cage(Materials or Passengers), Excavator(and all attachments), Front End Loaders(1 1/2 yards and over), High Lift Lull, Hoist(Single, Double, Triple Drum), Hoist Portable Mobile Unit, Hoist Engineer(Material), Jack and Bore Machine, Log Skidder, Milling Machine, Moveable Concrete Barrier Transfer & Transport Vehicle, Mucking Machines. Overhead Crane, Paver(Concrete), Post Pounder of any type, Push Cats, Road Reclaimer, Robot Hammer(Brokk or similar), Robotic Equipment(Scope of Engineer Schedule), Ross Carrier and similar machines, Scrapers(20 yards struck and over), Side Boom, Slip Form Machine, Spreader(Asphalt), Trenching Machines, Telephies-Vermeer Concrete Saw, Tractor type demolition equipment, Vacuum Truck, Vibratory Roller (Riding) used in mainline paving operations.

GROUP I-B: Asphalt Mobile Conveyor/Transfer Machine, Road Paver(Asphalt).

GROUP II-A: Ballast Regulators, Compactor(Self-propelled), Fusion Machine, Rail Anchor Machines, Roller(4 ton and over), Scrapers(20 yard struck and under).

GROUP II-B: Mechanic(outside)all types, Shop Mechanic.

GROUP III: Air Tractor Drill, Asphalt Plant, Batch Plant, Boiler(High Pressure), Concrete Breaker(Track or Rubber Tire), Concrete Pump, Concrete Spreader, Excavator Drill, Farm Tractor, Forklift(all types of power), Gas Tapping(Live), Hydroseeder, Loader(1 1/2 yards and under), Locomotive(all sizes), Machine Pulling Sheeps Foot Roller, Portable Asphalt Plant, Portable Batch Plant, Portable Crusher(Apprentice), Powerhouse Plant, Roller(under 4 ton), Sheer Excavator, Skidsteer/Bobcat, Stone Crusher, Sweeper(with seat), Well Drilling Machine.

GROUP IV-A: Service Person(Grease Truck), Deckhand.

GROUP IV-B: Conveyor Belt Machine(Truck Mounted), Heater(all types), Lighting Unit(Portable), Maintenance Engineer(for Crane only), Mechanics Helper, Pump(Fireproofing), Pumps-Pump Station/Water/Sewer/Gypsum/Plaster, etc., Pump Truck(Sewer Jet or similar), Welding Machine(Steel Erection), Welders Helper.

GROUP V-A: Engineer(all Tower Cranes, all Climbing Cranes & all Cranes of 100 ton capacity or greater),Hoist Engineer(Steel-Sub Structure), Engineer-Pile Driver, Jersey-Spreader, Pavement breaker, Post Hole Digger

WAGES: (per hour)

	07/01/2021	03/07/2022	03/06/2023
GROUP I	\$ 64.63	\$ 65.97	\$ 67.27
GROUP I-A	57.02	58.16	59.21
GROUP I-B	60.06	61.28	62.46
GROUP II-A	54.61	55.70	56.74
GROUP II-B	56.31	57.44	58.52
GROUP III	53.66	54.72	55.74
GROUP IV-A	48.80	49.74	50.63
GROUP IV-B	41.94	42.71	43.43
GROUP V-A			
Engineer-Cranes	73.18	74.73	76.24
Engineer-Pile Driver	70.67	72.16	73.61
Hoist Engineer	66.29	67.67	69.01
Jersey Spreader/Post Hole Digger	55.87	56.99	58.06

SHIFT DIFFERENTIAL:

A 15% premium on all hours paid, including overtime hours for 2nd, 3rd shifts
on all government mandated off-shift work

An additional 20% to wage when required to wear protective equipment on hazardous/toxic waste projects. Operators required to use two buckets pouring concrete on other than road pavement shall receive \$0.50 per hour over scale. Engineers operating cranes with booms 100 feet but less than 149 feet in length will be paid an additional \$2.00 per hour. Engineers operating cranes with booms 149 feet or over in length will be paid an additional \$3.00 per hour. Operators of shovels with a capacity over (4) cubic yards shall be paid an additional \$1.00 per hour. Operators of loaders with a capacity over (5) cubic yards shall be paid an additional \$0.50 per hour.

SUPPLEMENTAL BENEFITS

Per hour:

Journeyworker:

	07/01/2021	03/07/2022	03/06/2023
	\$ 23.60	\$ 24.55	\$ 25.70
	+ \$8.00	+ \$8.00	+ \$8.00
(Limited to first 40 hours)		(Limited to first 40 hours)	(Limited to first 40 hours)

OVERTIME PAY

See (D, O, *U, V) on OVERTIME PAGE

HOLIDAY

Paid: See (5, 6, 8, 15, 25, 26) on HOLIDAY PAGE

Overtime: See (5, 6, 8, 15, 25, 26) on HOLIDAY PAGE

* Note: For Holiday codes 5 & 6, code U applies. For Holiday codes 8, 15, 25, 26, code R applies.

Note: If employees are required to work on Easter Sunday, they shall be paid at the rate of triple time.

REGISTERED APPRENTICES

(1)year terms at the following rates:

	07/01/2021	03/07/2022	03/06/2023
1st term	\$ 28.51	\$ 29.08	\$ 29.63
2nd term	34.21	34.90	35.56
3rd term	39.91	40.71	41.48
4th term	45.61	46.53	47.41

Supplemental Benefits per hour:

All terms	\$ 23.60	\$ 24.55	\$ 25.70
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Operating Engineer - Marine Dredging

09/01/2021

JOB DESCRIPTION Operating Engineer - Marine Dredging

DISTRICT 4

ENTIRE COUNTIES

Albany, Bronx, Cayuga, Clinton, Columbia, Dutchess, Essex, Franklin, Greene, Jefferson, Kings, Monroe, Nassau, New York, Orange, Oswego, Putnam, Queens, Rensselaer, Richmond, Rockland, St. Lawrence, Suffolk, Ulster, Washington, Wayne, Westchester

WAGES

These wages do not apply to Operating Engineers on land based construction projects. For those projects, please see the Operating Engineer Heavy/Highway Rates. The wage rates below for all equipment and operators are only for marine dredging work in navigable waters found in the counties listed above.

Per Hour:	07/01/2021	10/01/2021
CLASS A1 Deck Captain, Leverman Mechanical Dredge Operator Licensed Tug Operator 1000HP or more.	\$ 41.42	\$ 41.42
CLASS A2 Crane Operator (360 swing)	36.91	36.91
CLASS B Dozer, Front Loader Operator on Land	To conform to Operating Engineer Prevailing Wage in locality where work is being performed including benefits.	
CLASS B1 Derrick Operator (180 swing) Spider/Spill Barge Operator Operator II, Fill Placer, Engineer, Chief Mate, Electrician, Chief Welder, Maintenance Engineer Licensed Boat, Crew Boat Operator	35.82	35.82
CLASS B2 Certified Welder	33.72	33.72
CLASS C1 Drag Barge Operator, Steward, Mate, Assistant Fill Placer	32.80	32.80
CLASS C2 Boat Operator	30.89	31.74
CLASS D Shoreman, Deckhand, Oiler, Rodman, Scowman, Cook, Messman, Porter/Janitor	25.66	26.37

SUPPLEMENTAL BENEFITS

Per Hour:

THE FOLLOWING SUPPLEMENTAL BENEFITS APPLY TO ALL CATEGORIES

All Classes A & B	07/01/2021 \$11.98 plus 8% of straight time wage, Overtime hours add \$ 0.63	10/01/2021 \$11.98 plus 8% of straight time wage, Overtime hours add \$ 0.63
All Class C	\$11.68 plus 8% of straight time wage, Overtime hours add \$ 0.48	11.68 plus 8% of straight time wage, Overtime hours add \$ 0.48
All Class D	\$11.38 plus 8%	11.38 plus 8%

of straight time
wage, Overtime hours
add \$ 0.33

of straight time
wage, Overtime hours
add \$ 0.33

OVERTIME PAY

See (B2, F, R) on OVERTIME PAGE

HOLIDAY

Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 15, 26) on HOLIDAY PAGE

4-25a-MarDredge

Operating Engineer - Survey Crew - Consulting Engineer

09/01/2021

JOB DESCRIPTION Operating Engineer - Survey Crew - Consulting Engineer

DISTRICT 9

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Putnam, Queens, Richmond, Suffolk, Westchester

PARTIAL COUNTIES

Dutchess: That part in Dutchess County lying South of the North City line of Poughkeepsie.

WAGES

Feasibility and preliminary design surveying, any line and grade surveying for inspection or supervision of construction.

Per hour: 07/01/2021
Survey Classifications

Party Chief \$ 45.83
Instrument Man 38.17
Rodman 33.34

SUPPLEMENTAL BENEFITS

Per Hour:

All Crew Members: \$ 20.60

OVERTIME PAY

OVERTIME:.... See (B, E*, Q, V) ON OVERTIME PAGE.

*Doubletime paid on the 9th hour on Saturday.

HOLIDAY

Paid: See (5, 6, 7, 11, 16) on HOLIDAY PAGE
Overtime: See (5, 6, 7, 11, 16) on HOLIDAY PAGE

9-15dconsult

Painter

09/01/2021

JOB DESCRIPTION Painter

DISTRICT 8

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Putnam, Queens, Richmond, Suffolk, Westchester

WAGES

Per hour: 07/01/2021

Brush \$ 50.30*

Abatement/Removal of lead based
or lead containing paint on
materials to be repainted. 50.30*

Spray & Scaffold \$ 53.30*
Fire Escape 53.30*
Decorator 53.30*
Paperhanger/Wall Coverer 52.93*

*Subtract \$ 0.10 to calculate premium rate.

SUPPLEMENTAL BENEFITS

Per hour: 07/01/2021

Paperhanger \$ 31.83
All others 29.81
Premium 33.40**

**Applies only to "All others" category, not paperhanger journeyworker.

OVERTIME PAY

See (A, H) on OVERTIME PAGE

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES

One (1) year terms at the following wage rate.

Per hour:	07/01/2021
Appr 1st term...	\$ 19.56*
Appr 2nd term...	25.12*
Appr 3rd term...	30.42*
Appr 4th term...	40.65*

*Subtract \$ 0.10 to calculate premium rate.

Supplemental benefits:

Per Hour:	07/01/2021
Appr 1st term...	\$ 14.72
Appr 2nd term...	18.23
Appr 3rd term...	21.06
Appr 4th term...	26.67

8-NYDC9-B/S

Painter

09/01/2021

JOB DESCRIPTION Painter

DISTRICT 8

ENTIRE COUNTIES

Putnam, Suffolk, Westchester

PARTIAL COUNTIES

Nassau: All of Nassau except the areas described below: Atlantic Beach, Ceadershurst, East Rockaway, Gibson, Hewlett, Hewlett Bay, Hewlett Neck, Hewlett Park, Inwood, Lawrence, Lido Beach, Long Beach, parts of Lynbrook, parts of Oceanside, parts of Valley Stream, and Woodmere. Starting on the South side of Sunrise Hwy in Valley Stream running east to Windsor and Rockaway Ave., Rockville Centre is the boundary line up to Lawson Blvd. turn right going west all the above territory. Starting at Union Turnpike and Lakeville Rd. going north to Northern Blvd. the west side of Lakeville road to Northern blvd. At Northern blvd. going east the district north of Northern blvd. to Port Washington Blvd. West of Port Washington blvd. to St. Francis Hospital then north of first traffic light to Port Washington and Sands Point, Manor HAVen, Harbour Acres.

WAGES

Per hour:	07/01/2021
Drywall Taper	\$ 50.30*

*Subtract \$ 0.10 to calculate premium rate.

SUPPLEMENTAL BENEFITS

Per hour:	07/01/2021
Journeyman	\$ 29.81

OVERTIME PAY

See (A, H) on OVERTIME PAGE

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wages - Per Hour:	07/01/2021
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1500 hour terms at the following wage rate:

1st term	\$ 19.56*
2nd term	25.12*
3rd term	30.42*
4th term	40.65*

*Subtract \$ 0.10 to calculate premium rate.

Supplemental Benefits - Per hour:

One year term (1500 hours) at the following dollar amount.

1st year	\$ 14.72
2nd year	18.23
3rd year	21.06
4th year	26.67

8-NYDCT9-DWT

Painter - Bridge & Structural Steel

09/01/2021

JOB DESCRIPTION Painter - Bridge & Structural Steel

DISTRICT 8

ENTIRE COUNTIES

Albany, Bronx, Clinton, Columbia, Dutchess, Essex, Franklin, Fulton, Greene, Hamilton, Kings, Montgomery, Nassau, New York, Orange, Putnam, Queens, Rensselaer, Richmond, Rockland, Saratoga, Schenectady, Schoharie, Suffolk, Sullivan, Ulster, Warren, Washington, Westchester

WAGES

Per Hour:

STEEL:

Bridge Painting:	07/01/2021	10/01/2021
	\$ 51.50	\$ 53.00
	+ 8.63*	+ 9.63*

ADDITIONAL \$6.00 per hour for POWER TOOL/SPRAY, whether straight time or overtime.

NOTE: All premium wages are to be calculated on base rate per hour only.

* For the period of May 1st to November 15th, this amount is payable up to 40 hours. For the period of Nov 16th to April 30th, this amount is payable up to 50 hours. EXCEPTION: First and last week of employment, and for the weeks of Memorial Day, Independence Day and Labor Day, where the amount is paid for the actual number of hours worked (no cap).

NOTE: Generally, for Bridge Painting Contracts, ALL WORKERS on and off the bridge (including Flagmen) are to be paid Painter's Rate; the contract must be ONLY for Bridge Painting.

SHIFT WORK:

When directly specified in public agency or authority contract documents for an employer to work a second shift and works the second shift with employees other than from the first shift, all employees who work the second shift will be paid 10% of the base wage shift differential in lieu of overtime for the first eight (8) hours worked after which the employees shall be paid at time and one half of the regular wage rate. When a single irregular work shift is mandated in the job specifications or by the contracting agency, wages shall be paid at time and one half for single shifts between the hours of 3pm-11pm or 11pm-7am.

SUPPLEMENTAL BENEFITS

Per Hour:

Journeyworker:	07/01/2021	10/01/2021
	\$ 10.90	\$ 10.90
	+ 30.00*	+ 30.60*

* For the period of May 1st to November 15th, this amount is payable up to 40 hours. For the period of Nov 16th to April 30th, this amount is payable up to 50 hours. EXCEPTION: First and last week of employment, and for the weeks of Memorial Day, Independence Day and Labor Day, where the amount is paid for the actual number of hours worked (no cap).

OVERTIME PAY

See (B, F, R) on OVERTIME PAGE

HOLIDAY

Paid: See (1) on HOLIDAY PAGE
Overtime: See (4, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wage - Per hour:

Apprentices: (1) year terms	07/01/2021	10/01/2021
1st year	\$ 20.60	\$ 21.20
	+ 3.45*	+ 3.86*
2nd year	\$ 30.90	\$ 31.80
	+ 5.18*	+ 5.78*

3rd year	\$ 41.20 + 6.90*	\$ 42.40 + 7.70*
Supplemental Benefits - Per hour:		
1st year	\$.25 + 12.00*	\$.25 + 12.24*
2nd year	\$ 10.90 + 18.00*	\$ 10.90 + 18.36*
3rd year	\$ 10.20 + 24.00*	\$ 10.90 + 24.48*

NOTE: All premium wages are to be calculated on base rate per hour only.

8-DC-9/806/155-BrSS

Painter - Line Striping	09/01/2021
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JOB DESCRIPTION Painter - Line Striping

DISTRICT 8

ENTIRE COUNTIES

Albany, Bronx, Clinton, Columbia, Dutchess, Essex, Franklin, Fulton, Greene, Hamilton, Kings, Montgomery, Nassau, New York, Orange, Putnam, Queens, Rensselaer, Richmond, Rockland, Saratoga, Schenectady, Schoharie, Suffolk, Sullivan, Ulster, Warren, Washington, Westchester

WAGES

Per hour:

Painter (Striping-Highway):	07/01/2021	07/01/2022
Striping-Machine Operator*	\$ 30.32	\$ 31.53
Linerman Thermoplastic	36.93	38.34

Note: * Includes but is not limited to: Positioning of cones and directing of traffic using hand held devices. Excludes the Driver/Operator of equipment used in the maintenance and protection of traffic safety.

Four (4), ten (10) hour days may be worked at straight time during a week, Monday thru Thursday. Friday may be used as a make-up day.

NOTE - In order to use the '4 Day/10 Hour Work Schedule,' as your normal schedule, you must submit an 'Employer Registration for Use of 4 Day/10 Hour Work Schedule,' form PW30.1; and there must be a dispensation of hours in place on the project. If the PW30.1 is not submitted you may be liable for overtime payments for work over 8 hours per day.

SUPPLEMENTAL BENEFITS

Per hour paid:	07/01/2021	07/01/2022
Journeyworker:		
Striping Machine Operator:	\$ 10.03	\$ 10.03
Linerman Thermoplastic:	10.03	10.03

OVERTIME PAY

See (B, B2, E2, F, S) on OVERTIME PAGE

HOLIDAY

Paid: See (5, 20) on HOLIDAY PAGE
Overtime: See (5, 20) on HOLIDAY PAGE

REGISTERED APPRENTICES

One (1) year terms at the following wage rates:

	07/01/2021	07/01/2022
1st Term:	\$ 12.50	\$ 12.61
2nd Term:	18.19	18.92
3rd Term:	24.26	25.22

Supplemental Benefits per hour:

1st term:	\$ 9.16	\$ 10.03
2nd Term:	9.16	10.03
3rd Term:	9.16	10.03

8-1456-LS

Painter - Metal Polisher**09/01/2021**

JOB DESCRIPTION Painter - Metal Polisher**DISTRICT 8****ENTIRE COUNTIES**

Albany, Allegany, Bronx, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Delaware, Dutchess, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Kings, Lewis, Livingston, Madison, Monroe, Montgomery, Nassau, New York, Niagara, Oneida, Onondaga, Ontario, Orange, Orleans, Oswego, Otsego, Putnam, Queens, Rensselaer, Richmond, Rockland, Saratoga, Schenectady, Schoharie, Schuylar, Seneca, St. Lawrence, Steuben, Suffolk, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Wayne, Westchester, Wyoming, Yates

WAGES

	07/01/2021
Metal Polisher	\$ 37.13
Metal Polisher*	38.23
Metal Polisher**	41.13

*Note: Applies on New Construction & complete renovation

** Note: Applies when working on scaffolds over 34 feet.

SUPPLEMENTAL BENEFITS

Per Hour: 07/01/2021

Journeyworker:

All classification \$ 10.64

OVERTIME PAY

See (B, E, P, T) on OVERTIME PAGE

HOLIDAY

Paid: See (5, 6, 11, 15, 16, 25, 26) on HOLIDAY PAGE

Overtime: See (5, 6, 9, 11, 15, 16, 25, 26) on HOLIDAY PAGE

REGISTERED APPRENTICES

Wages per hour:

One (1) year term at the following wage rates:

	07/01/2021
1st year	\$ 16.00
2nd year	17.00
3rd year	18.00
1st year*	\$ 16.39
2nd year*	17.44
3rd year*	18.54
1st year**	\$ 18.50
2nd year**	19.50
3rd year**	20.50

*Note: Applies on New Construction & complete renovation

** Note: Applies when working on scaffolds over 34 feet.

Supplemental benefits:

Per hour:

1st year	\$ 7.39
2nd year	7.39
3rd year	7.39

8-8A/28A-MP

Plumber**09/01/2021**

JOB DESCRIPTION Plumber**DISTRICT 8****ENTIRE COUNTIES**

Putnam, Westchester

WAGES

Per hour:

	07/01/2021
Plumber and Steamfitter	\$ 59.01

SHIFT WORK:

When directly specified in public agency or authority contract documents, shift work outside the regular hours of work shall be comprised of eight (8) hours per shift not including Saturday, Sundays and holidays. One half (1/2) hour shall be allowed for lunch after the first four (4) hours of each shift. Wage and Fringes for shift work shall be straight time plus a shift premium of twenty-five (25%) percent. A minimum of five days Monday through Friday must be worked to establish shift work.

SUPPLEMENTAL BENEFITS

Per hour:

Journeyworker \$ 39.26

OVERTIME PAY

See (B, E, E2, Q, V) on OVERTIME PAGE

OVERTIME:.... See on OVERTIME PAGE.

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6, 8, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES

(1)year terms at the following wages:

1st Term	\$ 21.89
2nd Term	25.13
3rd Term	29.01
4th Term	41.43
5th Term	44.45

Supplemental Benefits per hour:

1st term	\$ 16.25
2nd term	18.13
3rd term	21.57
4th term	28.41
5th term	30.11

8-21.1-ST

Plumber - HVAC / Service

09/01/2021

JOB DESCRIPTION Plumber - HVAC / Service

DISTRICT 8

ENTIRE COUNTIES

Dutchess, Putnam, Westchester

PARTIAL COUNTIES

Delaware: Only the townships of Middletown and Roxbury

Ulster: Entire County(including Wallkill and Shawangunk Prisons) except for remainder of Town of Shawangunk and Towns of Plattekill, Marlboro, and Wawarsing.

WAGES

Per hour: 07/01/2021

HVAC Service \$ 40.68
+ \$ 4.32*

*Note: This portion of wage is not subject to overtime premium.

SUPPLEMENTAL BENEFITS

Per hour:

07/01/2021

Journeyworker HVAC Service

\$ 26.54

OVERTIME PAY

See (B, F, R) on OVERTIME PAGE

HOLIDAY

Paid: See (5, 6, 16, 25) on HOLIDAY PAGE

Overtime: See (5, 6, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES

HVAC SERVICE

(1) year terms at the following wages:

1st yr.	2nd yr.	3rd yr.	4th yr.	5th yr.
\$ 18.50	\$ 21.88	\$ 27.31	\$ 33.56	\$ 36.36
+\$2.37*	+\$2.67*	+\$3.22*	+\$3.84*	+\$4.07*

*Note: This portion of wage is not subject to overtime premium.

Supplemental Benefits per hour:

Apprentices 07/01/2021

1st term	\$ 19.66
2nd term	20.86
3rd term	22.21
4th term	24.02
5th term	25.33

8-21.1&2-SF/Re/AC

Plumber - Jobbing & Alterations

09/01/2021

JOB DESCRIPTION Plumber - Jobbing & Alterations

DISTRICT 8

ENTIRE COUNTIES

Dutchess, Putnam, Westchester

PARTIAL COUNTIES

Ulster: Entire county (including Wallkill and Shawangunk Prisons in Town of Shawangunk) EXCEPT for remainder of Town of Shawangunk, and Towns of Plattekill, Marlboro, and Wawarsing.

WAGES

Per hour:	07/01/2021
Journeyworker:	\$ 45.83

Repairs, replacements and alteration work is any repair or replacement of a present plumbing system that does not change existing roughing or water supply lines.

SHIFT WORK:

When directly specified in public agency or authority contract documents, shift work outside the regular hours of work shall be comprised of eight (8) hours per shift not including Saturday, Sundays and holidays. One half (1/2) hour shall be allowed for lunch after the first four (4) hours of each shift. Wage and Fringes for shift work shall be straight time plus a shift premium of twenty-five (25%) percent. A minimum of five days Monday through Friday must be worked to establish shift work.

SUPPLEMENTAL BENEFITS

Per hour:

Journeyworker	\$ 32.96
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OVERTIME PAY

See (B, *E, E2, Q, V) on OVERTIME PAGE

*When used as a make-up day, hours after 8 on Saturday shall be paid at time and one half.

HOLIDAY

Paid:	See (1) on HOLIDAY PAGE
Overtime:	See (5, 6, 8, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES

(1) year terms at the following wages:

1st year	\$ 19.88
2nd year	22.06
3rd year	23.90
4th year	33.57
5th year	35.46

Supplemental Benefits per hour:

1st year	\$ 10.74
2nd year	12.65
3rd year	16.58
4th year	22.39
5th year	24.32

Roofer

09/01/2021

JOB DESCRIPTION Roofer

DISTRICT 9

ENTIRE COUNTIES

Bronx, Dutchess, Kings, New York, Orange, Putnam, Queens, Richmond, Rockland, Sullivan, Ulster, Westchester

WAGES

Per Hour: 07/01/2021

Roofer/Waterproofer \$ 45.25
+ \$7.00*

* This portion is not subjected to overtime premiums.

Note: Abatement/Removal of Asbestos containing roofs and roofing material is classified as Roofer.

SUPPLEMENTAL BENEFITS

Per Hour: \$ 28.62

OVERTIME PAY

See (B, H) on OVERTIME PAGE

Note: An observed holiday that falls on a Sunday will be observed the following Monday.

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES

(1) year term

1st	2nd	3rd	4th
\$ 15.84	\$ 22.63	\$ 27.15	\$ 33.94
	+ 3.50*	+ 4.20*	+ 5.26*

Supplements:

1st	2nd	3rd	4th
\$ 3.72	\$ 14.47	\$ 17.30	\$ 21.55

9-8R

Sheetmetal Worker

09/01/2021

JOB DESCRIPTION Sheetmetal Worker

DISTRICT 8

ENTIRE COUNTIES

Dutchess, Orange, Putnam, Rockland, Sullivan, Ulster, Westchester

WAGES

07/01/2021
SheetMetal Worker \$ 44.15
+ 3.37*

*This portion is not subject to overtime premiums.

SHIFT WORK

For all NYS D.O.T. and other Governmental mandated off-shift work:

10% increase for additional shifts for a minimum of five (5) days

SUPPLEMENTAL BENEFITS

Journeyworker \$ 44.20

OVERTIME PAY

OVERTIME:.. See (B, E, Q,) on OVERTIME PAGE.

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6, 8, 15, 16, 23) on HOLIDAY PAGE

REGISTERED APPRENTICES

1st	2nd	3rd	4th	5th	6th	7th	8th
\$ 16.36	\$ 18.41	\$ 20.46	\$ 22.51	\$ 24.54	\$ 26.60	\$ 29.12	\$ 31.65
+ 1.35*	+ 1.52*	+ 1.69*	+ 1.85*	+ 2.02*	+ 2.19*	+ 2.36*	+ 2.53*

*This portion is not subject to overtime premiums.

Supplemental Benefits per hour:

Apprentices	
1st term	\$ 18.96
2nd term	21.34
3rd term	23.71
4th term	26.11
5th term	28.46
6th term	30.82
7th term	32.72
8th term	34.64

8-38

Sheetmetal Worker	09/01/2021
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JOB DESCRIPTION Sheetmetal Worker

DISTRICT 4

ENTIRE COUNTIES

Bronx, Kings, Nassau, New York, Queens, Richmond, Rockland, Suffolk, Westchester

WAGES

Per Hour:	07/01/2021	8/01/2021
Sign Erector	\$ 52.29	\$ 53.97

NOTE: Structurally Supported Overhead Highway Signs(See STRUCTURAL IRON WORKER CLASS)

SUPPLEMENTAL BENEFITS

Per Hour:	07/01/2021	8/01/2021
Sign Erector	\$ 51.26	\$ 53.15

OVERTIME PAY

See (A, F, S) on OVERTIME PAGE

HOLIDAY

Paid: See (5, 6, 10, 11, 12, 16, 25) on HOLIDAY PAGE
Overtime: See (5, 6, 10, 11, 12, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES

Per Hour:
6 month Terms at the following percentage of Sign Erectors wage rate:

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
35%	40%	45%	50%	55%	60%	65%	70%	75%	80%

SUPPLEMENTAL BENEFITS

Per Hour:										
07/01/2021										
1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	
\$ 14.34	\$ 16.26	\$ 18.17	\$ 20.10	\$ 28.02	\$ 30.47	\$ 33.72	\$ 36.27	\$ 38.77	\$ 41.29	
8/01/2021										
1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	
\$ TBD	\$ TBD	\$ TBD	\$ TBD	\$ TBD	\$ TBD	\$ TBD	\$ TBD	\$ TBD	\$ TBD	

4-137-SE

Sprinkler Fitter	09/01/2021
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JOB DESCRIPTION Sprinkler Fitter

DISTRICT 1

ENTIRE COUNTIES

Dutchess, Orange, Putnam, Rockland, Sullivan, Ulster, Westchester

WAGES

Per hour	07/01/2021
Sprinkler Fitter	\$ 47.19

SUPPLEMENTAL BENEFITS

Per hour	
Journey person	\$ 28.09

OVERTIME PAY

See (B, E, Q) on OVERTIME PAGE

HOLIDAY

Paid: See (1) on HOLIDAY PAGE

Overtime: See (5, 6) on HOLIDAY PAGE

Note: When a holiday falls on Sunday, the following Monday shall be considered a holiday and all work performed on either day shall be at the double time rate. When a holiday falls on Saturday, the preceding Friday shall be considered a holiday and all work performed on either day shall be at the double time rate.

REGISTERED APPRENTICES

Wages per hour

One Half Year terms at the following wage.

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
\$ 22.67	\$ 25.19	\$ 27.46	\$ 29.98	\$ 32.50	\$ 35.02	\$ 37.54	\$ 40.05	\$ 42.57	\$ 45.09

Supplemental Benefits per hour

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
\$ 8.27	\$ 8.27	\$ 19.22	\$ 19.22	\$ 19.47	\$ 19.47	\$ 19.47	\$ 19.47	\$ 19.47	\$ 19.47
									1-669.2

Teamster - Building / Heavy&Highway

09/01/2021

JOB DESCRIPTION Teamster - Building / Heavy&Highway

DISTRICT 8

ENTIRE COUNTIES

Putnam, Westchester

WAGES

GROUP A: Straight Trucks (6-wheeler and 10-wheeler), A-frame, Winch, Dynamite Seeding, Mulching, Agitator, Water, Attenuator, Light Towers, Cement (all types), Suburban, Station Wagons, Cars, Pick Ups, any vehicle carrying materials of any kind.

GROUP AA: Tack Coat

GROUP B: Tractor & Trailers (all types).

GROUP BB: Tri-Axle, 14 Wheeler

GROUP C: Low Boy (carrying equipment).

GROUP D: Fuel Trucks, Tire Trucks.

GROUP E: Off-road Equipment (over 40 tons): Athey Wagons, Belly Dumps, Articulated Dumps, Trailer Wagons.

GROUP F: Off-road Equipment (over 40 tons) Euclid, DJB.

GROUP G: Off-road Equipment (under 40 tons) Athey Wagons, Belly Articulated Dumps, Trailer Wagons.

GROUP H: Off-road Equipment (under 40 tons), Euclid.

GROUP HH: Off-road Equipment (under 40 tons) D.J.B.

GROUP I: Off-road Equipment (under 40 tons) Darts.

GROUP II: Off-road Equipment (under 40 tons) RXS.

WAGES:(per hour)

07/01/2021

GROUP A	\$ 42.47*
GROUP AA	45.27*
GROUP B	43.09*
GROUP BB	42.59*
GROUP C	45.22*
GROUP D	42.92*
GROUP E	43.47*
GROUP F	44.47*
GROUP G	43.22*
GROUP H	43.84*
GROUP HH	44.22*
GROUP I	43.97*
GROUP II	44.34*

* To calculate premium wage, subtract \$.20 from the hourly wage.

Note: Fuel truck operators on construction sites addit. \$5.00 per day.

For work on hazardous/toxic waste site addit. 20% of hourly rate.

Shift Differential: NYS DOT or other Governmental Agency contracts shall receive a shift differential of Fifteen(15%)percent above the wage rate

Four (4), ten (10) hour days may be worked at straight time during a week, Monday thru Thursday.

NOTE - In order to use the '4 Day/10 Hour Work schedule', as your normal schedule, you must submit an 'Employer Registration for Use of 4 Day/10 Hour Work Schedule,' form PW30.1; and there must be a dispensation of hours in place on the project. If the PW30.1 is not submitted you may be liable for overtime payments for work over 8 hours per day.

SUPPLEMENTAL BENEFITS

Per hour:

Journeyworker

First 40 hours	\$ 33.64
41st-45th hours	15.18
Over 45 hours	0.26

OVERTIME PAY

See (B, E, P, R) on OVERTIME PAGE

HOLIDAY

Paid: See (5, 6, 8, 9, 15, 25) on HOLIDAY PAGE

Overtime: See (5, 6, 8, 9, 15, 25) on HOLIDAY PAGE

8-456

Welder

09/01/2021

JOB DESCRIPTION Welder

DISTRICT 1

ENTIRE COUNTIES

Albany, Allegany, Bronx, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Delaware, Dutchess, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Kings, Lewis, Livingston, Madison, Monroe, Montgomery, Nassau, New York, Niagara, Oneida, Onondaga, Ontario, Orange, Orleans, Oswego, Otsego, Putnam, Queens, Rensselaer, Richmond, Rockland, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Suffolk, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Wayne, Westchester, Wyoming, Yates

WAGES

Per hour 07/01/2021

Welder: To be paid the same rate of the mechanic performing the work.*

*EXCEPTION: If a specific welder certification is required, then the 'Certified Welder' rate in that trade tag will be paid.

OVERTIME PAY

HOLIDAY

1-As Per Trade

Overtime Codes

Following is an explanation of the code(s) listed in the OVERTIME section of each classification contained in the attached schedule. Additional requirements may also be listed in the HOLIDAY section.

NOTE: Supplemental Benefits are 'Per hour worked' (for each hour worked) unless otherwise noted

- (AA) Time and one half of the hourly rate after 7 and one half hours per day
- (A) Time and one half of the hourly rate after 7 hours per day
- (B) Time and one half of the hourly rate after 8 hours per day
- (B1) Time and one half of the hourly rate for the 9th & 10th hours week days and the 1st 8 hours on Saturday.
Double the hourly rate for all additional hours
- (B2) Time and one half of the hourly rate after 40 hours per week
- (C) Double the hourly rate after 7 hours per day
- (C1) Double the hourly rate after 7 and one half hours per day
- (D) Double the hourly rate after 8 hours per day
- (D1) Double the hourly rate after 9 hours per day
- (E) Time and one half of the hourly rate on Saturday
- (E1) Time and one half 1st 4 hours on Saturday; Double the hourly rate all additional Saturday hours
- (E2) Saturday may be used as a make-up day at straight time when a day is lost during that week due to inclement weather
- (E3) Between November 1st and March 3rd Saturday may be used as a make-up day at straight time when a day is lost during that week due to inclement weather, provided a given employee has worked between 16 and 32 hours that week
- (E4) Saturday and Sunday may be used as a make-up day at straight time when a day is lost during that week due to inclement weather
- (E5) Double time after 8 hours on Saturdays
- (F) Time and one half of the hourly rate on Saturday and Sunday
- (G) Time and one half of the hourly rate on Saturday and Holidays
- (H) Time and one half of the hourly rate on Saturday, Sunday, and Holidays
- (I) Time and one half of the hourly rate on Sunday
- (J) Time and one half of the hourly rate on Sunday and Holidays
- (K) Time and one half of the hourly rate on Holidays
- (L) Double the hourly rate on Saturday
- (M) Double the hourly rate on Saturday and Sunday
- (N) Double the hourly rate on Saturday and Holidays
- (O) Double the hourly rate on Saturday, Sunday, and Holidays
- (P) Double the hourly rate on Sunday
- (Q) Double the hourly rate on Sunday and Holidays
- (R) Double the hourly rate on Holidays
- (S) Two and one half times the hourly rate for Holidays

- (S1) Two and one half times the hourly rate the first 8 hours on Sunday or Holidays One and one half times the hourly rate all additional hours.
- (T) Triple the hourly rate for Holidays
- (U) Four times the hourly rate for Holidays
- (V) Including benefits at SAME PREMIUM as shown for overtime
- (W) Time and one half for benefits on all overtime hours.
- (X) Benefits payable on Paid Holiday at straight time. If worked, additional benefit amount will be required for worked hours. (Refer to other codes listed.)

Holiday Codes

PAID Holidays:

Paid Holidays are days for which an eligible employee receives a regular day's pay, but is not required to perform work. If an employee works on a day listed as a paid holiday, this remuneration is in addition to payment of the required prevailing rate for the work actually performed.

OVERTIME Holiday Pay:

Overtime holiday pay is the premium pay that is required for work performed on specified holidays. It is only required where the employee actually performs work on such holidays. The applicable holidays are listed under HOLIDAYS: OVERTIME. The required rate of pay for these covered holidays can be found in the OVERTIME PAY section listings for each classification.

Following is an explanation of the code(s) listed in the HOLIDAY section of each classification contained in the attached schedule. The Holidays as listed below are to be paid at the wage rates at which the employee is normally classified.

- (1) None
- (2) Labor Day
- (3) Memorial Day and Labor Day
- (4) Memorial Day and July 4th
- (5) Memorial Day, July 4th, and Labor Day
- (6) New Year's, Thanksgiving, and Christmas
- (7) Lincoln's Birthday, Washington's Birthday, and Veterans Day
- (8) Good Friday
- (9) Lincoln's Birthday
- (10) Washington's Birthday
- (11) Columbus Day
- (12) Election Day
- (13) Presidential Election Day
- (14) 1/2 Day on Presidential Election Day
- (15) Veterans Day
- (16) Day after Thanksgiving
- (17) July 4th
- (18) 1/2 Day before Christmas
- (19) 1/2 Day before New Years
- (20) Thanksgiving
- (21) New Year's Day
- (22) Christmas
- (23) Day before Christmas
- (24) Day before New Year's
- (25) Presidents' Day
- (26) Martin Luther King, Jr. Day
- (27) Memorial Day
- (28) Easter Sunday

(29) Juneteenth



New York State Department of Labor - Bureau of Public Work
State Office Building Campus
Building 12 - Room 130
Albany, New York 12240

REQUEST FOR WAGE AND SUPPLEMENT INFORMATION

As Required by Articles 8 and 9 of the NYS Labor Law

Fax (518) 485-1870 or mail this form for new schedules or for determination for additional occupations.

This Form Must Be Typed

Submitted By:

(Check Only One)

☐

Contracting Agency

☐

Architect or Engineering Firm

☐

Public Work District Office

Date:

A. Public Work Contract to be let by: (Enter Data Pertaining to Contracting/Public Agency)

1. Name and complete address ☐ (Check if new or change)

Telephone: ()

Fax: ()

E-Mail:

2. NY State Units (see Item 5)

☐ 01 DOT

☐ 02 OGS

☐ 03 Dormitory Authority

☐ 04 State University
Construction Fund

☐ 05 Mental Hygiene
Facilities Corp.

☐ 06 OTHER N.Y. STATE UNIT

☐ 07 City

☐ 08 Local School District

☐ 09 Special Local District, i.e.,
Fire, Sewer, Water District

☐ 10 Village

☐ 11 Town

☐ 12 County

☐ 13 Other Non-N.Y. State
(Describe)

3. SEND REPLY TO ☐ (check if new or change)
Name and complete address:

Telephone:()

Fax: ()

E-Mail:

4. SERVICE REQUIRED. Check appropriate box and provide project information.

☐ New Schedule of Wages and Supplements.

APPROXIMATE BID DATE :

☐ Additional Occupation and/or Redetermination

PRC NUMBER ISSUED PREVIOUSLY FOR
THIS PROJECT :

OFFICE USE ONLY

B. PROJECT PARTICULARS

5. Project Title _____

Description of Work _____

Contract Identification Number _____

Note: For NYS units, the OSC Contract No. _____

6. Location of Project:
Location on Site _____

Route No/Street Address _____

Village or City _____

Town _____

County _____

7. Nature of Project - Check One:

- ☐ 1. New Building
☐ 2. Addition to Existing Structure
☐ 3. Heavy and Highway Construction (New and Repair)
☐ 4. New Sewer or Waterline
☐ 5. Other New Construction (Explain)
☐ 6. Other Reconstruction, Maintenance, Repair or Alteration
☐ 7. Demolition
☐ 8. Building Service Contract

8. OCCUPATION FOR PROJECT :

- ☐ Construction (Building, Heavy
Highway/Sewer/Water)
☐ Tunnel
☐ Residential
☐ Landscape Maintenance
☐ Elevator maintenance
☐ Exterminators, Fumigators
☐ Fire Safety Director, NYC Only
- ☐ Guards, Watchmen
☐ Janitors, Porters, Cleaners,
Elevator Operators
☐ Moving furniture and
equipment
☐ Trash and refuse removal
☐ Window cleaners
☐ Other (Describe)

9. Has this project been reviewed for compliance with the Wicks Law involving separate bidding?

YES ☐ NO ☐

10. Name and Title of Requester

Signature



NEW YORK STATE DEPARTMENT OF LABOR
Bureau of Public Work - Debarment List

**LIST OF EMPLOYERS INELIGIBLE TO BID ON OR BE
AWARDED ANY PUBLIC WORK CONTRACT**

Under Article 8 and Article 9 of the NYS Labor Law, a contractor, sub-contractor and/or its successor shall be debarred and ineligible to submit a bid on or be awarded any public work or public building service contract/sub-contract with the state, any municipal corporation or public body for a period of five (5) years from the date of debarment when:

- Two (2) final determinations have been rendered within any consecutive six-year (6) period determining that such contractor, sub-contractor and/or its successor has WILLFULLY failed to pay the prevailing wage and/or supplements;
- One (1) final determination involves falsification of payroll records or the kickback of wages and/or supplements.

The agency issuing the determination and providing the information, is denoted under the heading 'Fiscal Officer'. DOL = New York State Department of Labor; NYC = New York City Comptroller's Office; AG = New York State Attorney General's Office; DA = County District Attorney's Office.

Debarment Database: To search for contractors, sub-contractors and/or their successors debarred from bidding or being awarded any public work contract or subcontract under NYS Labor Law Articles 8 and 9, or under NYS Workers' Compensation Law Section 141-b, access the database at this link: <https://applications.labor.ny.gov/EDList/searchPage.do>

For inquiries where WCB is listed as the "Agency", please call 1-866-546-9322

NYSDOL Bureau of Public Work Debarment List 08/27/2021

Article 8

AGENCY	Fiscal Officer	FEIN	EMPLOYER NAME	EMPLOYER DBA NAME	ADDRESS	DEBARMENT START DATE	DEBARMENT END DATE
DOL	NYC	*****9839	A.J.S. PROJECT MANAGEMENT, INC.		149 FIFTH AVENUE NEW YORK NY 10010	12/29/2016	12/29/2021
DOL	DOL	*****4018	ADIRONDACK BUILDING RESTORATION INC.		4156 WILSON ROAD EAST TABERG NY 13471	03/26/2019	03/26/2024
DOL	AG	*****1812	ADVANCED BUILDERS & LAND DEVELOPMENT, INC.		400 OSER AVE #2300HAUPPAUGE NY 11788	09/11/2019	09/11/2024
DOL	DOL	*****1687	ADVANCED SAFETY SPRINKLER INC		261 MILL ROAD P.O BOX 296EAST AURORA NY 14052	05/29/2019	05/29/2024
DOL	NYC	*****6775	ADVENTURE MASONRY CORP.		1535 RICHMOND AVENUE STATEN ISLAND NY 10314	12/13/2017	12/13/2022
DOL	NYC		AGOSTINHO TOME		405 BARRETTO ST BRONX NY 10474	05/31/2018	05/31/2023
DOL	NYC		AMJAD NAZIR		2366 61ST ST BROOKLYN NY 11204	12/15/2016	12/15/2021
DOL	NYC		AMJED PARVEZ		401 HANOVER AVENUE STATEN ISLAND NY 10304	01/11/2021	01/11/2026
DOL	DOL		ANGELO F COKER		2610 SOUTH SALINA STREET SUITE 14SYRACUSE NY 13205	09/17/2020	09/17/2025
DOL	DOL		ANGELO F COKER		2610 SOUTH SALINA STREET SUITE 14SYRACUSE NY 13205	12/04/2018	12/04/2023
DOL	DOL		ANITA SALERNO		158 SOLAR ST SYRACUSE NY 13204	01/07/2019	01/07/2024
DOL	NYC		ANTHONY J SCLAFANI		149 FIFTH AVE NEW YORK NY 10010	12/29/2016	12/29/2021
DOL	DOL		ANTHONY PERGOLA		3 WEST MAIN ST/SUITE 208 ELMSFORD NY 10323	01/23/2017	01/23/2022
DOL	DOL		ANTONIO ESTIVEZ		442 ARMONK RD MOUNT KISCO NY 10549	06/12/2018	06/12/2023
DOL	DOL		ARNOLD A. PAOLINI		1250 BROADWAY ST BUFFALO NY 14212	02/03/2020	02/03/2025
DOL	NYC		ARSHAD MEHMOOD		168-42 88TH AVENUE JAMAICA NY 11432	11/20/2019	11/20/2024
DOL	DOL		ARVINDER ATWAL		65 KENNETH PLACE NEW HYDE PARK NY 11040	07/19/2017	07/19/2022
DOL	NYC	*****6683	ATLAS RESTORATION CORP.		35-12 19TH AVENUE ASTORIA NY 11105	08/02/2017	08/02/2022
DOL	NYC	*****5532	ATWAL MECHANICALS, INC		65 KENNETH PLACE NEW HYDE PARK NY 11040	07/19/2017	07/19/2022
DOL	NYC	*****2591	AVI 212 INC.		260 CROPSEY AVENUE APT 11GBROOKLYN NY 11214	10/30/2018	10/30/2023
DOL	NYC		AZIDABEGUM		524 MCDONALD AVENUE BROOKLYN NY 11218	09/17/2020	09/17/2025
DOL	NYC		BALWINDER SINGH		421 HUDSON ST SUITE C5NEW YORK NY 10014	02/20/2019	02/20/2024
DOL	NYC	*****8416	BEAM CONSTRUCTION, INC.		50 MAIN ST WHITE PLAINS NY 10606	01/04/2019	01/04/2024
DOL	NYC	*****2113	BHW CONTRACTING, INC.		401 HANOVER AVENUE STATEN ISLAND NY 10304	01/11/2021	01/11/2026
DOL	DOL		BIAGIO CANTISANI			06/12/2018	06/12/2023
DOL	DOL	*****4512	BOB BRUNO EXCAVATING, INC		5 MORNINGSIDE DR AUBURN NY 13021	05/28/2019	05/28/2024
DOL	DOL		BOGDAN MARKOVSKI		370 W. PLEASANTVIEW AVE SUITE 2.329HACKENSACK NJ 07601	02/11/2019	02/11/2024
DOL	DOL		BRADLEY J SCHUKA		4 BROTHERS ROAD WAPPINGERS FALLS NY 12590	10/20/2020	10/20/2025
DOL	DOL	*****1449	BRRESTORATION NY INC		140 ARCADIA AVENUE OSWEGO NY 13126	09/12/2016	09/12/2021
DOL	DOL		BRUCE P. NASH JR.		5841 BUTTERNUT ROAD EAST SYRACUSE NY 13057	09/12/2018	09/12/2023
DOL	DOL	*****0225	C&D LAFACE CONSTRUCTION, INC.		8531 OSWEGO RD BALDWINVILLE NY 13027	02/03/2020	01/09/2023
DOL	DOL	*****8809	C.B.E. CONTRACTING CORPORATION		310 MCGUINNESS BLVD GREENPOINT NY 11222	03/07/2017	03/07/2022
DOL	DOL	*****9383	C.C. PAVING AND EXCAVATING, INC.		2610 SOUTH SALINA ST SUITE 12SYRACUSE NY 13205	09/17/2020	09/17/2025
DOL	DOL	*****9383	C.C. PAVING AND EXCAVATING, INC.		2610 SOUTH SALINA ST SUITE 12SYRACUSE NY 13205	12/04/2018	12/04/2023
DOL	DOL	*****5161	CALADRI DEVELOPMENT CORP.		1223 PARK ST. PEFKSKILL NY 10566	05/17/2021	05/17/2026

NYSDOL Bureau of Public Work Debarment List 08/27/2021

Article 8

DOL	DOL	*****3391	CALI ENTERPRISES, INC.		1223 PARK STREET PEEKSKILL NY 10566	05/17/2021	05/17/2026
DOL	NYC		CALVIN WALTERS		465 EAST THIRD ST MT. VERNON NY 10550	09/09/2019	09/09/2024
DOL	DOL		CANTISANI & ASSOCIATES LTD		442 ARMONK RD MOUNT KISCO NY 10549	06/12/2018	06/12/2023
DOL	DOL		CANTISANI HOLDING LLC			06/12/2018	06/12/2023
DOL	DOL		CARMEN RACHETTA		8531 OSWEGO RD BALDWINVILLE NY 13027	02/03/2020	02/03/2025
DOL	DOL		CARMENA RACHETTA		8531 OSWEGO ROAD BALDWINVILLE NY 13027	02/03/2020	01/09/2023
DOL	DOL	*****3812	CARMODY "2" INC			06/12/2018	06/12/2023
DOL	DOL	*****1143	CARMODY BUILDING CORP	CARMODY CONTRACTIN G AND CARMODY CONTRACTIN G CORP.	442 ARMONK RD MOUNT KISCO NY 10549	06/12/2018	06/12/2023
DOL	DOL		CARMODY CONCRETE CORPORATION			06/12/2018	06/12/2023
DOL	DOL		CARMODY ENTERPRISES, LTD.		442 ARMONK RD MOUNT KISCO NY 10549	06/12/2018	06/12/2023
DOL	DOL		CARMODY INC		442 ARMONK RD MOUNT KISCO NY 10549	06/12/2018	06/12/2023
DOL	DOL	*****3812	CARMODY INDUSTRIES INC			06/12/2018	06/12/2023
DOL	DOL		CARMODY MAINTENANCE CORPORATION		442 ARMONK RD MOUNT KISCO NY 10549	06/12/2018	06/12/2023
DOL	DOL		CARMODY MASONRY CORP		442 ARMONK RD MOUNT KISCO NY 10549	06/12/2018	06/12/2023
DOL	DOL	*****8809	CBE CONTRACTING CORP		142 EAST MARKET STREET LONG BEACH NY 11561	03/07/2017	03/07/2022
DOL	AG		CESAR J. AGUDELO		81-06 34TH AVENUE APT. 6E JACSON HEIGHTS NY 11372	02/07/2018	02/07/2023
DOL	DOL	*****0026	CHANTICLEER CONSTRUCTION LLC		4 BROTHERS ROAD WAPPINGERS FALLS NY 12590	10/20/2020	10/20/2025
DOL	DOL		CHRISTOPHER GRECO		26 NORTH MYRTLE AVENUE SPRING VALLEY NY 10956	02/18/2021	02/18/2026
DOL	DOL		CHRISTOPHER J MAINI		19 CAITLIN AVE JAMESTOWN NY 14701	09/17/2018	09/17/2023
DOL	DOL		CHRISTOPHER PAPASTEFANOU A/K/A CHRIS PAPASTEFANOU		1445 COMMERCE AVE BRONX NY 10461	05/30/2019	05/30/2024
DOL	DOL	*****1927	CONSTRUCTION PARTS WAREHOUSE, INC.	CPW	5841 BUTTERNUT ROAD EAST SYRACUSE NY 13057	09/12/2018	09/12/2023
DOL	DOL	*****3228	CROSS-COUNTY LANDSCAPING AND TREE SERVICE, INC.	ROCKLAND TREE SERVICE	26 NORTH MYRTLE AVENUE SPRING VALLEY NY 10956	02/18/2021	02/18/2026
DOL	DOL	*****2524	CSI ELECTRICAL & MECHANICAL INC		42-32 235TH ST DOUGLSTON NY 11363	01/14/2019	01/14/2024
DOL	NYC		DALJIT KAUR BOPARAI		185-06 56TH AVE FRESH MEADOW NY 11365	10/17/2017	10/17/2022
DOL	DOL		DANICA IVANOSKI		61 WILLETT ST. PASSAIC NJ 07503	10/26/2016	10/26/2021
DOL	DOL		DARIAN L COKER		2610 SOUTH SALINA ST SUITE 2CSYRACUSE NY 13205	09/17/2020	09/17/2025
DOL	DOL		DARIAN L COKER		2610 SOUTH SALINA ST SUITE 2CSYRACUSE NY 13205	12/04/2018	12/04/2023
DOL	NYC		DAVID WEINER		14 NEW DROP LANE 2ND FLOORSTATEN ISLAND NY 10306	11/14/2019	11/14/2024
DOL	DOL		DEBBIE STURDEVANT		29 MAPLEWOOD DRIVE BINGHAMTON NY 13901	02/21/2017	02/21/2022
DOL	AG		DEBRA MARTINEZ		31 BAY ST BROOKLYN NY 11231	03/28/2018	03/28/2023
DOL	DOL		DELPHI PAINTING & DECORATING CO INC		1445 COMMERCE AVE BRONX NY 10461	05/30/2019	05/30/2024
DOL	DOL		DF CONTRACTORS OF ROCHESTER, INC.		1835 DAANSEN RD. PALMYRA NY 14522	05/16/2017	05/16/2022
DOL	DOL		DF CONTRACTORS, INC.		1835 DAANSEN RD. PALMYRA NY 14522	05/16/2017	05/16/2022
DOL	NYC		DIMITRIOS TSOMAS		35-12 19TH AVENUE	08/02/2017	08/02/2022

NYSDOL Bureau of Public Work Debarment List 08/27/2021

Article 8

DOL	DOL		DOMENICO LAFACE		8531 OSWEGO RD BALDWINVILLE NY 13027	02/03/2020	01/09/2023
DOL	DOL	*****3242	DONALD R. FORSAY	DF LAWN SERVICE	1835 DAANSEN RD. PALMYRA NY 14522	05/16/2017	05/16/2022
DOL	DOL		DONALD R. FORSAY		1835 DAANSEN RD. PALMYRA NY 14522	05/16/2017	05/16/2022
DOL	NYC		DUARTE LOPES		66-05 WOODHAVEN BLVD. STE 2 REGO PARK NY 11374	04/20/2017	04/20/2022
DOL	DOL	*****5175	EAGLE MECHANICAL AND GENERAL CONSTRUCTION LLC		11371 RIDGE RD WOLCOTT NY 14590	02/03/2020	02/03/2025
DOL	DOL		EAST COAST PAVING		2238 BAKER RD GILLET PA 16923	03/12/2018	03/12/2023
DOL	NYC	*****4269	EAST PORT EXCAVATION & UTILITIES		601 PORTION RD RONKONKOMA NY 11779	11/18/2016	11/18/2021
DOL	DOL	*****0780	EMES HEATING & PLUMBING CONTR		5 EMES LANE MONSEY NY 10952	01/20/2002	01/20/3002
DOL	NYC	*****5917	EPOCH ELECTRICAL, INC		97-18 50TH AVE CORONA NY 11368	04/19/2018	04/19/2024
DOL	DOL	*****7403	F & B PAINTING CONTRACTING INC		2 PARKVIEW AVENUE HARRISON NY 10604	09/26/2016	09/26/2021
DOL	DOL		FAIGY LOWINGER		11 MOUNTAIN RD 28 VAN BUREN DR MONROE NY 10950	03/20/2019	03/20/2024
DOL	DOL		FRANK BENEDETTO		19 CATLIN AVE JAMESTOWN NY 14701	09/17/2018	09/17/2023
DOL	DOL		FRANK BENEDETTO		C/O F & B PAINTING CONTRA 2 PARKVIEW AVENUE HARRISON NY 10604	09/26/2016	09/26/2021
DOL	DOL	*****4722	FRANK BENEDETTO AND CHRISTOPHER J MAINI	B & M CONCRETE	19 CAITLIN AVE JAMESTOWN NY 14701	09/17/2018	09/17/2023
DOL	NYC		FRANK MAINI		1766 FRONT ST YORKTOWN HEIGHTS NY 10598	01/17/2018	01/17/2023
DOL	NYC	*****6616	G & G MECHANICAL ENTERPRISES, LLC.		1936 HEMPSTEAD TURNPIKE EAST MEDOW NY 11554	11/29/2019	11/29/2024
DOL	DOL		GABRIEL FRASSETTI			04/10/2019	04/10/2024
DOL	DOL		GEOFF CORLETT		415 FLAGGER AVE #302 STUART FL 34994	10/31/2018	10/31/2023
DOL	DA		GEORGE LUCEY		150 KINGS STREET BROOKLYN NY 11231	01/19/1998	01/19/2998
DOL	DOL		GIGI SCHNECKENBURGER		261 MILL RD EAST AURORA NY 14052	05/29/2019	05/29/2024
DOL	DOL		GIOVANNI LAFACE		8531 OSWEGO RD BALDWINVILLE NY 13027	02/03/2020	01/09/2023
DOL	NYC	*****3164	GLOBE GATES INC	GLOBAL OVERHEAD DOORS	405 BARRETTO ST BRONX NY 10474	05/31/2018	05/31/2023
DOL	NYC		GREAT ESTATE CONSTRUCTION, INC.		327 STAGG ST BROOKLYN NY 11206	10/10/2017	10/10/2022
DOL	DOL		GREGORY S. OLSON		P.O BOX 100 200 LATTA BROOK PARKHORSEHEADS NY 14845	03/08/2018	03/08/2023
DOL	DOL		HANS RATH		24 ELDOR AVENUE NEW CITY NY 10956	02/03/2020	02/03/2025
DOL	NYC	*****3228	HEIGHTS ELEVATOR CORP.		1766 FRONT ST YORKTOWN HEIGHTS NY 10598	01/17/2018	01/17/2023
DOL	DOL	*****5131	INTEGRITY MASONRY, INC.	M&R CONCRETE	722 8TH AVE WATERVLIT NY 12189	06/05/2018	06/05/2023
DOL	DOL		IRENE KASELIS		32 PENNINGTON AVE WALDWICK NJ 07463	05/30/2019	05/30/2024
DOL	DOL	*****9211	J. WASE CONSTRUCTION CORP.		8545 RT 9W ATHENS NY 12015	03/09/2021	03/09/2026
DOL	DOL		J.A. HIRES CADWALLADER		P.O BOX 100 200 LATTA BROOK PARKHORSEHEADS NY 14845	03/08/2018	03/08/2023
DOL	DOL		JAMES C. DELGIACCO		722 8TH AVE WATERVLIT NY 12189	06/05/2018	06/05/2023
DOL	DOL		JAMES LIACONE		9365 WASHINGTON ST LOCKPORT IL 60441	07/23/2018	07/23/2023
DOL	DOL		JAMES RACHEL		9365 WASHINGTON ST LOCKPORT IL 60441	07/23/2018	07/23/2023
DOL	DOL	*****5368	JCH MASONRY &		35 CLINTON AVE	09/12/2018	09/12/2023

NYSDOL Bureau of Public Work Debarment List 08/27/2021

Article 8

DOL	NYC		JENNIFER GUERRERO		1936 HEMPSTEAD TURNPIKE EAST MEADOW NY 11554	11/29/2019	11/29/2024
DOL	DOL		JESSICA WHITESIDE		C/O BRRESTORATION NY INC 140 ARCADIA AVENUEOSWEGO NY 13126	09/12/2016	09/12/2021
DOL	AG		JOHN ANTHONY MASSINO		36-49 204TH STREET BAYSIDE NY 11372	02/07/2018	02/07/2023
DOL	DOL		JOHN F. CADWALLADER		200 LATTA BROOK PARK HORSEHEADS NY 14845	03/08/2018	03/08/2023
DOL	DOL	*****4612	JOHN F. CADWALLADER, INC.	THE GLASS COMPANY	P.O BOX 100 200 LATTA BROOK PARKHORSEHEADS NY 14845	03/08/2018	03/08/2023
DOL	DOL		JOHN GOCEK		14B COMMERCIAL AVE ALBANY NY 12065	11/14/2019	11/14/2024
DOL	DOL		JOHN WASE		8545 RT 9W ATHENS NY 12015	03/09/2021	03/09/2026
DOL	AG	*****0600	JOHNCO CONTRACTING, INC.		36-49 204TH STREET BAYSIDE NY 11372	02/07/2018	02/07/2023
DOL	DOL		JON E DEYOUNG		261 MILL RD P.O BOX 296EAST AURORA NY 14052	05/29/2019	05/29/2024
DOL	DOL		JORI PEDERSEN		415 FLAGER AVE #302STUART FL 34994	10/31/2018	10/31/2023
DOL	DOL		JOSE CHUCHUCA		35 CLINTON AVE OSSINING NY 10562	09/12/2018	09/12/2023
DOL	NYC		JOSEPH FOLEY		66-05 WOODHAVEN BLVD. STE 2REGO PARK NY 11374	04/20/2017	04/20/2022
DOL	NYC		JOSEPH MARTINO		1535 RICHMOND AVENUE STATEN ISLAND NY 10314	12/13/2017	12/13/2022
DOL	DOL		JOY MARTIN		2404 DELAWARE AVE NIGARA FALLS NY 14305	09/12/2018	09/12/2023
DOL	DOL		JULIUS AND GITA BEHREND		5 EMES LANE MONSEY NY 10952	11/20/2002	11/20/3002
DOL	DOL	*****5062	K R F SITE DEVELOPMENT INC		375 LAKE SHORE DRIVE PUTNAM VALLEY NY 10579	01/23/2017	01/23/2022
DOL	NYC		K.S. CONTRACTING CORP.		29 PHILLIP DRIVE PARSIPPANY NJ 07054	02/13/2017	02/13/2022
DOL	DOL		KARIN MANGIN		796 PHELPS ROAD FRANKLIN LAKES NJ 07417	12/01/2020	12/01/2025
DOL	DOL		KATE E. CONNOR		7088 INTERSTATE ISLAND RD SYRACUSE NY 13209	03/31/2021	03/31/2026
DOL	DOL		KATIE BURDICK		2238 BAKER RD GILLETT PA 16923	03/12/2018	03/12/2023
DOL	DOL	*****2959	KELC DEVELOPMENT, INC		7088 INTERSTATE ISLAND RD SYRACUSE NY 13209	03/31/2021	03/31/2026
DOL	DOL		KENNETH FIORENTINO		375 LAKE SHORE DRIVE PUTNAM VALLEY NY 10579	01/23/2017	01/23/2022
DOL	DOL	*****3490	L & M CONSTRUCTION/DRYWALL INC.		1079 YONKERS AVE YONKERS NY 10704	08/07/2018	08/07/2023
DOL	DA	*****8816	LAKE CONSTRUCTION AND DEVELOPMENT CORPORATION		150 KINGS STREET BROOKLYN NY 11231	08/19/1998	08/19/2998
DOL	DOL	*****4505	LARAPINTA ASSOCIATES INC		29 MAPLEWOOD DRIVE BINGHAMTON NY 13901	02/21/2017	02/21/2022
DOL	DOL		LAVERN GLAVE		161 ROBYN RD MONROE NY 10950	01/30/2018	01/30/2023
DOL	DOL	*****4388	LEN.J CONSTRUCTION, LLC		PO BOX 10007 ALBANY NY 12201	06/24/2016	09/19/2022
DOL	DOL	*****4388	LEN.J CONSTRUCTION, LLC		PO BOX 10007 ALBANY NY 12201	06/24/2016	09/19/2022
DOL	DOL	*****4388	LEN.J CONSTRUCTION, LLC		PO BOX 10007 ALBANY NY 12201	09/19/2017	09/19/2022
DOL	DOL	*****4388	LEN.J CONSTRUCTION, LLC		PO BOX 10007 ALBANY NY 12201	09/19/2017	09/19/2022
DOL	DOL	*****4388	LEN.J CONSTRUCTION, LLC		PO BOX 10007 ALBANY NY 12201	01/17/2017	09/19/2022
DOL	DOL	*****4388	LEN.J CONSTRUCTION, LLC		PO BOX 10007 ALBANY NY 12201	09/19/2017	09/19/2022
DOL	DOL	*****4388	LEN.J CONSTRUCTION, LLC		PO BOX 10007 ALBANY NY 12201	09/19/2017	09/19/2022
DOL	DOL	*****4388	LEN.J CONSTRUCTION, LLC		PO BOX 10007 ALBANY NY 12201	08/14/2017	09/19/2022
DOL	DOL		LEROY NELSON JR		PO BOX 10007 ALBANY NY 12201	09/19/2017	09/19/2022

NYSDOL Bureau of Public Work Debarment List 08/27/2021

Article 8

DOL	DOL		LEROY NELSON JR		PO BOX 10007 ALBANY NY 12201	09/19/2017	09/19/2022
DOL	DOL		LEROY NELSON JR		PO BOX 10007 ALBANY NY 12201	09/19/2017	09/19/2022
DOL	DOL		LEROY NELSON JR		PO BOX 10007 ALBANY NY 12201	09/19/2017	09/19/2022
DOL	DOL		LEROY NELSON JR		PO BOX 10007 ALBANY NY 12201	08/14/2017	08/14/2022
DOL	DOL		LEROY NELSON JR		PO BOX 10007 ALBANY NY 12201	01/17/2017	09/19/2022
DOL	DA	*****4460	LONG ISLAND GLASS & STOREFRONTS, LLC		4 MANHASSET TRL RIDGE NY 11961	09/06/2018	09/06/2023
DOL	AG	*****4216	LOTUS-C CORP.		81-06 34TH AVENUE APT. 6EJACKSON HEIGHTS NY 11372	02/07/2018	02/07/2023
DOL	DOL		LOUIS A. CALICCHIA		1223 PARK ST. PEEKSKILL NY 10566	05/17/2021	05/17/2026
DOL	NYC		LUBOMIR PETER SVOBODA		27 HOUSMAN AVE STATEN ISLAND NY 10303	12/26/2019	12/26/2024
DOL	NYC		M & L STEEL & ORNAMENTAL IRON CORP.		27 HOUSMAN AVE STATEN ISLAND NY 10303	12/26/2019	12/26/2024
DOL	DOL		M ANVER BEIG		142 EAST MARKET STREET LONG BEACH NY 11561	03/07/2017	03/07/2022
DOL	DOL		M. ANVER BEIG		142 EAST MARKET STREET LONG BEACH NY 11561	03/07/2017	03/07/2022
DOL	DOL	*****1784	MADISON AVE CONSTRUCTION CORP		39 PENNY STREET WEST ISLIP NY 11795	11/02/2016	11/02/2021
DOL	DOL	*****2196	MAINSTREAM SPECIALTIES, INC.		11 OLD TOWN RD SELKIRK NY 12158	02/02/2021	02/02/2026
DOL	DA		MANUEL P TOBIO		150 KINGS STREET BROOKLYN NY 14444	08/19/1998	08/19/2998
DOL	DA		MANUEL TOBIO		150 KINGS STREET BROOKLYN NY 11231	08/19/1998	08/19/2998
DOL	NYC		MAREK FABIJANOWSKI		50 MAIN ST WHITE PLAINS NY 10606	01/04/2019	01/04/2024
DOL	NYC		MARTINE ALTER		1010 NORTHERN BLVD. GREAT NECK NY 11021	03/09/2017	03/09/2022
DOL	DOL		MARVIN A STURDEVANT		29 MAPLEWOOD DRIVE BINGHAMTON NY 13901	02/21/2017	02/21/2022
DOL	DOL		MASONRY CONSTRUCTION, INC.		442 ARMONK RD MOUNT KISCO NY 10549	06/12/2018	06/12/2023
DOL	DOL	*****3333	MASONRY INDUSTRIES, INC.		442 ARMONK RD MOUNT KISCO NY 10549	06/12/2018	06/12/2023
DOL	NYC		MATINA KARAGIANNIS		97-18 50TH AVE CORONA NY 11368	04/19/2018	04/19/2023
DOL	DOL		MATTHEW P. KILGORE		4156 WILSON ROAD EAST TABERG NY 13471	03/26/2019	03/26/2024
DOL	DOL		MAURICE GAWENO		442 ARMONK RD MOUNT KISCO NY 10549	06/12/2018	06/12/2023
DOL	DOL		MCLEAN "MIKKI BEANE"		1229 JAMES STREET SYRACUSE NY 13203	05/02/2017	05/02/2022
DOL	DOL		MCLEAN "MIKKI" DRAKE		1229 JAMES STREET SYRACUSE NY 13203	05/02/2017	05/02/2022
DOL	DOL		MCLEAN M DRAKE-BEANE		1229 JAMES STREET SYRACUSE NY 13203	05/02/2017	05/02/2022
DOL	DOL	*****9445	MCLEAN M WALSH	ELITE PROFESSION AL PAINTING OF CNY	1229 JAMES STREET SYRACUSE NY 13203	05/02/2017	05/02/2022
DOL	DOL	*****9445	MCLEAN M WALSH	ELITE PROFESSION AL PAINTING OF CNY	1229 JAMES STREET SYRACUSE NY 13203	05/02/2017	05/02/2022
DOL	DOL		MICHAEL LENIHAN		1079 YONKERS AVE UNIT 4YONKERS NY 10704	08/07/2018	08/07/2023
DOL	AG		MICHAEL RIGLIETTI		31 BAY ST BROOKLYN NY 11231	03/28/2018	03/28/2023
DOL	DOL	*****4829	MILESTONE ENVIRONMENTAL CORPORATION		704 GINESI DRIVE SUITE 29MORGANVILLE NJ 07751	04/10/2019	04/10/2024
DOL	NYC	*****9926	MILLENNIUM FIRE PROTECTION, LLC		325 W. 38TH STREET SUITE 204NEW YORK NY 10018	11/14/2019	11/14/2024
DOL	NYC	*****0627	MILLENNIUM FIRE SERVICES, LLC		14 NEW DROP LNE 2ND FLOORSTATEN ISLAND	11/14/2019	11/14/2024

NYSDOL Bureau of Public Work Debarment List 08/27/2021

Article 8

DOL	NYC	*****3826	MOVING MAVEN OF NY, INC.		1010 NORTHERN BLVD. GREAT NECK NY 11021	03/09/2017	03/09/2022
DOL	NYC	*****3550	MOVING MAVEN, INC		1010 NORTHERN BLVD. GREAT NECK NY 11021	03/09/2017	03/09/2022
DOL	AG		MSR ELECTRICAL CONSTRUCTION CORP.		31 BAY ST BROOKLYN NY 11231	03/28/2018	03/28/2023
DOL	DOL		MUHAMMAD BEIG		142 EAST MARKET STREET LONG BEACH NY 11561	03/07/2017	03/07/2022
DOL	DOL		MUHAMMAD BEIG		142 EAST MARKET STREET LONG BEACH NY 11561	03/07/2017	03/07/2022
DOL	NYC		MUHAMMED A. HASHEM		524 MCDONALD AVENUE BROOKLYN NY 11218	09/17/2020	09/17/2025
DOL	DA	*****9786	NATIONAL INSULATION & GC CORP		180 MILLER PLACE HICKSVILLE NY 11801	12/12/2018	12/12/2023
DOL	NYC		NICHOLAS FILIPAKIS		7113 FORT HAMILTON PARKWA BROOKLYN NY 11228	12/09/2016	12/09/2021
DOL	DOL	*****7429	NICOLAE I. BARBIR	BESTUCCO CONSTRUCTI ON, INC.	444 SCHANTZ ROAD ALLENTOWN PA 18104	09/17/2020	09/17/2025
DOL	DOL	*****6966	NORTH COUNTRY DRYWALL AND PAINT		23167 COUNTY ROUTE 59 DEXTER NY 13634	10/24/2016	10/24/2021
DOL	DOL	*****0065	NORTHEAST LANDSCAPE AND MASONRY ASSOC		3 WEST MAIN ST/SUITE 208 ELMSFORD NY 10523	01/23/2017	01/23/2022
DOL	DOL	*****1845	OC ERECTERS, LLC A/K/A OC ERECTERS OF NY INC.		1207 SW 48TH TERRACE DEERFIELD BEACH FL 33442	01/16/2018	01/16/2023
DOL	NYC	*****0818	ONE TEN RESTORATION, INC.		2366 61ST ST BROOKLYN NY 11204	12/15/2016	12/15/2021
DOL	NYC		PARESH SHAH		29 PHILLIP DRIVE PARSIPPANY NJ 07054	02/13/2017	02/13/2022
DOL	DOL		PAULINE CHAHALES		935 S LAKE BLVD MAHOPAC NY 10541	03/02/2021	03/02/2026
DOL	NYC	*****9422	PELIUM CONSTRUCTION, INC.		22-33 35TH ST. ASTORIA NY 11105	12/30/2016	12/30/2021
DOL	DOL		PETER M PERGOLA		3 WEST MAIN ST/SUITE 208 ELMSFORD NY 10523	01/23/2017	01/23/2022
DOL	DOL		PETER STEVENS		11 OLD TOWN ROAD SELKIRK NY 12158	02/02/2021	02/02/2026
DOL	DOL		PIERRE LAPORT		224 COUNTY HIGHWAY 138 BROADALBIN NY 12025	03/07/2017	03/07/2022
DOL	DOL	*****1543	PJ LAPORT FLOORING INC		224 COUNTY HIGHWAY 138 BROADALBIN NY 12025	03/07/2017	03/07/2022
DOL	NYC	*****5771	PMJ ELECTRICAL CORP		7113 FORT HAMILTON PARKWA BROOKLYN NY 11228	12/09/2016	12/09/2021
DOL	DOL	*****0466	PRECISION BUILT FENCES, INC.		1617 MAIN ST PEEKSKILL NY 10566	03/03/2020	03/03/2025
DOL	NYC	*****4532	PROFESSIONAL PAVERS CORP.		66-05 WOODHAVEN BLVD. REGO PARK NY 11374	04/20/2017	04/20/2022
DOL	NYC		RASHEL CONSTRUCTION CORP		524 MCDONALD AVENUE BROOKLYN NY 11218	09/17/2020	09/17/2025
DOL	DOL	*****1068	RATH MECHANICAL CONTRACTORS, INC.		24 ELDOR AVENUE NEW CITY NY 10956	02/03/2020	02/03/2025
DOL	DOL	*****2633	RAW POWER ELECTRIC CORP		3 PARK CIRCLE MIDDLETOWN NY 10940	01/30/2018	01/30/2023
DOL	AG	*****7015	RCM PAINTING INC.		69-06 GRAND AVENUE 2ND FLOORMASPETH NY 11378	02/07/2018	02/07/2023
DOL	DOL		REGINALD WARREN		161 ROBYN RD MONROE NY 10950	01/30/2018	01/30/2023
DOL	DOL	*****9148	RICH T CONSTRUCTION		107 WILLOW WOOD LANE CAMILLUS NY 13031	11/13/2018	11/13/2023
DOL	DOL		RICHARD MACONE		8617 THIRD AVE BROOKLYN NY 11209	09/17/2018	09/17/2023
DOL	DOL		RICHARD REGGIO		1617 MAIN ST PEEKSKILL NY 10566	03/03/2020	03/03/2025
DOL	DOL	*****9148	RICHARD TIMIAN	RICH T CONSTRUCTI ON	108 LAMONT AVE SYRACUSE NY 13209	10/16/2018	10/16/2023
DOL	DOL		RICHARD TIMIAN JR.		108 LAMONT AVE SYRACUSE NY 13209	10/16/2018	10/16/2023
DOL	DOL		RICHARD TIMIAN JR.		108 LAMONT AVE SYRACUSE NY 13209	11/13/2018	11/13/2023
DOL	DOL		ROBBYE BISSESEAR		89-51 SPRINGFIELD BLVD	01/11/2003	01/11/3003

NYSDOL Bureau of Public Work Debarment List 08/27/2021

Article 8

DOL	DOL		ROBERT A. VALERINO		3841 LANYARD COURT NEW PORT RICHEY FL 34652	07/09/2019	07/09/2024
DOL	DOL		ROBERT BRUNO		3 GAYLORD ST AUBURN NY 13021	11/15/2016	11/15/2021
DOL	DOL		ROBERT BRUNO		5 MORNINGSIDE DRIVE AUBURN NY 13021	05/28/2019	05/28/2024
DOL	NYC		ROBERT HOHMAN		149 FIFTH AVE NEW YORK NY 10010	12/29/2016	12/29/2021
DOL	DOL		RODERICK PUGH		404 OAK ST SUITE 101SYRACUSE NY 13203	07/23/2018	07/23/2023
DOL	DOL	*****4880	RODERICK PUGH CONSTRUCTION INC.		404 OAK ST SUITE 101SYRACUSE NY 13203	07/23/2018	07/23/2023
DOL	DOL		ROMEO WARREN		161 ROBYN RD MONROE NY 10950	01/30/2018	01/30/2023
DOL	DOL		RONALD MESSEN		14B COMMERCIAL AVE ALBANY NY 12065	11/14/2019	11/14/2024
DOL	DOL		ROSEANNE CANTISANI			06/12/2018	06/12/2023
DOL	DOL		RYAN ALBIE		21 S HOWELLS POINT ROAD BELLPORT NY 11713	02/21/2017	02/21/2022
DOL	DOL	*****3347	RYAN ALBIE CONTRACTING INC		21 S HOWELLS POINT ROAD BELLPORT NY 11713	02/21/2017	02/21/2022
DOL	DOL	*****1365	S & L PAINTING, INC.		11 MOUNTAIN ROAD P.O BOX 408MONROE NY 10950	03/20/2019	03/20/2024
DOL	DOL	*****7730	S C MARTIN GROUP INC.		2404 DELAWARE AVE NIAGARA FALLS NY 14305	09/12/2018	09/12/2023
DOL	NYC	*****0349	SAM WATERPROOFING INC		168-42 88TH AVENUE APT.1 AJAMAICA NY 11432	11/20/2019	11/20/2024
DOL	NYC		SANDEEP BOPARAI		185-06 56TH AVE FRESH MEADOW NY 11365	10/17/2017	10/17/2022
DOL	DOL	*****9751	SCW CONSTRUCTION		544 OLD ROUTE 23 ACRE NY 12405	02/14/2017	02/14/2022
DOL	NYC	*****6597	SHAIRA CONSTRUCTION CORP.		421 HUDSON STREET SUITE C5NEW YORK NY 10014	02/20/2019	02/20/2024
DOL	DOL	*****1961	SHANE BURDICK	CENTRAL TRAFFIC CONTROL, LLC.	2238 BAKER ROAD GILLETT PA 16923	03/12/2018	03/12/2023
DOL	DOL		SHANE BURDICK		2238 BAKER ROAD GILLETT PA 16923	03/12/2018	03/12/2023
DOL	DOL		SHANE NOLAN		9365 WASHINGTON ST LOCKPORT IL 60441	07/23/2018	07/23/2023
DOL	DOL		SHULEM LOWINGER		11 MOUNTAIN ROAD 28 VAN BUREN DRMONROE NY 10950	03/20/2019	03/20/2024
DOL	DOL	*****0816	SOLAR ARRAY SOLUTIONS, LLC		9365 WASHINGTON ST LOCKPORT IL 60441	07/23/2018	07/23/2023
DOL	DOL	*****2221	SOUTH BUFFALO ELECTRIC, INC.		1250 BROADWAY ST BUFFALO NY 14212	02/03/2020	02/03/2025
DOL	DOL	*****3496	STAR INTERNATIONAL INC		89-51 SPRINGFIELD BLVD QUEENS VILLAGE NY 11427	08/11/2003	08/11/3003
DOL	DOL	*****6844	STEAM PLANT AND CHX SYSTEMS INC.		14B COMMERCIAL AVENUE ALBANY NY 12065	11/14/2019	11/14/2024
DOL	DOL	*****9933	STEED GENERAL CONTRACTORS, INC.		1445 COMMERCE AVE BRONX NY 10461	05/30/2019	05/30/2024
DOL	DOL		STEFANOS PAPASTEFANOU, JR. A/K/A STEVE PAPASTEFANOU, JR.		256 WEST SADDLE RIVER RD UPPER SADDLE RIVER NJ 07458	05/30/2019	05/30/2024
DOL	DOL	*****9751	STEPHEN C WAGAR		544 OLD ROUTE 23 ACRE NY 12405	02/14/2017	02/14/2022
DOL	DOL		STEVE TATE		415 FLAGER AVE #302STUART FL 34994	10/31/2018	10/31/2023
DOL	NYC		STEVEN GOVERNALE		601 PORTION RD RONKONKOMA NY 11779	11/18/2016	11/18/2021
DOL	DOL		STEVEN MARTIN		2404 DELWARE AVE NIAGARA FALLS NY 14305	09/12/2018	09/12/2023
DOL	DOL		STEVEN TESTA		50 SALEM STREET - BLDG B LYNNFIELD MA 01940	01/23/2017	01/23/2022
DOL	NYC	*****5863	SUKHMANY CONSTRUCTION, INC.		185-06 56TH AVE FRESH MEADOW NY 11365	10/17/2017	10/17/2022
DOL	DOL	*****1060	SUNN ENTERPRISES GROUP, LLC		370 W. PLEASANTVIEW AVE SUITE 2.329HACKENSACK NJ	02/11/2019	02/11/2024

NYSDOL Bureau of Public Work Debarment List 08/27/2021

Article 8

DOL	DOL	*****8209	SYRACUSE SCALES, INC.		158 SOLAR ST SYRACUSE NY 13204	01/07/2019	01/07/2024
DOL	DOL		TALAILA OCAMPA		1207 SW 48TH TERRACE DEERFIELD BEACH FL 33442	01/16/2018	01/16/2023
DOL	DOL		TERRY THOMPSON		11371 RIDGE RD WOLCOTT NY 14590	02/03/2020	02/03/2025
DOL	DOL		TEST		P.O BOX 123 ALBANY NY 12204	05/20/2020	05/20/2025
DOL	DOL	*****6789	TEST1000		P.O BOX 123 ALBANY NY 12044	03/01/2021	03/01/2026
DOL	DOL	*****5570	TESTA CORP		50 SALEM STREET - BLDG B LYNNFIELD MA 01940	01/23/2017	01/23/2022
DOL	DOL	*****5766	THE COKER CORPORATION	COKER CORPORATIO N	2610 SOUTH SALINA ST SUITE 14SYRACUSE NY 13205	12/04/2018	12/04/2023
DOL	DOL	*****5766	THE COKER CORPORATION	COKER CORPORATIO N	2610 SOUTH SALINA ST SUITE 14SYRACUSE NY 13205	09/17/2020	09/17/2025
DOL	DOL	*****8311	TRIPLE B FABRICATING, INC.		61 WILLETT ST. PASSAIC NJ 07503	10/26/2016	10/26/2021
DOL	DOL	*****6392	V.M.K CORP.		8617 THIRD AVE BROOKLYN NY 11209	09/17/2018	09/17/2023
DOL	DOL	*****6418	VALHALLA CONSTRUCTION, LLC.		796 PHEPS ROAD FRANKLIN LAKES NJ 07417	12/01/2020	12/01/2025
DOL	NYC	*****7361	VIALE HOLDINGS, INC.	MOVING MAVEN	1010 NORTHERN BLVD. GREAT NECK NY 11021	03/09/2017	03/09/2022
DOL	DOL		VICTOR ALICANTI		42-32 235TH ST DOUGLSTON NY 11363	01/14/2019	01/14/2024
DOL	NYC		VIKTAR PATONICH		2630 CROPEY AVE BROOKLYN NY 11214	10/30/2018	10/30/2023
DOL	DOL		VIKTORIA RATH		24 ELDOR AVENUE NEW CITY NY 10956	02/03/2020	02/03/2025
DOL	NYC		VITO GARGANO		1535 RICHMOND AVE STATEN ISLAND NY 10314	12/13/2017	12/13/2022
DOL	NYC	*****3673	WALTERS AND WALTERS, INC.		465 EAST AND THIRD ST MT. VERNON NY 10550	09/09/2019	09/09/2024
DOL	DOL		WAYNE LIVINGSTON JR	NORTH COUNTRY DRYWALL AND PAINT	23167 COUNTY ROUTE 59 DEXTER NY 13634	10/24/2016	10/24/2021
DOL	DOL	*****3296	WESTERN NEW YORK CONTRACTORS, INC.		3841 LAYNARD COURT NEW PORT RICHEY FL 34652	07/09/2019	07/09/2024
DOL	DOL		WHITE PLAINS CARPENTRY CORP		442 ARMONK RD	06/12/2018	06/12/2023
DOL	DOL		WILLIAM C WATKINS		1229 JAMES STREET SYRACUSE NY 13203	05/02/2017	05/02/2022
DOL	DOL		WILLIAM DEAK		C/O MADISON AVE CONSTR CO 39 PENNY STREETWEST ISLIP NY 11795	11/02/2016	11/02/2021
DOL	DOL	*****4043	WINDSHIELD INSTALLATION NETWORK, INC.		200 LATTA BROOK PARK HORSEHEADS NY 14845	03/08/2018	03/08/2023
DOL	DOL	*****4730	XGD SYSTEMS, LLC	TDI GOLF	415 GLAGE AVE #302STUART FL 34994	10/31/2018	10/31/2023
DOL	NYC		ZAKIR NASEEM		30 MEADOW ST BROOKLYN NY 11206	10/10/2017	10/10/2022
DOL	NYC	*****8277	ZHN CONTRACTING CORP		30 MEADOW ST BROOKLYN NY 11206	10/10/2017	10/10/2022

PROJECT LABOR AGREEMENT (PLA)

DEPARTMENT OF PUBLIC WORKS AND TRANSPORTATION
Division of Engineering

PROJECT LABOR AGREEMENT
(Contract No. *{Insert Contract Number}*)

COVERING

CONSTRUCTION PERFORMED

ON BEHALF OF

WESTCHESTER COUNTY, NEW YORK

TABLE OF CONTENTS

Article 1 - Preamble	1
Section 1 - Parties to the Agreement.....	2
Article 2 - General Conditions	2
Section 1 - Definitions	2
Section 2 - Conditions for Agreement to Become Effective.....	2
Section 3 - Entities Bound & Administration of Agreement	2
Section 4 - Supremacy Clause	3
Section 5 - Liability.....	3
Section 6 - The County	3
Section 7 - Availability & Applicability to All Successful Bidders	4
Article 3 - Scope of This Agreement.....	4
Section 1 - The Work	4
Section 2 - Excluded Employees.....	4
Section 3 - Non-Application to Certain Entities	5
Section 4 - County Liability	5
Article 4 - Union Recognition and Employment	6
Section 1 - Pre-Hire Recognition	6
Section 2 - Union's Referral	6
Section 3 - Non-Discrimination in Referrals	7
Section 4 - Minority and Female Referrals	7
Section 5 - Cross and Qualified Referrals.....	7
Section 6 - Union Dues	8
Section 7 - Trade Forepersons and General Forepersons.....	8
Article 5 - Union Representation	8
Section 1 - Local Union Representative.....	8
Section 2 - Stewards.....	8
Section 3 - Layoff of a Steward	9
Article 6 - Management's Rights	9
Section 1 - Reservation of Rights	9
Section 2 - Materials, Methods & Equipment.....	10
Article 7 - Work Stoppages and Lockouts.....	10
Section 1 - No Strikes - No Lockouts	10
Section 2 - Discharge for Violation	10
Section 3 - Notification	10
Section 4 - Expedited Arbitration	11
Section 5 - Arbitration of Discharges.....	12
Article 8 - Labor Management Committee.....	12
Section 1 - Subjects.....	12
Section 2 - Composition.....	13
Article 9 - Grievance & Arbitration Procedure	13
Section 1 - Procedure for Resolution of Grievances	13
Section 2 - Limitation as to Retroactivity	14
Article 10 - Jurisdictional Disputes	14
Section 1 - No Disruptions.....	14
Section 2 - Assignment	15
Section 3 - Procedure for Settlement of Jurisdictional Disputes.....	15

Section 4 - Award	15
Section 5 - Limitations	16
Section 6 - No Interference with Work	16
Article 11 - Wages and Benefits	16
Section 1 - Classification and Base Hourly Rate	16
Section 2 - Employee Benefit Funds.....	16
Article 12 - Hours of Work, Premium Payments, Shifts and Holidays.....	17
Section 1 - Work Week and Work Day	17
Section 2 - Overtime	18
Section 3 - Shifts	18
Section 4 - Holidays	19
Section 5 - Reporting Pay	19
Section 6 - Payment Of Wages	20
Section 7 - Emergency Work Suspension	20
Section 8 - Injury-Disability	20
Section 9 - Time Keeping	21
Section 10 - Meal Period.....	21
Section 11 - Break Periods.....	21
Article 13 - Apprentices.....	21
Section 1 - Ratios	21
Section 2 - Department of Labor.....	22
Article 14 - Safety Protection of Person and Property	22
Section 1 - Safety Requirements	22
Section 2 - Contractor Rules	22
Section 3 - Inspections	22
Article 15 - No Discrimination	22
Section 1 - Cooperative Efforts.....	22
Section 2 - Language of Agreement.....	23
Article 16 - General Terms.....	23
Section 1 - Project Rules	23
Section 2 - Tools of the Trade.....	23
Section 3 - Supervision	23
Section 4 - Travel Allowances	23
Section 5 - Full Work Day	24
Section 6 - Cooperation.....	24
Article 17 - Savings and Separability	24
Section 1 - This Agreement	24
Section 2 - The Bid Specifications	24
Section 3 - Non-Liability	24
Section 4 - Non-Waiver	25
Article 18 - Future Changes in Schedule “A” Collective Bargaining Agreements	25
Section 1 - Changes to Collective Bargaining Agreements	25
Section 2 - Labor Disputes during Collective Bargaining Agreement Negotiations	25
Article 19 – Workers’ Compensation ADR	26
Signatures	27
Schedule “A” Local Collective Bargaining Agreements.....	28

**PROJECT LABOR AGREEMENT
COVERING CONSTRUCTION WORK PERFORMED
ON BEHALF OF WESTCHESTER COUNTY, NEW YORK**

ARTICLE 1 - PREAMBLE

WHEREAS, *{Insert Name of Contractor}* (the “Contractor”) on behalf of itself, and reflecting the objectives of the owner, **Westchester County, New York** (the “County”), desires to provide for the efficient, safe, quality, and timely completion of the following construction project: *{Insert Contract Title}* (the “Project”) in a manner designed to afford the lowest reasonable costs to the County and the public it represents, and the advancement of public policy objectives;

WHEREAS, this Project Labor Agreement will foster the achievement of these goals, inter alia, by:

1. avoiding the costly delays of potential strikes, slowdowns, walkouts, picketing and other disruptions arising from work disputes and promote labor harmony and peace for the duration of the Project;
2. standardizing the terms and conditions governing the employment of labor on the Project;
3. permitting wide flexibility in work scheduling and shift hours and times;
4. receiving negotiated adjustments to work rules and staffing requirements from those which otherwise might control;
5. providing comprehensive and standardized mechanisms for the settlement of work disputes, including but not limited to, those relating to jurisdiction;
6. ensuring a reliable source of skilled and experienced labor;
7. furthering public policy objectives as to improved employment opportunities for minorities, women and the economically disadvantaged in the construction industry;
8. minimizing potential losses of revenues through timely completion of contracts;
9. expediting the construction process and otherwise minimizing the inconveniences of citizens of the County; and

WHEREAS, the parties desire to maximize Project safety conditions for both workers and the public;

NOW, THEREFORE, the parties enter into this Agreement:

SECTION 1 - PARTIES TO THE AGREEMENT

This is a Project Labor Agreement (“Agreement”) entered into by and between the Contractor, on behalf of itself and its successors, assigns and its subcontractors engaged in On-Site Project Work as defined in Article 3; and by the Building and Construction Trades Council of Westchester and Putnam Counties, New York AFL-CIO, on behalf of itself and all of its affiliated Local Unions that perform On-Site Project Work and their members.

ARTICLE 2 - GENERAL CONDITIONS

SECTION 1 - DEFINITIONS

Throughout this Agreement, “Council” shall refer to the Building and Construction Trades Council of Westchester and Putnam Counties, New York AFL-CIO. “Local Unions” shall refer to all of the Council’s affiliated Local Unions that perform On-Site Project Work and their members. “Contractor(s)” shall include the Contractor, all other contractors who sign a similar Project Labor Agreement in connection with the Project and their subcontractors of whatever tier, engaged in On-Site Project Work within the scope of this Agreement as defined in Article 3.

SECTION 2 - CONDITIONS FOR AGREEMENT TO BECOME EFFECTIVE

This Agreement shall not become effective unless each of the following conditions is met: (1) the Agreement is signed by the Council on behalf of itself and all of its affiliated Local Unions that perform On-Site Project Work; (2) the Agreement is signed by the Contractor; and (3) the Agreement is approved by the County.

SECTION 3 - ENTITIES BOUND & ADMINISTRATION OF AGREEMENT

This Agreement shall be binding on the Council, the Local Unions and the Contractors performing On-site Project Work, including site preparation and staging areas, as defined in Article 3. The Contractors shall include in any subcontract that they let, for performance during the term of this Agreement, a requirement that each and every one of their subcontractors, of whatever tier, become bound by this Agreement with respect to subcontracted work performed within the scope of Article 3. This Agreement shall be administered by the Contractor, on behalf of itself and its subcontractors. In the event a

Contractor desires to review the provisions of a Local Union's collective bargaining agreement, that Contractor shall request a copy of same from the Council and the Council shall provide same without delay.

SECTION 4 - SUPREMACY CLAUSE

This Agreement together with the applicable collective bargaining agreements of the Local Unions, copies of which can be obtained from the Council, represents the complete understanding of all signatories and supersedes any national agreement, local agreement or collective bargaining agreement of any type which would otherwise apply to this Project, in whole or in part. Where a subject covered by the provisions, explicit or implicit, of this Agreement is also covered by the collective bargaining agreements of one or more of the Local Unions, the provisions of this Agreement shall prevail. It is further understood that no Contractor or subcontractor shall be required to sign any other agreement with the Council or the Local Unions as a condition of performing work on this Project. No practice, understanding or agreement between a Contractor and a Local Union which is not set forth or referenced in this Agreement shall be binding on this Project unless endorsed in writing by the Contractor or subcontractor.

SECTION 5 - LIABILITY

The liability of any Contractor or subcontractor and the liability of any Local Union under this Agreement shall be several and not joint. The Contractor and any subcontractor shall not be liable for any violations of this Agreement by any other contractor, and the Council and Local Unions shall not be liable for any violations of this Agreement by any other Local Union.

SECTION 6 - THE COUNTY

The County requires in its bid specifications that all successful bidders become bound by and signatory to this Agreement for work within the scope of Article 3. In addition, all of their subcontracts shall provide that their subcontractors are subject to all terms and conditions set forth in this Agreement as if signatories thereto. The County is not a party to this Agreement and shall not be liable in any manner under this Agreement. It is understood that nothing in this Agreement shall be construed as limiting the sole discretion of the County in determining which Contractors shall be awarded contracts for Project work; nor as limiting any of the rights or remedies of the County as set forth in any and all of the Contract Documents that pertain in any way to the Project. It is further understood that the County has sole discretion at any time to terminate, delay or suspend the work, in whole or in part, on this Project.

SECTION 7 - AVAILABILITY & APPLICABILITY TO ALL SUCCESSFUL BIDDERS

The Local Unions agree that this Agreement will be made available to, and will fully apply to any successful bidder for Project work who becomes signatory hereto, without regard to whether that successful bidder performs work at other sites on either a union or non-union basis and without regard to whether employees of such successful bidder are, or are not, members of any union. This Agreement shall not apply to the work of any contractor or subcontractor which is performed at any location other than the Project site, as defined in Article 3, Section 1.

ARTICLE 3 - SCOPE OF THIS AGREEMENT

The Project work covered by this Agreement shall be as defined and limited by the following sections of this Article.

SECTION 1 - THE WORK

This Agreement shall only apply to On-Site Project Work performed in connection with the Project.

“On-Site Project Work” shall be defined to include Project work performed at the Project site and preparation and staging areas located within 15 miles of the Project site.

SECTION 2 - EXCLUDED EMPLOYEES

The following persons are not subject to the provisions of this Agreement, even though performing On-Site Project Work:

- a) Superintendents, supervisors (excluding field engineers/supervisors, general and forepersons specifically covered by a Local Union’s collective bargaining agreement), engineers, inspectors and testers, quality control/assurance personnel, timekeepers, mail carriers, clerks, office workers, messengers, guards, technicians, non-manual employees, and all professional, engineering, administrative and management persons;
- b) Employees of the County, or of any State agency, authority or entity or employees of any municipality or other public employer;
- c) Employees and entities engaged in off-site manufacture, modifications, repair, maintenance, assembly, painting, handling or fabrication of components, materials, equipment or machinery or involved in deliveries to and from the Project site, excepting local deliveries of all major

construction materials including fill, ready mix concrete, asphalt and sub-base stone/gravel materials which are covered by this Agreement;

- d) Employees of the Contractor, other contractors or subcontractors excepting those performing manual, on-site construction labor who will be covered by this Agreement;
- e) Employees engaged in on-site equipment maintenance/warranty work. When a Contractor has on site an employee already certified by the relevant manufacturer to make warranty repairs on that Contractor's equipment, that employee shall be used; when a Contractor has on site an employee already qualified to make warranty repairs, although not certified by the equipment manufacturer to do so, that employee shall be used to make repairs working under the direction of a manufacturer certified warranty representative. Notwithstanding the foregoing, if a Contractor, in order to satisfy the warranty requirements of a manufacturer must utilize a person or entity designated by the manufacturer, it may do so without coverage under this Agreement;
- f) Employees engaged in laboratory or specialty testing or inspections whether on or off-site.
- g) Employees engaged in geophysical testing (whether land or water) other than boring for core samples;
- h) Employees engaged in ancillary Project work performed by third parties such as electric utilities, gas utilities, telephone companies, and railroads.

SECTION 3 - NON-APPLICATION TO CERTAIN ENTITIES

This Agreement shall not apply to the parents, affiliates, subsidiaries, or other joint or sole ventures of any Contractors which do not perform work at this Project. It is agreed, for the purposes of this Agreement only, that this Agreement does not have the effect of creating any joint employment, single employer or alter ego status among the County and the Contractors. This Agreement shall further not apply to the County or any other state agency, authority, or other municipal or public entity and nothing contained herein shall be construed to prohibit or restrict the County or its employees or any other state authority, agency or entity and its employees from performing on or off-site work related to the Project.

SECTION 4 - COUNTY LIABILITY

The County shall not be liable, directly or indirectly, to any party for any act or omission of the Contractor, any other contractors or subcontractors, the Council or Local Unions, including but not limited to, any violation or breach of this Agreement by any of the aforementioned.

ARTICLE 4 - UNION RECOGNITION AND EMPLOYMENT

SECTION 1 - PRE-HIRE RECOGNITION

The Contractors recognize the Local Unions as the sole and exclusive bargaining representatives of all trade employees who are performing On-Site Project Work within the scope of this Agreement as defined in Article 3.

SECTION 2 - UNION'S REFERRAL

- A. The Contractors agree to hire trade employees covered by this Agreement through the job referral system and hiring halls (where the referrals meet the qualifications set forth in items 1, 2 and 4 of subparagraph B below) established in the collective bargaining agreements of the applicable Local Unions listed in Schedule A. Notwithstanding this, the Contractors shall have the sole right to determine the competency of all referrals; the number of employees required; the selection of employees to be laid off (except as provided in Article 5, Section 3); and to reject any applicant referred by a Local Union, subject to the show-up payments required in the applicable Local Union's collective bargaining agreement. In the event that a Local Union is unable to fill any request for qualified employees within a 48 hour period after such requisition is made by the Contractor (Saturdays, Sundays and Holidays excepted), the Contractor may employ qualified applicants from any other available source. In the event that the Local Union does not have a job referral system, the Contractor shall give the Local Union first preference to refer applicants, subject to the other provisions of this Article. The Contractor shall notify the applicable Local Union of trade employees hired within its jurisdiction from any source other than referral by the Local Union.
- B. A Contractor may request by name, and the Local Union will honor, referral of persons who have applied to the Local Union for On-Site Project Work and who meet the following qualifications as determined by a committee of 3 persons (the "Committee") designated, respectively, by the applicable Local Union, the Contractor and a mutually selected third party or, in the absence of agreement, the permanent arbitrator (or designee) designated in Article 7:
1. possess licenses required by New York State law for the On-Site Project Work to be performed by that individual;
 2. have worked a total of at least 1000 hours in the applicable construction trade during the prior 3 years;

3. were on the Contractor's active payroll for at least 60 out of the 180 calendar days prior to the contract award;
 4. have demonstrated ability to safely perform the basic functions of the applicable trade.
- C. No more than 12 per centum of the employees covered by this Agreement, per Contractor by trade, shall be hired through the special provisions above (any fraction shall be rounded to the next highest whole number).
- D. The Committee may also allow a Contractor, subject to the above per centum, to employ apprentice equivalents to afford an opportunity to minority, women or economically disadvantaged persons for entry into the construction industry outside of the formal apprenticeship program.

SECTION 3 - NON-DISCRIMINATION IN REFERRALS

The Local Unions represent that their hiring halls and referral systems will be operated in a non-discriminatory manner and in full compliance with all applicable federal, state and local laws and regulations which require equal employment opportunities. Referrals shall not be affected in any way by the rules, regulations, bylaws, constitutional provisions or any other aspects or obligations of union membership, policies or requirements and shall be subject to such other conditions as are established in this Article. No employment applicant shall be discriminated against by any referral system or hiring hall because of the applicant's union membership, or lack thereof.

SECTION 4 - MINORITY AND FEMALE REFERRALS

In the event a Local Union either fails, or is unable, to refer qualified minority or female applicants in percentages equaling Project affirmative action goals as set forth in the County's Project specifications, the Contractor may employ qualified minority or female applicants from any other available source.

SECTION 5 - CROSS AND QUALIFIED REFERRALS

The Local Union shall not knowingly refer to a Contractor an employee then employed by another Contractor working under this Agreement. The Local Unions will exert their utmost efforts to recruit sufficient numbers of skilled and qualified trade employees to fulfill the requirements of the Contractor.

SECTION 6 - UNION DUES

All employees covered by this Agreement shall be subject to the union security provisions contained in the applicable Local Unions' collective bargaining agreements as amended from time to time, but only for the period of time during which they are performing On-Site Project Work and only to the extent of rendering payment of the applicable monthly union dues uniformly required for union membership in the applicable Local Union which represents the trade in which the employee is performing On-Site Project Work. No employee shall be discriminated against at the Project site because of the employee's union membership or lack thereof. In the case of unaffiliated employees, the dues payment will be received by the Local Unions as an agency shop fee.

SECTION 7 - TRADE FOREPERSONS AND GENERAL FOREPERSONS

- A. The selection of trade forepersons and/or general forepersons and the number of forepersons required shall be solely the responsibility of the Contractor except where otherwise provided by specific provisions of an applicable Local Union's collective bargaining agreement. All forepersons shall take orders exclusively from the designated Contractor representatives. Trade forepersons shall be designated as working forepersons at the request of the Contractor, except when an existing Local Union's collective bargaining agreement prohibits a foreperson from working when the tradepersons he is leading exceed a specified number.
- B. There will be no non-productive employees of any title on the Project.

ARTICLE 5 - UNION REPRESENTATION

SECTION 1 - LOCAL UNION REPRESENTATIVE

Each Local Union representing employees who perform On-Site Project Work shall be entitled to designate in writing (copy to Contractor) one representative, and/or the Business Manager, who shall be afforded access to the Project. The Contractor shall provide a copy of such notification to each of its subcontractors.

SECTION 2 - STEWARDS

- A. Each Local Union shall have the right to designate a working journeyman as a Steward and an alternate, and shall notify the Contractor of the identity of the designated Steward (and alternate) prior to the assumption of such duties. Stewards shall not exercise supervisory functions and will

receive the regular rate of pay for their trade classifications. There will be no non-working Stewards on the Project.

- B. In addition to their work as employees, Stewards shall have the right to receive complaints or grievances and to discuss and assist in their adjustment with the Contractor's appropriate supervisor. Each Steward shall be concerned with the employees of the Steward's Contractor, and, if applicable, subcontractors of the Contractor, but not with the employees of any other contractor. The Contractor will not discriminate against the Steward in the proper performance of Union duties.
- C. The Stewards shall not have the right to determine when overtime shall be worked, or who shall work overtime except pursuant to a provision in a Local Union's collective bargaining agreement providing procedures for the equitable distribution of overtime.

SECTION 3 - LAYOFF OF A STEWARD

Contractors agree to notify the appropriate Union 24 hours prior to the layoff of a Steward, except in cases of discipline or discharge for just cause. If a Steward is protected against layoff by a Local Union's collective bargaining agreement, such provisions shall be recognized to the extent the Steward possesses the necessary qualifications to perform the work required. In any case in which a Steward is discharged or disciplined for just cause, the Local Union involved shall be notified immediately by the Contractor.

ARTICLE 6 - MANAGEMENT'S RIGHTS

SECTION 1 - RESERVATION OF RIGHTS

Except as expressly limited by a specific provision of this Agreement, the Contractor retains full and exclusive authority for the management of the Project operations including, but not limited to: the right to direct the work force, including determination as to the number to be hired and the qualifications therefore; the promotion, transfer, and layoff of its employees; the discipline or discharge for just cause of its employees; the assignment and schedule of work; the promulgation of reasonable Project work rules; and, the requirement, timing and number of employees to be utilized for overtime work. No rules, customs, or practices which limit or restrict productivity or efficiency of the individual, as determined by the Contractor, and/or joint working efforts with other employees shall be permitted or observed.

SECTION 2 - MATERIALS, METHODS & EQUIPMENT

There shall be no limitation or restriction upon the Contractor's choice of materials, techniques, methods, technology or design, or, regardless of source or location, upon the use and installation of equipment, machinery, package units, pre-cast, pre-fabricated, pre-finished, or pre-assembled materials, tools or other labor-saving devices. Contractors may, without restriction, install or use materials, supplies or equipment regardless of their source. The on-site installation or application of such items shall be performed by the trade having jurisdiction over such work; provided, however, it is recognized that other personnel having special qualifications may participate, in a supervisory capacity, in the installation, check-off or testing of specialized or unusual equipment or facilities as designated by the Contractor. There shall be no restrictions as to work which is not On-Site Project Work.

ARTICLE 7 - WORK STOPPAGES AND LOCKOUTS

SECTION 1 - NO STRIKES - NO LOCKOUTS

There shall be no strikes, sympathy strikes, picketing, work stoppages, slowdowns, hand billing, demonstrations or other disruptive activity at the Project for any reason by any Local Union or employee against any Contractors or employer while performing On-Site Project Work. There shall be no other Local Union, or concerted or employee activity which disrupts or interferes with the operation of the Contractors or the County. Failure of any Local Union or employee to cross any picket line established by any union, signatory or non-signatory to this Agreement, or the picket or demonstration line of any other organization, at or in proximity to the On-Site Project Work shall be deemed a violation of this Article. There shall be no lockout at the Project by any Contractor. Contractors and Local Unions shall take all steps necessary to ensure compliance with this Section 1 and to ensure uninterrupted construction for the duration of this Agreement.

SECTION 2 - DISCHARGE FOR VIOLATION

Contractors may discharge any employee violating Section 1, above, and any such employee will not be eligible thereafter for referral under this Agreement for a period of 100 days.

SECTION 3 - NOTIFICATION

If the Contractor contends that any Local Union has violated this Article, it will notify the President of the Council advising of such fact, with copies of the notification to the Local Union. The President of the Council shall instruct, order and otherwise use its best efforts to cause the employees and/or the Local

Unions to immediately cease and desist from any violation of this Article. The Council, in complying with these obligations, shall not be liable for the unauthorized acts of a Local Union or its members.

SECTION 4 - EXPEDITED ARBITRATION

Any Contractor or Local Union alleging a violation of Section 1 of this Article may utilize the expedited procedure set forth below in lieu of, or in addition to, any actions at law or equity that may be brought.

- A. A party invoking this procedure shall notify the American Arbitration Association to appoint an Arbitrator under this expedited arbitration procedure. Copies of such notification will be simultaneously sent to the alleged violator and, if a Local Union is alleged to be in violation, its International Union, the Council, and the Contractor.
- B. Upon appointment in accordance with the rules and regulations of the American Arbitration Association for an expedited arbitration proceeding, the Arbitrator shall thereupon, after notice as to time and place to the Contractor, the Local Union involved, and the Council hold a hearing within 48 hours of receipt of the notice invoking the procedure if it is contended that the violation still exists. The hearing will not, however, be scheduled for less than 24 hours after the notice to the Council required by Section 3, above.
- C. All notices pursuant to this Article may be by telephone, telegraph, hand delivery, or fax, confirmed by overnight delivery, to the Arbitrator, Contractor, the involved Local Union and the Council. The hearing may be held on any day including Saturdays or Sundays. The hearing shall be completed in one session, which shall not exceed 8 hours duration (no more than 4 hours being allowed to either side to present their case, and conduct their cross examination) unless otherwise agreed. A failure of any Local Union or Contractor to attend the hearing shall not delay the hearing of evidence by those present or the issuance of an award by the Arbitrator.
- D. The sole issue at the hearing shall be whether a violation of Section 1, above, occurred. If a violation is found to have occurred, the Arbitrator shall issue a Cease and Desist Award restraining such violation and serve copies on the Contractor and the Local Union involved. The Arbitrator shall have no authority to consider any matter in justification, explanation or mitigation of such violation or to award damages, which issue is reserved solely for court proceedings, if any. The Award shall be issued in writing within 3 hours after the close of the hearing, and may be issued without an Opinion. If any involved party desires an Opinion, one shall be issued within 15 calendar days, but its issuance shall not delay compliance with, or enforcement of, the Award.

- E. An Award issued under this procedure may be enforced by any court of competent jurisdiction upon the filing of this Agreement, together with the Award. Notice of the filing of such enforcement proceedings shall be given to the Local Union or Contractor involved. In any court proceeding to obtain a temporary or preliminary order enforcing the Arbitrator's award as issued under this expedited procedure, the involved Local Union and Contractor waive their right to a hearing and agree that such proceedings may be ex parte, provided notice is given to opposing counsel. Such agreement does not waive any party's right to participate in a hearing for a final court order of enforcement or in any contempt proceeding.
- F. Any rights created by statute or law governing arbitration proceedings which are inconsistent with the procedure set forth in this Article, or which interfere with compliance thereto, are hereby waived by the Contractors and Local Unions to whom they accrue.
- G. The fees and expenses of the Arbitrator shall be equally divided between the involved Contractor and Local Union.

SECTION 5 - ARBITRATION OF DISCHARGES

Procedures contained in Article 9 shall not be applicable to any alleged violation of this Article, with the single exception that an employee discharged for violation of Section 1, above, may have recourse to the procedures of Article 9 to determine only if the employee did, in fact, violate the provisions of Section 1 of this Article; but not for the purpose of modifying the discipline imposed where a violation is found to have occurred.

ARTICLE 8 - LABOR MANAGEMENT COMMITTEE

SECTION 1 - SUBJECTS

The Project Labor Management Committee (the "Labor Management Committee") will meet on a regular basis to: 1) promote harmonious relations among the contractors and Unions; 2) enhance safety awareness, cost effectiveness and productivity of construction operations; 3) protect the public interests; 4) discuss matters relating to staffing and scheduling with safety and productivity as considerations; 5) review Affirmative Action and equal employment opportunity matters pertaining to the Project; and 6) discuss such other matters as may be desirable or necessary in furtherance of the expeditious completion of the Project.

SECTION 2 - COMPOSITION

The Labor Management Committee shall be composed of one designee each of the Council, the Contractors and the Local Unions involved in the issues being discussed. The Labor Management Committee may conduct business through mutually agreed sub-committees.

ARTICLE 9 - GRIEVANCE & ARBITRATION PROCEDURE

SECTION 1 - PROCEDURE FOR RESOLUTION OF GRIEVANCES

Any question, dispute or claim arising out of, or involving the interpretation or application of this Agreement (other than jurisdictional disputes or alleged violations of Article 7, Section 1) shall be considered a grievance and shall be resolved pursuant to the exclusive procedure described below; provided, in all cases, that the question, dispute or claim arose during the term of this Agreement.

Step 1:

- (a) When any employee covered by this Agreement feels aggrieved by a claimed violation of this Agreement, the employee shall, through the Local Union business representative or job steward give notice of the claimed violation to the work site representative of the involved Contractor. To be timely, such notice of the grievance must be given within 14 calendar days after the act, occurrence or event giving rise to the grievance. The business representative of the Local Union or the job steward and the work site representative of the involved Contractor shall meet and endeavor to adjust the matter within 14 calendar days after a timely notice has been given. If they fail to resolve the matter within the prescribed period, the grieving party, may, within 14 calendar days thereafter, pursue Step 2 of the grievance procedure by serving the involved Contractor with written copies of the grievance setting forth a description of the claimed violation, the date on which the grievance occurred, and the provisions of the Agreement alleged to have been violated. Grievances and disputes settled at Step 1 are non-precedential except as to the specific Local Union, employee and Contractor directly involved unless the settlement is accepted in writing by the Contractor as creating a precedent.
- (b) Should any Contractor or Local Union have a dispute (excepting jurisdictional disputes or alleged violations of Article 7, Section 1) with any other Contractor or Local Union and after conferring a settlement is not reached within 14 calendar days, the dispute shall be reduced to writing and proceed to Step 2 in the same manner as outlined in subparagraph (a) for the adjustment of employee grievances.

Step 2:

The Business Manager or designee of the involved Local Union, together with representatives of the Council and the involved Contractor, shall meet in Step 2 within 14 calendar days of service of the written grievance to arrive at a satisfactory settlement.

Step 3:

- (a) If the grievance shall have been submitted but not resolved in Step 2, any of the participating Step 2 entities may, within 21 calendar days after the initial Step 2 meeting, submit the grievance in writing (copies to other participants) to the American Arbitration Association. The Labor Arbitration Rules of the American Arbitration Association shall govern the appointment and conduct of the arbitration hearing, at which all Step 2 participants shall be parties. The decision of the Arbitrator shall be final and binding on the involved Contractor, Local Union and employees and the fees and expenses of such arbitration shall be borne equally by the involved Contractor and Local Union.
- (b) Failure of the grieving party to adhere to the time limits set forth in this Article shall render the grievance null and void. These time limits may be extended only by written consent of the Contractor and the involved Local Union at the particular step where the extension is agreed upon. The Arbitrator shall have authority to make decisions only on the issues presented to him and shall not have the authority to change, add to, delete or modify any provision of this Agreement.

SECTION 2 - LIMITATION AS TO RETROACTIVITY

No arbitration decision or award may provide retroactivity of any kind exceeding 60 calendar days prior to the date of service of the written grievance on the Contractor or Local Union.

ARTICLE 10 - JURISDICTIONAL DISPUTES

SECTION 1 - NO DISRUPTIONS

There will be no strikes, sympathy strikes, work stoppages, slowdowns, picketing or other disruptive activity of any kind arising out of any jurisdictional dispute. Pending the resolution of the dispute, the work shall continue uninterrupted and as assigned by the Contractor. No jurisdictional dispute shall excuse a violation of Article 7.

SECTION 2 - ASSIGNMENT

All On-Site Project Work assignments shall be made pursuant to law.

SECTION 3 - PROCEDURE FOR SETTLEMENT OF JURISDICTIONAL DISPUTES

- A. Any Local Union having a jurisdictional dispute with respect to On-Site Project Work assigned to another Local Union will submit the dispute in writing to the Administrator, Plan for the Settlement of Jurisdictional Disputes in the Construction Industry (“the Plan”) within 72 hours and send a copy of the letter to the Local Union and the International Union involved, the President of the Council, the County and the Contractor involved. Upon receipt of a dispute letter from any Local Union, the Administrator will invoke the procedures set forth in the Plan to resolve the jurisdictional dispute. The jurisdictional dispute letter shall contain the information described in Article IV of the Plan.
- B. Within 5 calendar days of receipt of the dispute letter, there shall be a meeting of the Contractor involved, the Local Unions involved and the President of the Council for the purpose of resolving the jurisdictional dispute.
- C. If the dispute remains unresolved after this meeting, the parties will proceed to final and binding arbitration in accordance with the principles and procedures set forth in the rules of the Plan.
- D. The Arbitrator will render a short-form decision within 5 days of the hearing based upon the evidence submitted at the hearing, with a full written decision to follow within 30 days of the close of the hearing.
- E. This Jurisdictional Dispute Resolution Procedure will only apply to On-Site Project Work performed by Local Unions. A representative of the County and the International Union involved may also attend the meeting.
- F. Any Local Union involved in a jurisdictional dispute on this Project shall continue working in accordance with Section 2 above and without disruption of any kind.
- G. Copies of the Plan will be provided by the Council upon request.

SECTION 4 - AWARD

Any jurisdictional award pursuant to Section 3 shall be final and binding on the disputing Local Unions and the involved Contractor on this Project only, and may be enforced in any court of competent

jurisdiction. Such award or resolution shall not establish a precedent on any other construction work not covered by this Agreement. In all disputes under this Article, the involved Contractors shall be considered parties in interest.

SECTION 5 - LIMITATIONS

The Jurisdictional Dispute Arbitrator shall have no authority to assign work to a double crew, that is, to more employees than the minimum required by the involved Contractor to perform the work involved; nor to assign the work to employees who are not qualified to perform work involved; nor to assign work being performed by non-union employees to union employees. This does not prohibit the establishment, with the agreement of the involved Contractor, of composite crews where more than one employee is needed for the job. The aforesaid determinations shall decide only to whom the disputed work belongs.

SECTION 6 - NO INTERFERENCE WITH WORK

There shall be no interference or interruption of any kind with the On-Site Project Work while any jurisdictional dispute is being resolved. The On-Site Project Work shall proceed as assigned by the involved Contractor until finally resolved under the applicable procedure of this Article. The award shall be confirmed in writing to the involved parties. There shall be no strike, work stoppage, or interruption in protest of any such award.

ARTICLE 11 - WAGES AND BENEFITS

SECTION 1 - CLASSIFICATION AND BASE HOURLY RATE

All employees covered by this Agreement shall be classified in accordance with the work performed and paid the base hourly wage rates for those classifications as specified in the applicable Local Unions' collective bargaining agreements, as they may be amended during the term of this Agreement. Recognizing, however, that special conditions may exist or occur on the Project, the parties, by mutual agreement may establish rates and/or hours for one or more classifications which may differ from the applicable collective bargaining agreements. Parties to such agreements shall be the Contractor involved, the involved Local Unions and the Council.

SECTION 2 - EMPLOYEE BENEFIT FUNDS

The Contractors agree to pay contributions on behalf of all employees covered by this Agreement to the established employee benefit funds in the amount designated in the appropriate Local Unions' collective bargaining agreements; provided, however, that the involved Contractors and the Local Unions agree that

only such bona fide employee benefits as are explicitly required under Section 220 of the New York State Labor Law shall be included in this requirement and paid by the Contractors on this Project. Bona fide jointly trusted fringe benefit plans established or negotiated through collective bargaining during the life of this Agreement may be added if similarly protected under Section 220. Contractors shall not be required to contribute to non-Section 220 benefits, trusts or plans.

The Contractors agree to be bound by the written terms of the legally-established Local Union collective bargaining agreement and/or Trust Agreements specifying the detailed basis on which payments are to be paid into, and benefits paid out of, such Trust Funds but only with regard to work done on this Project and only for those employees to whom this Agreement requires such benefit payments. Copies of such Trust Agreements will be provided by the Council upon request.

ARTICLE 12 - HOURS OF WORK, PREMIUM PAYMENTS, SHIFTS AND HOLIDAYS

SECTION 1 - WORK WEEK AND WORK DAY

- A. The standard work week shall consist of 40 hours of work at straight time rates per one of the following schedules:
 - i.) Five-Day Work Week: Monday-Friday; 5 days, 8 hours plus 1/2 hour unpaid lunch period each day.
 - ii.) Four-Day Work Week: Monday-Thursday; 4 days, 10 hours plus 1/2 hour unpaid lunch period each day.
- B. The day shift shall commence between the hours of 6:00 a.m. and 9:00 a.m. and shall end between the hours of 2:00 p.m. and 7:30 p.m. Starting and quitting times shall occur at the staging areas as may be designated by the Contractor.
- C. Scheduling – The Contractor shall have the option of scheduling either a five-day or four-day work week and the work day hours consistent with the Project requirements, the Project schedule and minimization of interference. When conditions beyond the control of the Contractor, such as severe weather, power failure, fire or natural disaster, prevent the performance of On-Site Project Work on a regularly scheduled work day, the Contractor may, with mutual agreement of the involved Local Unions on a trade-by-trade basis, schedule work on Friday (where on four 10s) or Saturday (where on five 8s) during that calendar week in which a work day was lost, at straight

time pay, provided that the employees involved work a total of 40 hours or less during that work week. When conditions on the Project cause the Contractor to stop work or be unable to commence work on the day in question, the Contractor will notify the Local Unions and the employees at that time that Friday or Saturday, as the case may be, will be a make-up day for the affected operation(s) and the Friday or Saturday work will then be at straight time for the day or any portion of the work day that work was stopped. The balance of the day on Friday or Saturday, if any, will be at time and one-half (1/2) the straight time rate of pay. If the Contractor seeks to cancel a day's work in advance of that day and to schedule the following Friday or Saturday as a make-up day, the determination of whether the Contractor is unable to perform the affected work operation(s) shall be jointly made between the Contractor and the involved Local Unions, the Local Unions' agreement not to be unreasonably withheld.

- D. Notice – Contractors shall provide not less than five (5) days prior notice to the Local Unions as to the work week and work hours scheduled to be worked or such lesser notice as may be mutually agreed upon.

SECTION 2 - OVERTIME

Overtime pay for hours outside of the standard work week and work day, described in Paragraph A above, shall be paid in accordance with the applicable Local Unions' collective bargaining agreements. There will be no restriction upon the Contractor's scheduling of overtime or the non-discriminatory designation of employees who work. There shall be no pyramiding of overtime pay under any circumstances. The Contractor shall have the right to schedule work so as to minimize overtime.

SECTION 3 - SHIFTS

- A. Flexible Schedules - Scheduling of shift work shall remain flexible in order to meet Project schedules and existing Project conditions including the minimization of interference with traffic. It is not necessary to work a day shift in order to schedule a second shift. Shifts must be worked a minimum of five consecutive work days, must have prior approval of the Contractor and/or subcontractor, and must be scheduled with not less than five work days notice to the Local Union.
- B. Second Shift - The second shift (starting between 2 p.m. and 8 p.m.) shall consist of 8 hours work (or 10 hours of work) for an equal number of hours pay at the straight time rate plus 15% in lieu of overtime and exclusive of a 1/2 hour unpaid lunch period. Where specifically required by the applicable Local Unions' collective bargaining agreements, employees on second shift, where there are no first shift employees scheduled for that trade, will be paid at time and one-half rates

for such second shift work, but without any shift differential. In all other cases, the first sentence of this paragraph B shall apply.

- C. Flexible Starting Times - Shift starting times will be adjusted by the Contractor as necessary to fulfill Project requirements subject to the notice requirements of Paragraph A.
- D. Four Tens - When working a four-day work week, the standard work day shall consist of 10 hours work for 10 hours of pay at the straight time rate exclusive of an unpaid 1/2 hour meal period and regardless of the starting time. This provision is applicable to night shifts only, and such night shifts are subject to the shift differential in paragraph B above.

SECTION 4 - HOLIDAYS

- A. Schedule - There shall be eight (8) recognized holidays on the Project:

New Year's Day	Labor Day
President's Day	Veterans Day
Memorial Day	Thanksgiving Day
Fourth of July	Christmas Day

All said holidays shall be observed on the dates designated by New York State law. In the absence of such designation, they shall be observed on the calendar date except those holidays which occur on Sunday shall be observed on the following Monday.

- B. Payment - Regular holiday pay, if any, and/or premium pay for work performed on such a recognized holiday shall be in accordance with the applicable Local Unions' collective bargaining agreements.
- C. Exclusivity - No holidays other than those listed in paragraph A above shall be recognized nor observed.

SECTION 5 - REPORTING PAY

- A. Employees who report to the work location pursuant to regular schedule and who are not provided with work or whose work is terminated early by a Contractor, for whatever reason, shall receive minimum reporting pay in accordance with the applicable Local Unions' collective bargaining agreements.
- B. When an employee, who has completed his/her scheduled shift and left the Project site, is "called out" to perform special work of a casual, incidental or irregular nature, the employee shall receive

pay for actual hours worked with a minimum guarantee, as may be required by the applicable Local Union's collective bargaining agreement, at the employee's straight time rate.

- C. When an employee leaves the job or work location of his/her own volition or is discharged for cause or is not working as a result of the Contractor's invocation of Section 7 below, he/she shall be paid only for the actual time worked.
- D. Except as specifically set forth in this Article, there shall be no premiums, bonuses, hazardous duty, high time or other special payment of any kind.
- E. There shall be no pay for time not actually worked except as specifically set forth in this Article and except where an applicable Local Union's collective bargaining agreement requires a full week's pay for forepersons.

SECTION 6 - PAYMENT OF WAGES

- A. Payday - Payment shall be made by check, drawn on a New York bank with branches located within commuting distance of the job site. Paychecks shall be issued by a Contractor at the job site by 10 a.m. on Thursdays. In the event that the following Friday is a bank holiday, paychecks shall be issued on Wednesday of that week. Not more than 3 days wages shall be held back in any pay period. Paycheck stubs shall contain the name and business address of the Contractor, together with an itemization of deductions from gross wages.
- B. Termination - Employees who are laid off or discharged for cause shall be paid in full for that which is due them at the time of termination. The Contractor shall also provide the employee with a written statement setting forth the date of lay off or discharge.

SECTION 7 - EMERGENCY WORK SUSPENSION

A Contractor may, if considered necessary for the protection of life and/or safety of employees or others, suspend all or a portion of On-Site Project Work. In such instances, employees will be paid for actual time worked; provided, however, that when a Contractor requests that employees remain at the job site available for work, employees will be paid for "stand by" time at their hourly rate of pay.

SECTION 8 - INJURY-DISABILITY

An employee who, after commencing work, suffers a work-related injury or disability while performing work duties, shall receive no less than 8 hours wages for that day. Further, the employee shall be rehired

at such time as able to return to duties provided there is still work available on the Project for which the employee is qualified and able to perform.

SECTION 9 - TIME KEEPING

A Contractor may utilize brassing or other systems to check employees in and out. Each employee must check in and out. The Contractor will provide adequate facilities for checking in and out in an expeditious manner.

SECTION 10 - MEAL PERIOD

A Contractor shall schedule an unpaid period of not more than 1/2 hour duration at the work location between the 3rd and 5th hour of the scheduled shift. A Contractor may, for efficiency of operation, establish a schedule which coordinates the meal periods of two or more trades. If an employee is required to work through the meal period, the employee shall be compensated in a manner established in the applicable Local Union's collective bargaining agreement.

SECTION 11 - BREAK PERIODS

There will be no rest periods, organized coffee breaks or other non-working time established during working hours. Individual coffee containers will be permitted at the employee's work location.

ARTICLE 13 - APPRENTICES

SECTION 1 - RATIOS

Recognizing the need to maintain continuing supportive programs designed to develop adequate numbers of competent workers in the construction industry and to provide trade entry opportunities for minorities and women, Contractors will employ apprentices in their respective trades to perform such work as is within their capabilities and which is customarily performed by the trade in which they are indentured. Contractors may utilize apprentices and such other appropriate classifications as are contained in the applicable Local Union's collective bargaining agreement in a ratio not to exceed 25% of the work force by trade (without regard to whether a lesser ratio is set forth in the applicable Local Union's collective bargaining agreement), unless the applicable Local Union's collective bargaining agreement provides for a higher percentage. Apprentices and such other classifications as are appropriate shall be employed in a manner consistent with the provisions of the appropriate Local Union's collective bargaining agreement.

SECTION 2 - DEPARTMENT OF LABOR

To assist the Contractors in attaining a maximum effort on this Project, the Local Unions agree to work in close cooperation with, and accept monitoring by, the New York State Department of Labor and the County to ensure that minorities and women are afforded every opportunity to participate in apprenticeship programs which result in the placement of apprentices on this Project. To further ensure that this contractor effort is attained, up to 50% of the apprentices placed on this Project shall be first year minority or women apprentices as shall be 60% of the apprentice equivalents, placed on the Project, who do not necessarily meet all of the age or entrance requirements for the apprentice program or have not necessarily passed the entrance examination. The Local Unions will cooperate with the contractor requests for minority, women or economically disadvantaged referrals to meet this contractor effort.

ARTICLE 14 - SAFETY PROTECTION OF PERSON AND PROPERTY

SECTION 1 - SAFETY REQUIREMENTS

Each Contractor will ensure that applicable OSHA requirements are at all times maintained on the Project and the employees and the Local Unions agree to cooperate fully with these efforts. Employees must perform their work at all times in a safe manner and protect themselves and the property of the Contractors and the County from injury or harm. Failure to do so will be grounds for discipline, including discharge.

SECTION 2 - CONTRACTOR RULES

Employees covered by this Agreement shall at all times be bound by the reasonable safety, security, and visitor rules as established by the Contractors for this Project. Such rules will be published and posted in conspicuous places throughout the Project.

SECTION 3 - INSPECTIONS

The Contractors retain the right to inspect incoming shipments of equipment, apparatus, machinery and construction materials of every kind.

ARTICLE 15 - NO DISCRIMINATION

SECTION 1 - COOPERATIVE EFFORTS

The Contractors and the Local Unions agree that they will not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, national origin, age or

marital status in any manner prohibited by law or regulation. It is recognized that special procedures may be established by the Contractors, the Local Unions and the New York State Department of Labor for the training and employment of persons who have not previously qualified to be employed on construction projects of the type covered by this Agreement. The parties to this Agreement will assist in such programs and agree to use their best efforts to ensure that the goals for female and minority employment are met on this Project.

SECTION 2 - LANGUAGE OF AGREEMENT

The use of the masculine or feminine gender in this Agreement shall be construed as including both genders.

ARTICLE 16 - GENERAL TERMS

SECTION 1 - PROJECT RULES

The Contractors shall establish such reasonable Project rules as are appropriate for the good order of the Project. These rules will be explained at the pre-job conference and posted at the Project site and may be amended thereafter as necessary. Failure of an employee to observe these rules and regulations shall be grounds for discipline, including discharge. The fact that no order was posted prohibiting a certain type of misconduct shall not be a defense to an employee disciplined or discharged for such misconduct when the action taken is for cause.

SECTION 2 - TOOLS OF THE TRADE

The welding/cutting torch and chain fall are tools of the trade having jurisdiction over the work performed. Employees using these tools shall perform any of the work of the trade. There shall be no restrictions on the emergency use of any tools or equipment by any qualified employee or on the use of any tools or equipment for the performance of work within the employee's jurisdictions.

SECTION 3 - SUPERVISION

Employees shall work under the supervision of the trade foreperson or general foreperson.

SECTION 4 - TRAVEL ALLOWANCES

There shall be no payments for travel expenses, travel time, subsistence allowance or other such reimbursements or special pay except as expressly set forth in this Agreement.

SECTION 5 - FULL WORK DAY

Employees shall be at their staging area at the starting time established by the Contractor and shall be returned to their staging area by quitting time after performing their assigned functions under the supervision of the Contractor. The signatories reaffirm their policy of a fair day's work for a fair day's wage.

SECTION 6 - COOPERATION

The Contractor and the Local Unions will cooperate in seeking any New York State Department of Labor approvals that may be required for implementation of any terms of this Agreement.

ARTICLE 17 - SAVINGS AND SEPARABILITY

SECTION 1 - THIS AGREEMENT

In the event that the application of any provision of this Agreement is enjoined, on either an interlocutory or permanent basis, or otherwise found in violation of law, the provision involved shall be rendered, temporarily or permanently, null and void but the remainder of the Agreement shall remain in full force and effect. In such event, the Agreement shall remain in effect for contracts already bid and awarded or in construction where the Contractor voluntarily accepts the Agreement. The parties to this Agreement will enter into negotiations for a substitute provision in conformity with the law and the intent of the parties for contracts to be let in the future.

SECTION 2 - THE BID SPECIFICATIONS

In the event that the County bid specifications, or other action, requiring that a successful bidder become signatory to this Agreement is enjoined, on either an interlocutory or permanent basis, or otherwise found in violation of law such requirement shall be rendered, temporarily or permanently, null and void but the Agreement shall remain in full force and effect to the extent allowed by law. In such event, the Agreement shall remain in effect for contracts already bid and awarded or in construction where the Contractor voluntarily accepts the Agreement. The parties will enter into negotiations as to modifications to the Agreement to reflect the court action taken and the intent of the parties for contracts to be let in the future.

SECTION 3 - NON-LIABILITY

In the event of an occurrence referenced in Section 1 or Section 2 of this Article, neither the County, the Contractors, or any Local Union shall be liable, directly or indirectly, for any action taken, or not taken, to

comply with any court order, injunction or determination. Project bid specifications will be issued in conformance with court orders then in effect and no retroactive payments or other action will be required if the original court determination is ultimately reversed.

SECTION 4 - NON-WAIVER

Nothing in this Article shall be construed as waiving the prohibitions of Article 7 as to Contractors and Local Unions.

ARTICLE 18 - FUTURE CHANGES IN SCHEDULE "A" COLLECTIVE BARGAINING AGREEMENTS

SECTION 1 - CHANGES TO COLLECTIVE BARGAINING AGREEMENTS

- A. The Contractors and/or Local Unions who are parties to the collective bargaining agreements which are applicable to the On-Site Project Work shall notify the Contractor in writing of any mutually agreed upon changes in provisions of such agreements and the effective dates of such changes.
- B. It is agreed that any provisions negotiated into collective bargaining agreements will not apply to On-Site Project Work if such provisions are less favorable to this Project than those uniformly required of contractors for construction work normally covered by those agreements; nor shall any provision be recognized or applied on this Project if it may be construed to apply exclusively, or predominantly, to work covered by this Agreement.
- C. Any disagreement between signatories to this Agreement over the application to On-Site Project Work of provisions agreed upon in the renegotiation of collective bargaining agreements shall be resolved in accordance with the procedure set forth in Article 9 of this Agreement.

SECTION 2 - LABOR DISPUTES DURING COLLECTIVE BARGAINING AGREEMENT NEGOTIATIONS

The Local Unions agree that there will be no strikes, work stoppages, sympathy actions, picketing, slowdowns or other disruptive activity or other violations of Article 7 affecting the Project by any Local Union involved in the renegotiation of collective bargaining agreements nor shall there be any lock-out on this Project affecting a Local Union during the course of such renegotiations.

ARTICLE 19 – WORKERS’ COMPENSATION ADR

All Local Unions, the Contractor and its subcontractors performing On-Site Project Work agree to adopt and be bound by the Alternative Dispute Resolution Agreement entered into between the Construction Industry Council of Westchester and Hudson Valley, Inc. and the Council (herein after referred to as the “Workers’ Compensation ADR Agreement”).

The Contractor and its subcontractors may provide Workers’ Compensation insurance through an alternative insurance carrier (or through self-insurance) or may use an alternative Program Manager, other than the primary carrier or Program Manager designated in Article III, Section 2 of the Workers’ Compensation ADR Agreement. The use of an alternative carrier (or self-insurance) and/or Program Manager is subject to approval by the Workers’ Compensation ADR Agreement Oversight Committee, which approval shall not be unreasonably withheld.

The determination to utilize the Workers’ Compensation ADR Agreement will be at the exclusive option of the County.

SIGNATURES

IN WITNESS WHEREOF the parties have caused this Agreement to be executed and effective as the ____ day of _____, 20__.

**BUILDING AND CONSTRUCTION TRADES COUNCIL OF
WESTCHESTER AND PUTNAM COUNTIES, NEW YORK, AFL-CIO
on behalf of itself and its affiliated Local Unions.**

BY: _____
PRESIDENT

DATE: _____

BY: _____
VICE-PRESIDENT

DATE _____

BY: _____
SECRETARY-TREASURER

DATE _____

{INSERT NAME OF CONTRACTOR}

BY: _____
(Name & Title)

DATE _____

**APPROVED BY:
COUNTY OF WESTCHESTER**

BY: _____
Commissioner of Public Works and Transportation

DATE: _____

Approved as to form:

Sr. Assistant County Attorney
County of Westchester

SCHEDULE “A”

LOCAL COLLECTIVE BARGAINING AGREEMENTS

Below is a list of the affiliate Local Unions of the Building and Construction Trades Council of Westchester and Putnam Counties, New York, AFL-CIO (“Council”). Copies of the applicable Collective Bargaining Agreements of the Local Unions can be obtained by writing to the Building and Construction Trades Council Westchester and Putnam Counties, New York AFL-CIO at 258 Saw Mill River Road, Elmsford, New York 10523, Attn: Edward Doyle, President.

1. Asbestos Workers Local #91 (International Association of Heat and Frost Insulators and Asbestos Workers).
2. Boilermakers Local #5
3. Bricklayers and Allied Craftworkers Local #5 New York
4. Bridge Painters Local 806
5. Dockbuilders Local Union 1456
6. Empire State Regional Council of Carpenters, Reg. 2, Local 11
7. Glaziers Local 1281
8. International Association of Bridge and Structural Ironworkers Local Union 40
9. International Brotherhood of Electrical Workers Local Union 363
10. International Brotherhood of Painters & Allied Trades District Council 9 of New York
11. International Union of Operating Engineers Local 15, 15A, 15B, 15C and 15D
12. International Union of Operating Engineers Local Unions No. 137, 137A, 137B, 137C, 137R
13. Iron Workers District Council of Greater New York and Vicinity
14. IUOE Local No. 30 – Operating Engineers
15. Laborers’ International Union of N.A. Local 235 of Westchester and Putnam Counties, New York AFL-CIO
16. Local One International Union of Elevator Constructors of New York and New Jersey – (AFL-CIO)
17. Local Union #3 International Brotherhood of Electrical Workers
18. Metal Polishers Local 8A-28A
19. Metallic Lathers Local No. 46
20. Millwright and Machinery Erectors Local Union No. 740
21. Operative Plasterers’ and Cement Masons’ International Association Local 530
22. Ornamental Ironworkers Local Union No. 580
23. Plumbers and Steamfitters Local 21
24. Resilient Floor Coverers Local No. 2287

25. Road Sprinkler Fitters Local 669
26. Sheet Metal Workers' International Association Local 137
27. Sheet Metal Workers' Local Union 38
28. Stone Derrickmen and Riggers Local Union No. 197
29. Teamsters Local 813 (Waste Removal)
30. Teamsters Local No. 814 (Moving & Storage)
31. Teamsters Local Union No. 456 (Construction)
32. Tile, Marble & Terrazzo Bricklayers & Allied Craftsmen Local Union No. 7 of New York & New Jersey
33. United Cement Masons' Union of Greater New York and Long Island Local 780
34. United Union of Roofers, Waterproofers and Allied Workers, Local No. 8, New York
35. Westchester Putnam Counties Heavy and Highway Laborers' Local No. 60 L.I.U.N.A.

Not all Local Unions will necessarily be involved in the Project. If it is determined that additional affiliates of the Council are required to be engaged in Project construction work, then the PLA will include those additional affiliates.



George Latimer, Westchester County Executive

TECHNICAL SPECIFICATIONS

**CROTONVILLE PUMPING STATION REHABILITATION
OSSINING SANITARY SEWER DISTRICT
OSSINING, NEW YORK**

CONTRACT NO. 17-529



333 West Washington Street | PO Box 4873 | Syracuse, NY 13221-4873 | (315) 956-6100 | www.obg.com
Advanced Manufacturing | Energy | Environment | Water

DEPARTMENT OF PUBLIC WORKS AND TRANSPORTATION

Division of Engineering

TABLE OF CONTENTS

TECHNICAL SPECIFICATIONS

CONTRACT NO. 17-529

DIVISION 1 – GENERAL REQUIREMENTS

Section 01 10 00	Summary	01 10 00-1 to 6
Section 01 31 00	Project Coordination	01 31 00-1 to 8
Section 01 32 00	Construction Progress Documentation	01 32 00-1 to 7
Section 01 33 00	Submittal Procedures	01 33 00-1 to 10
Section 01 42 00	References	01 42 00-1 to 11
Section 01 45 00	Quality Requirements	01 45 00-1 to 8
Section 01 51 00	Temporary Facilities and Controls	01 51 00-1 to 6
Section 01 52 00	Environmental Requirements for Construction	01 52 00-1 to 3
Section 01 60 00	Product Requirements	01 60 00-1 to 2
Section 01 73 00	Execution	01 73 00-1 to 10
Section 01 77 00	Closeout Procedures	01 77 00-1 to 4
Section 01 78 23	Operation and Maintenance Data	01 78 23-1 to 6
Section 01 78 40	Project Record Documents	01 78 40-1 to 3
Section 01 79 00	Demonstration and Training	01 79 00-1 to 4

DIVISION 2 – EXISTING CONDITIONS

Section 02 41 13	Selective Demolition	02 41 13-1 to 6
------------------	----------------------	-----------------

DIVISION 3 – CONCRETE

Section 03 30 00	Cast-in-Place Concrete	03 30 00-1 to 15
------------------	------------------------	------------------

DIVISION 5 – METALS

Section 05 50 00	Metal Fabrications	05 50 00-1 to 4
Section 05 52 13	Pipe and Tube Railings	05 52 13-1 to 8
Section 05 53 00	Metal Grating	05 53 00-1 to 6

DIVISION 6 – WOOD, PLASTICS, AND COMPOSITES

Section 06 10 00	Rough Carpentry	06 10 00-1 to 6
------------------	-----------------	-----------------

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

Section 07 01 50	Preparation for Re-Roofing	07 01 50-1 to 4
Section 07 21 00	Thermal Insulation	07 21 00-1 to 4
Section 07 27 26	Fluid Applied Weather Barrier	07 27 26-1 to 7
Section 07 53 23	EPDM Roofing	07 53 23-1 to 13
Section 07 72 00	Roof Accessories	07 72 00-1 to 7
Section 07 92 00	Joint Sealants	07 92 00-1 to 6

TABLE OF CONTENTS

DIVISION 8 – OPENINGS

Section 08 45 00	Insulated Translucent Panels	08 45 00-1 to 6
Section 08 90 00	Louvers and Vents	08 90 00-1 to 5

DIVISION 9 – FINISHES

Section 09 90 00	Field Painting	09 90 00-1 to 22
------------------	----------------	------------------

DIVISION 10 – SPECIALTIES

Section 10 28 13	Toilet Accessories	10 28 13-1 to 2
------------------	--------------------	-----------------

DIVISION 22 – PLUMBING

Section 22 05 00	Common Work Results for Plumbing	22 05 00-1 to 12
Section 22 05 23	General Duty Valves for Plumbing	22 05 23-1 to 11
Section 22 05 29	Hangers & Supports for Plumbing Piping and Equipment	22 05 29-1 to 6
Section 22 05 53	Identification for Plumbing Piping and Equipment	22 05 53-1 to 5
Section 22 05 93.50	Pipe Pressure Tests for Plumbing	22 05 93-1 to 5
Section 22 07 19	Plumbing Insulation	22 07 19-1 to 8
Section 22 11 16	Domestic Water Piping	22 11 16-1 to 5
Section 22 11 19	Domestic Water Piping Specialties	22 11 19-1 to 5
Section 22 11 23	Domestic Water Pumps	22 13 16-1 to 5
Section 22 11 30	Non-potable Water Piping	22 11 30-1 to 4
Section 22 13 16	Sanitary Waste and Vent Piping	22 13 16-1 to 5
Section 22 13 19	Sanitary Waste Piping Specialties	22 13 19-1 to 5
Section 22 33 00	Electric Domestic Water Heaters	22 33 00-1 to 3
Section 22 40 00	Plumbing Fixtures	22 40 00-1 to 3

DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING

Section 23 05 00	Common Work Results for HVAC	23 05 00-1 to 13
Section 23 05 29	Hangers and Supports for HVAC Systems	23 05 29-1 to 5
Section 23 05 53	Identification for HVAC Systems	23 05 53-1 to 4
Section 23 05 93	Testing Adjusting and Balancing for HVAC	23 05 93-1 to 12
Section 23 07 00	HVAC Insulation	23 07 00-1 to 10
Section 23 09 13	Instrumentation and Control Devices for HVAC	23 09 13-1 to 5
Section 23 31 00	HVAC Ducts and Casings	23 31 00-1 to 5
Section 23 33 00	Air Duct Accessories	23 33 00-1 to 5
Section 23 34 00	HVAC Fans	23 34 00-1 to 7
Section 23 37 00	Air Outlets and Inlets	23 37 00-1 to 6
Section 23 73 13	Heat Recovery Unit	23 73 13-1 to 8
Section 23 82 00	Electric Terminal Units	23 82 00-1 to 5

DIVISION 26 – ELECTRICAL

Section 26 00 00	Electrical	26 00 00-1 to 13
Section 26 00 20	Common Motor Requirements	26 00 20-1 to 6
Section 26 05 15	Medium Voltage Conductors	26 05 15-1 to 8
Section 26 05 19	Low-Voltage Electrical Power Conductors and Cables	26 05 19-1 to 7
Section 26 05 26	Grounding and Bonding for Electrical Systems	26 05 26-1 to 6

TABLE OF CONTENTS

Section 26 05 33	Raceways and Boxes for Electrical Systems	26 05 33-1 to 11
Section 26 05 53	Identification for Electrical Systems	26 05 53-1 to 4
Section 26 05 73	Overcurrent Protective Device Coordination Study	26 05 73-1 to 7
Section 26 09 16	Electrical Controls	26 09 16-1 to 4
Section 26 21 00	Electrical Service Entrance	26 21 00-1 to 3
Section 26 22 13	Low-Voltage Distribution Transformers	26 22 13-1 to 4
Section 26 24 13	Switchboard	26 24 13-1 to 5
Section 26 24 16	Panelboards	26 24 16-1 to 5
Section 26 24 19	Motor Control Centers	26 24 19-1 to 8
Section 26 27 26	Wiring Devices	26 27 27-1 to 5
Section 26 28 16	Enclosed Switches	26 28 16-1 to 8
Section 26 32 13	Diesel-Engine-Driven Generator Sets	26 32 13-1 to 16
Section 26 41 13	Lightning Protection for Structures	26 41 13-1 to 5
Section 26 43 00	Surge Protective Devices	26 43 00-1 to 3
Section 26 50 00	Lighting	26 50 00-1 to 3
 DIVISION 27 – COMMUNICATIONS		
Section 27 00 00	Communications	27 00 00-1 to 3
 DIVISION 31 – EARTHWORK		
Section 31 01 01	Earthwork	31 01 01-1 to 9
Section 31 05 14	Select Fill	31 05 14-1 to 3
Section 31 23 33	Trench Excavation and Backfill	31 23 33-1 to 3
 DIVISION 32 – EXTERIOR IMPROVEMENTS		
Section 32 01 00	Restoration of Surfaces	32 01 00-1 to 5
Section 32 12 16	Asphalt Paving	32 12 16-1 to 3
Section 32 31 13	Chain Link Fences and Gates	32 31 13-1 to 5
Section 32 93 13	Topsoil and Seeding	32 93 13-1 to 3
 DIVISION 33 – UTILITIES		
Section 33 29 60	Wastewater Temporary Bypass Pumping	33 29 60-1 to 4
 DIVISION 40 – PROCESS INTERCONNECTIONS		
Section 40 05 07	Hangers and Supports for Process Piping	40 05 07-1 to 7
Section 40 05 13	Process Piping Systems	40 05 13-1 to 16
Section 40 05 25	Miscellaneous Valves and Appurtenances	40 05 25-1 to 5
Section 40 05 52	Identification for Process Piping and Equipment	40 05 52-1 to 6
Section 40 05 53	Process Valves Three Inches and Larger	40 05 53-1 to 6
Section 40 05 59	Stainless Steel Gates	40 05 59-1 to 8
Section 40 05 76	Line Stop Bypass System	40 05 76-1 to 6
Section 40 61 00	Process Control Systems	40 61 00-1 to 11
Section 40 61 13	Process Control System Integrator General Provisions	40 61 13-1 to 12
Section 40 63 43	Programmable Logic Controllers	40 63 43-1 to 11
Section 40 67 00	Control System Equipment Panels	40 67 00-1 to 14
Section 40 71 00	Instrumentation and Control for Process Piping	40 71 00-1 to 16

TABLE OF CONTENTS

Section 40 71 13.13	Inline Magnetic Flow Meter	40 71 13-1 to 9
Section 40 72 13	Ultrasonic Level Meters	40 72 13-1 to 7
Section 40 72 43	Pressure Type Level Meters	40 72 43-1 to 8
Section 40 72 46	Bubbler Systems	40 72 46-1 to 9
Section 40 72 76	Level Switches	40 72 76-1 to 8
Section 40 73 26	Gauge Pressure Transmitters	40 73 26-1 to 8
Section 40 73 36	Pressure and Differential Pressure Switches	40 73 36-1 to 8
Section 40 76 00	Gas Analysis System	40 76 00-1 to 11
Section 40 78 63	Alarm Dialer	40 78 63-1 to 11
DIVISION 43 – PROCESS GAS AND LIQUID HANDLING, PURIFICATION AND STORAGE EQUIPMENT		
Section 43 21 16	Tests on Pumping Equipment	43 21 16-1 to 5
Section 43 21 39	Dry Pit Submersible Pumps	43 21 39-1 to 11
Section 43 41 43	Polyethylene Chemical Storage Tanks	43 41 43-1 to 8
DIVISION 46 – WATER AND WASTEWATER EQUIPMENT		
Section 46 21 16	Flexible Rake Bar Screens	46 21 16-1 to 14
Section 46 33 44	Peristaltic Chemical Feed Pumps	46 33 44-1 to 7

SECTION 01 10 00 SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Project information
 - 2. Work covered by Contract Documents
 - 3. Access to site
 - 4. Coordination with Occupants
 - 5. Work restrictions
 - 6. Demolition, Salvage, and Recycle of Equipment and Materials
 - 7. Specification and drawing conventions

1.2 PROJECT INFORMATION

- A. Project Identification: Crotonville Pumping Station Rehabilitation, Ossining Sanitary Sewer District
 - 1. Project Location: Croton River Road, Ossining, NY 10562
- B. Owner: Westchester County Department of Public Works and Transportation, Michaelian Office Building, 148 Martine Avenue, White Plains, NY, 10601
- C. Engineer: O'Brien & Gere Engineers, Inc., 50 Main Street, Suite 1000, White Plains, NY 10606

1.3 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of the Project is defined by the Contract Documents and generally consists of the following:
 - 1. Construction of comprehensive improvements to the existing pumping station. Improvements include, but are not limited to, new dry-pit submersible pumps, mechanically cleaned bar screen and washer-compactor, all associated piping, valves and appurtenances, flood-mitigating improvements to the facility, electrical improvements, and an extensive bypass pumping operation.
- B. Type of Contract
 - 1. Project will be constructed under a single General Contract, as defined herein and in the Contract Drawings.

1.4 ACCESS TO SITE

- A. General: Contractor shall have shared use of Project site for construction operations during construction period within project limits, as shown. Contractor's use of Project site is limited by Owner's right to operate and maintain existing facilities.
- B. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Limits: Confine construction operations to the limits indicated on the Contract Drawings.
2. Owner Occupancy: Allow for Owner occupancy of Project site.
3. Driveways, Walkways and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. Use of Existing Building: Maintain existing buildings in weathertight condition throughout construction period. Repair damage caused by construction operations.

1.5 COORDINATION WITH OCCUPANTS

- A. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.
 1. Engineer will prepare a Certificate of Partial Utilization for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
 2. Obtain a Certificate of Occupancy from authorities having jurisdiction before Owner occupancy.
 3. Before partial Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
 4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.6 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 1. Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: In accordance with the General Clauses.
- C. Employee Identification: Provide identification tags for Contractor personnel working on the Project site. Require personnel to utilize identification tags at all times.
- D. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 1. Notify Engineer not less than five (5) days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Engineer and Owner's written permission.

1.7 DEMOLITION, SALVAGE AND RECYCLE OF EQUIPMENT AND MATERIALS

- A. Existing equipment and materials removed, and not shown or specified to be reused as part of the Work, shall become Contractor's property except as designated for salvage by Owner. For items designated for salvage by Owner, Contractor shall remove items from the site and arrange for transfer of these items to Owner.
- B. All metal waste, including items containing lead based paints (except for motors) shall be placed in Owner supplied dumpsters for recycling by Owner. Owner will, through a third-party hauling company, provide a dumpster for collection of metal items removed as part of the Work. Contractor shall separate metal items, cut them as required to fit a 20-cubic yard dumpster with approximate dimensions of 8' wide x 4' high x 22' long, and deposit them into the designated dumpster. This dumpster will be removed from the site by the third-party hauling company. Contractor shall coordinate dumpster replacement through WCDEF operations staff. Contractor shall notify Owner a minimum of five (5) working days in advance of needing a replacement dumpster.
- C. Electric motors shall be turned over to Owner and brought to storage garage.
- D. Contractor to cut metal waste as required to fit in dumpster and to inform Owner when dumpster is almost full. Owner reserves the right to designate any and all removed equipment and materials as salvage by Owner.
- E. Existing equipment and materials removed by Contractor shall not be reused in the Work, except where so specified or indicated.
- F. Carefully remove, in a manner to prevent damage, all equipment and materials specified or indicated to be salvaged and reused or to remain the property of Owner. Store and protect salvaged items specified or indicated to be reused in the Work. Replace in kind or with new items any items damaged in removal, storage, or handling through carelessness or improper procedures.
- G. Refer to Specification Section 02 41 00 for more details.

1.8 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on the Contract Drawings are described in detail in the Specifications. One or more of the following are used on the Contract Drawings to identify materials and products:
 - 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 - 2. Abbreviations: Materials and products are identified by abbreviations scheduled on Contract Drawings.

1.9 MEASUREMENT AND PAYMENT – GENERAL

A. Lump Sum Items

1. Payment for the work of lump sum items will be made at the Contractor's lump sum prices stated in the Bid and appropriate to each item identified.
2. No payment will be made for work performed by Contractor to replace defective work, or for work which is not shown or ordered, or which is outside the limits shown or ordered.
3. Payment for fixed maximum lump sum items will be made as specified.
4. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

B. Unit Price Items

1. Payment for the work of unit price items will be made at the Contractor's unit prices stated in the Bid and appropriate to each item identified.
2. No payment will be made for work performed by Contractor to replace defective work, or for work which is not shown or ordered, or which is outside the limits shown or ordered.

1.10 BID ITEM DESCRIPTIONS

A. Item 1 – Crotonville Pumping Station Construction

1. Method of Payment: Lump Sum
2. Work Included
 - a. Work under this Item shall generally be comprised of the following:
 - 1) Coordination with Owner, Engineer, and utilities
 - 2) Selective demolition and removals indicated on the Contract Drawings
 - 3) Cast-in-place concrete, including flood mitigation walls
 - 4) Metals, including metal fabrications, stairs and aluminum railing
 - 5) FRP grating
 - 6) Double leaf watertight access hatch
 - 7) Watertight manhole covers
 - 8) Joint sealants
 - 9) Field painting of work provided under this Item
 - 10) Erosion and sediment control
 - 11) Select fill materials shown on the Contract Drawings
 - 12) Restoration of surfaces
 - 13) Earthwork, excavation and backfill shown on the Contract Drawings and required to perform work as shown
 - 14) Rough and finish grading
 - 15) Asphalt pavement

- 16) Topsoil and seeding
- 17) Gate valves
- 18) Temporary bypass pumping
- 19) Process piping systems (inside and outside), including pressure and leakage testing, hangers and supports
- 20) Magnetic flow meter
- 21) Mechanical bar screen and washer/compactor
- 22) Manual bar rack
- 23) Slide gates
- 24) Stop plates
- 25) Replacement of existing chain link fence
- 26) Bollards
- 27) Record drawings
- 28) Operation and maintenance manuals for equipment provided under this Item
- 29) Electrical demolition
- 30) Motor control center
- 31) Lighting panel
- 32) Diesel generator
- 33) Transformers and switchgear
- 34) Grounding and bonding
- 35) Panelboards
- 36) Low voltage distribution transformer
- 37) Electrical controls and relays
- 38) Enclosed controllers
- 39) Wiring devices
- 40) Lighting
- 41) Combustible gas monitoring equipment
- 42) Identification for electrical systems
- 43) Installation of mechanical bar screen control panel furnished by General Contract
- 44) Instrumentation
- 45) Wiring including conduit, conductor, fittings, junction boxes, handholes, pull boxes, supports, connections to equipment of this Item, connections to equipment, connections to existing equipment and connection to existing wiring; all wall and floor penetrations necessary for wiring installation; sealing of wall and floor penetrations necessary for wiring installation; excavation, concrete, reinforcing steel, backfill and restoration of surfaces necessary for wiring installation
- 46) All supports, concrete for supports, hardware, devices and appurtenances necessary for a complete installation

- 47) All testing, start-up and adjustments necessary for placing into satisfactory working condition equipment, systems and wiring of this Item including existing equipment and wiring modified or connected by this Item
 - 48) Make up air handling equipment
 - 49) Ventilation system ductwork, duct heater, fans and controls
 - 50) Hangers, supports, mechanical identification, ductwork accessories, duct insulation, and duct jacketing
 - 51) Testing, adjusting and balancing of ventilation systems
- 3. Related Work Not Included
 - a. Concrete Surface Repair
 - b. Concrete Crack Repair

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 31 00 PROJECT COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General project coordination procedures
 - 2. Administrative and supervisory personnel
 - 3. Coordination drawings
 - 4. Requests for Information (RFIs)
 - 5. Project meetings
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

1.2 DEFINITIONS

- A. RFI: Request from Owner, Engineer, or Contractor seeking information from each other during construction.

1.3 COORDINATION

- A. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with operations, included in different Sections that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Contractor's construction schedule
 - 2. Preparation of schedule of values
 - 3. Installation and removal of temporary facilities and controls
 - 4. Delivery and processing of submittals
 - 5. Progress meetings
 - 6. Preinstallation conferences

7. Startup and adjustment of systems
8. Project closeout activities

1.4 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings in accordance with requirements in individual Sections, where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
 1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a. Use applicable Contract Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
 - b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
 - c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, instrumentation and electrical systems.
 - d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
 - e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
 - f. Indicate required installation sequences.
 - g. Indicate dimensions shown on the Contract Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Engineer indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:
 1. Floor Plans: Show Architectural and structural elements, and mechanical, plumbing, and electrical Work. Supplement plan drawings with section drawings where required to adequately represent the Work.
 2. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire protection, fire alarm, and electrical equipment.
 3. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
 4. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
 5. Electrical Work: Show the following:
 - a. Runs of vertical and horizontal conduit 1-1/4 inch diameter and larger.

- b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire alarm locations.
 - c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
 - d. Location of pull boxes and junction boxes, dimensioned from column center lines.
6. Review: Engineer will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are the Contractor's responsibility. If Engineer determines that the coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, the Engineer will so inform the Contractor, who shall make changes as directed and resubmit.
 7. Coordination Drawing Prints: Prepare coordination drawing prints in accordance with requirements of Division 01 Section "Submittal Procedures."

1.5 KEY PERSONNEL

- A. Key Personnel Names: Within 5 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and email addresses. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.

1.6 REQUESTS FOR INFORMATION (RFIS)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
 1. Engineer will return RFIs submitted by other entities controlled by Contractor with no response.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
 1. Project name
 2. Project number
 3. Date
 4. Name of Contractor
 5. Name of Engineer
 6. RFI number, numbered sequentially
 7. RFI subject
 8. Specification Section number and title and related paragraphs, as appropriate
 9. Drawing number and detail references, as appropriate
 10. Field dimensions and conditions, as appropriate
 11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Price, Contractor shall state impact in the RFI.

12. Contractor's signature
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Engineer.
- D. Engineer will review each RFI, determine action required, and respond. In general, allow seven (7) working days for response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.
 1. The following RFIs will be returned without action:
 - a. Requests for approval of submittals
 - b. Requests for approval of substitutions
 - c. Requests for coordination information already indicated in the Contract Documents
 - d. Requests for adjustments in the Contract Time or the Contract Price
 - e. Requests for interpretation of Engineer's actions on submittals
 - f. Incomplete RFIs or inaccurately prepared RFIs
 2. Action may include a request for additional information, in which case time for response will date from time of receipt of additional information.
 3. If Contractor believes an RFI response warrants change in the Contract Time or the Contract Price, notify Engineer in writing within 10 days of receipt of the RFI response, in accordance with the General Conditions.
- E. Review response and notify Engineer within seven days if Contractor disagrees with response.
- F. RFI Log: Engineer will prepare, maintain, and regularly distribute to Contractor a tabular log of RFIs organized by RFI number, including the following:
 1. Project name
 2. Name and address of Contractor
 3. Name and address of Engineer
 4. RFI number
 5. RFI description
 6. Date the RFI was submitted
 7. Date Engineer's response was received
 8. Identification of related Field Order, Work Change Directive, and Change Proposal, as appropriate

1.7 PROJECT MEETINGS

- A. General: Engineer will schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

1. Attendees: Engineer will inform participants and others involved, and individuals whose presence is required, of date and time of each meeting.
 2. Agenda: Engineer will prepare the meeting agenda and distribute to all invited attendees.
 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to all parties concerned, including Owner, Engineer and Contractors, within five days of the meeting.
- B. Preconstruction Conference: Engineer will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner, but no later than 30 days after execution of the Agreement.
1. Conduct the conference to review responsibilities and personnel assignments.
 2. Attendees: Authorized representatives of Owner, Engineer, and their consultants; Contractor and its superintendent; representatives from regulatory agencies, highway/public works, and utilities as appropriate; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Items of significance that could affect progress, including the following:
 - a. Tentative construction schedule
 - b. Phasing
 - c. Critical work sequencing and long-lead items
 - d. Designation of key personnel and their duties
 - e. Lines of communications
 - f. Procedures for processing field decisions and Change Orders
 - g. Procedures for RFIs
 - h. Procedures for testing and inspecting
 - i. Procedures for processing Applications for Payment
 - j. Distribution of the Contract Documents
 - k. Submittal procedures
 - l. Preparation of record documents
 - m. Use of the premises
 - n. Work restrictions
 - o. Working hours
 - p. Owner's occupancy requirements
 - q. Responsibility for temporary facilities and controls
 - r. Coordination of separate contracts
 - s. Procedures for disruptions and shutdowns
 - t. Parking availability
 - u. Office, work, and storage areas
 - v. Equipment deliveries and priorities
 - w. First aid

- x. Security
 - y. Progress cleaning
- 4. Minutes: Engineer will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
 - 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Engineer of scheduled meeting dates.
 - 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents
 - b. Related RFIs
 - c. Related Change Orders
 - d. Purchases
 - e. Deliveries
 - f. Submittals
 - g. Review of mockups
 - h. Possible conflicts
 - i. Compatibility problems
 - j. Time schedules
 - k. Weather limitations
 - l. Manufacturer's written recommendations
 - m. Warranty requirements
 - n. Compatibility of materials
 - o. Acceptability of substrates
 - p. Temporary facilities and controls
 - q. Space and access limitations
 - r. Regulations of authorities having jurisdiction
 - s. Testing and inspecting requirements
 - t. Installation procedures
 - u. Coordination with other work
 - v. Required performance results
 - w. Protection of adjacent work
 - x. Protection of construction and personnel
 - 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 - 4. Reporting: Appropriate Contractor shall distribute minutes of the meeting to each party present and to other parties requiring information, including Engineer.

5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Project Closeout Conference: Engineer will schedule and conduct a Project closeout conference, at a time convenient to Owner, but no later than 30 days prior to the scheduled date of Substantial Completion.
1. The conference is to review requirements and responsibilities related to Project closeout.
 2. Attendees: Authorized representatives of Owner, Engineer, and their consultants; Contractor and its superintendent; representatives from regulatory agencies, highway/public works, and utilities as appropriate; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Preparation of record documents
 - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
 - c. Submittal of written warranties
 - d. Requirements for preparing operations and maintenance data
 - e. Requirements for demonstration and training
 - f. Preparation of punch list
 - g. Procedures for processing Applications for Payment at Substantial Completion and for final payment
 - h. Submittal procedures
 - i. Coordination of separate contracts
 - j. Owner's partial occupancy requirements
 - k. Installation of Owner's furniture, fixtures, and equipment
 - l. Responsibility for removing temporary facilities and controls
 4. Minutes: Engineer will record and distribute meeting minutes.
- E. Progress and Coordination Meetings: Engineer will conduct progress and coordination meetings at biweekly intervals during periods of active construction.
1. Coordinate dates of meetings with preparation of payment requests.
 2. Attendees: Authorized representatives of Owner, Engineer and their consultants; Contractor and its superintendent; representatives from regulatory agencies, highway/public works, and utilities as appropriate; major subcontractors; suppliers; and other concerned parties shall attend these meetings. Participants at meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Review and correct or approve minutes of previous progress and coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Progress Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to

Contractor's progress schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

- 1) Review schedule for next period.
- b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements
 - 2) Sequence of operations
 - 3) Status of submittals
 - 4) Deliveries
 - 5) Off-site fabrication
 - 6) Access
 - 7) Site utilization
 - 8) Temporary facilities and controls
 - 9) Progress cleaning
 - 10) Quality and work standards
 - 11) Status of correction of deficient items
 - 12) Field observations
 - 13) Status of RFIs
 - 14) Status of proposal requests
 - 15) Pending changes
 - 16) Status of Change Orders
 - 17) Pending claims and disputes
 - 18) Documentation of information for payment requests
4. Minutes: Engineer will record and distribute the meeting minutes to each party present and to parties requiring information.
5. Schedule Updating: Revise Contractor's progress schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 32 00 CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Contractor's construction schedule

1.2 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Price, unless otherwise approved by Engineer.
- C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of the Project.
- D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- E. Event: The starting or ending point of an activity.
- F. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
 - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- G. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.3 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. PDF electronic file

- B. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
 - 1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.
- C. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
 - 1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
 - 2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
 - 3. Total Float Report: List of all activities sorted in ascending order of total float.
 - 4. Earnings Report: Compilation of Contractor's total earnings from Notice to Proceed until most recent Application for Payment.
- D. Qualification Data: For scheduling consultant.

1.4 QUALITY ASSURANCE

- A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams as specified herein.
- B. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Coordination." Review methods and procedures related to the Contractor's construction schedule, including, but not limited to, the following:
 - 1. Review software limitations and content and format for reports.
 - 2. Verify availability of qualified personnel needed to develop and update schedule.
 - 3. Discuss constraints, including interim Milestones and Partial Utilization.
 - 4. Review delivery dates for Owner-furnished products.
 - 5. Review schedule for work of Owner's separate contracts.
 - 6. Review time required for review of submittals and resubmittals.
 - 7. Review requirements for tests and inspections by independent testing and inspecting agencies.
 - 8. Review time required for completion and startup procedures.
 - 9. Review and finalize list of construction activities to be included in schedule.
 - 10. Review submittal requirements and procedures.
 - 11. Review procedures for updating schedule.

1.5 COORDINATION

- A. Contractor shall incorporate detailed schedules prepared by sub-contractors (as applicable) into the overall Progress Schedule, and shall maintain throughout duration of Project.

- B. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
- C. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work from entities involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for Notice to Proceed to date of final completion.
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each separate area as a separate numbered activity for each principal element of the Work. Comply with the following:
 - 1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Engineer.
 - 2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 - 3. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
 - 4. Startup and Testing Time: Include appropriate durations for startup and testing.
 - 5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Engineer's and Construction Manager's administrative procedures necessary for certification of Substantial Completion.
 - 6. Punch List and Final Completion: Include preparation of punch lists and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
 - 1. Work under More Than One Contract: Include separate activities for each contract.
 - 2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
 - 3. Owner-Furnished Products: Include a separate activity for each product.
 - 4. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Subcontract awards
 - b. Submittals

- c. Purchases
- d. Mockups
- e. Fabrication
- f. Sample testing
- g. Deliveries
- h. Installation
- i. Tests and inspections
- j. Adjusting
- k. Curing
- l. Startup, commissioning and placement into final use and operation
- 5. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
 - a. Structural completion
 - b. Permanent space enclosure
 - c. Completion of mechanical installation
 - d. Completion of electrical installation
 - e. Substantial Completion
- 6. Other Constraints: As may apply.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule.
- E. Cost Correlation: At the head of schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of the Work performed as of dates used for preparation of payment requests.
- F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
 - 1. Unresolved issues
 - 2. Unanswered RFIs
 - 3. Rejected or unreturned submittals
 - 4. Notations on returned submittals
- G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.
- H. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. CPM Schedule: Prepare Contractor's construction schedule using a cost- and resource-loaded, time-scaled CPM network analysis diagram for the Work.
 - 1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 60 days after date of the Notice of Award.
 - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Engineer's approval of the schedule.
 - 2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
 - 3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 - 4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to correlate with Contract Time.
- C. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the start-up network diagram, prepare a skeleton network to identify probable critical paths.
 - 1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
 - a. Preparation and processing of submittals
 - b. Mobilization and demobilization
 - c. Purchase of materials
 - d. Delivery
 - e. Fabrication.
 - f. Utility interruptions
 - g. Installation
 - h. Work by Owner that may affect or be affected by Contractor's activities.
 - i. Testing and commissioning
 - j. Punch list and final completion
 - k. Activities occurring following final completion
 - 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract Milestone dates.
 - 3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
 - 4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

- a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
- 5. Cost- and Resource-Loading of CPM Schedule: Assign cost to construction activities on the CPM schedule. Do not assign costs to submittal activities. Obtain Engineer's approval prior to assigning costs to fabrication and delivery activities. Assign costs under principal subcontracts for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project record documents, and demonstration and training (if applicable), in the amount of 5 percent of the Contract Price.
 - a. Each activity cost shall reflect an appropriate value subject to approval by Engineer.
 - b. Total cost assigned to activities shall equal the total Contract Price.
- D. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.
- E. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
 - 1. Contractor or subcontractor and the Work or activity
 - 2. Description of activity
 - 3. Principal events of activity
 - 4. Immediate preceding and succeeding activities
 - 5. Early and late start dates
 - 6. Early and late finish dates
 - 7. Activity duration in workdays
 - 8. Total float or slack time
 - 9. Average size of workforce
 - 10. Dollar value of activity (coordinated with the schedule of values).
- F. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
 - 1. Identification of activities that have changed
 - 2. Changes in early and late start dates
 - 3. Changes in early and late finish dates
 - 4. Changes in activity durations in workdays
 - 5. Changes in the critical path
 - 6. Changes in total float or slack time
 - 7. Changes in the Contract Time
- G. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.
 - 1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
 - 2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.

3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.
 - a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
 - b. Submit value summary printouts one week before each regularly scheduled progress meeting.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.
 1. In-House Option: Owner may waive the requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
 2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.
- B. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
 1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 3. As the Work progresses, indicate final completion percentage for each activity.
- C. Distribution: Distribute copies of approved schedule to Engineer, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
 1. Post copies in Project meeting rooms and temporary field offices.
- D. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION

SECTION 01 33 00 SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Requirements in this Section are in addition to those specified in the General Clauses.

1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Engineer's responsive action. Action submittals are those submittals indicated in individual Specification Sections as action submittals.
- B. Informational Submittals: Written and graphic information and physical samples that do not require Engineer's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as informational submittals.
- C. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.3 ACTION SUBMITTALS

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or modifications to submittals noted by the Engineer and additional time for handling and reviewing submittals required by those corrections.
 - 1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
 - 2. Initial Submittal: Submit concurrently with start-up construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
 - 3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
 - 4. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal
 - b. Specification Section number and title
 - c. Submittal category: Action, informational
 - d. Name of subcontractor

- e. Description of the Work covered
- f. Scheduled date for Engineer's final release or approval
- g. Scheduled dates for purchasing
- h. Scheduled dates for installation
- i. Activity or event number

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Engineer's Digital Data Files: Electronic copies of CAD Drawings of the Contract Drawings will be provided by Engineer for Contractor's use in preparing submittals.
 - 1. Engineer will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.
 - a. Engineer makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
 - b. Digital Drawing Software Program: Contract Drawings are available in AutoCAD® 2013 and newer for Windows by Autodesk, Inc.
 - c. Contractor shall execute a data licensing agreement in the form of AIA Document C106, Digital Data Licensing Agreement or a similar form acceptable to the Owner and Engineer.
 - d. Electronic drawing files are furnished only for the convenience of the Contractor. Any conclusions or information obtained or derived from such electronic files shall be at the Contractor's sole risk. In the event of a discrepancy between the electronic files and the paper copies, the paper copies shall govern. Engineer makes no representation as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by Engineer.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 - 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 - 4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow 15 days for review of each resubmittal.
- D. Identification and Information: Identify and incorporate information in each electronic submittal file as follows:
1. Assemble complete submittal package into a single indexed file with links enabling navigation to each item.
 2. Name file with submittal number or other unique identifier, including revision identifier.
 - a. File name shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06100.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06100.01.A).
 3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Engineer.
 4. Include the following information on an inserted cover sheet:
 - a. Project name
 - b. Date
 - c. Name and address of Engineer
 - d. Name of Contractor
 - e. Name of firm or entity that prepared submittal
 - f. Name of subcontractor
 - g. Name of supplier
 - h. Name of manufacturer
 - i. Number and title of appropriate Specification Section
 - j. Drawing number and detail references, as appropriate
 - k. Location(s) where product is to be installed, as appropriate
 - l. Related physical samples submitted directly
 - m. Other necessary identification
 5. Include the following information as keywords in the electronic file metadata:
 - a. Project name
 - b. Number and title of appropriate Specification Section
 - c. Manufacturer name
 - d. Product name
- E. Options: Identify options requiring selection by the Engineer.
- F. Deviations: Identify deviations from the Contract Documents on submittals.

- G. Transmittal: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Engineer will return submittals without review, received from sources other than Contractor.
 - 1. Transmittal Form: Provide locations on form for the following information:
 - a. Project name
 - b. Date
 - c. Destination (To:)
 - d. Source (From:)
 - e. Names of subcontractor, manufacturer, and supplier
 - f. Category and type of submittal
 - g. Submittal purpose and description
 - h. Specification Section number and title
 - i. Indication of full or partial submittal
 - j. Drawing number and detail references, as appropriate
 - k. Transmittal number, numbered consecutively
 - l. Submittal and transmittal distribution record
 - m. Remarks
 - n. Signature of transmitter
 - 2. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Engineer on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 - 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked with approval notation from Engineer's action stamp.
- I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- J. Use for Construction: Use only final submittals that are marked with approval notation from Engineer's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 - 1. Submit electronic submittals via email as PDF electronic files.

- a. Engineer will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
2. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in the Section entitled "Closeout Procedures."
3. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 - a. Provide a digital signature with digital certificate on electronically-submitted certificates and certifications where indicated.
 - b. Provide a notarized statement on original paper copy certificates and certifications where indicated.
4. Test and Inspection Reports Submittals: Comply with requirements specified in the Section entitled "Quality Requirements."
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts
 - b. Manufacturer's product specifications
 - c. Standard color charts
 - d. Statement of compliance with specified referenced standards
 - e. Testing by recognized testing agency
 - f. Application of testing agency labels and seals
 - g. Notation of coordination requirements
 - h. Availability and delivery time information
 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring
 - b. Printed performance curves
 - c. Operational range diagrams
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 5. Submit Product Data before or concurrent with Samples.
 6. Submit Product Data in the following format:
 - a. PDF electronic file
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based upon Engineer's digital data drawing files is otherwise permitted.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products
 - b. Schedules
 - c. Compliance with specified standards
 - d. Notation of coordination requirements
 - e. Notation of dimensions established by field measurement
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified
2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 42 inches.
3. Submit Shop Drawings in the following format:
 - a. PDF electronic file
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample
 - b. Product name and name of manufacturer
 - c. Sample source
 - d. Number and title of applicable Specification Section
 3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit two full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Engineer will return submittal with options selected.
 5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing

color, texture, and pattern; color range sets; and components used for independent testing and inspection.

- a. Number of Samples: Submit three sets of Samples. Engineer will retain two Sample sets; remainder will be returned.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
 1. Type of product. Include unique identifier for each product indicated in the Contract Documents.
 2. Manufacturer and product name, and model number if applicable.
 3. Number and name of room or space
 4. Location within room or space
 5. Submit product schedule in the following format:
 - a. PDF electronic file
- F. Contractor's Construction Schedule: Comply with requirements specified in the Section entitled "Construction Progress Documentation."
- G. Application for Payment: Comply with requirements specified in General Conditions.
- H. Schedule of Values: Comply with requirements specified in General Conditions.
- I. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 2. Number and title of related Specification Section(s) covered by subcontract.
 3. Drawing number and detail references, as appropriate, covered by subcontract.
 4. Submit subcontract list in the following format:
 - a. PDF electronic file
- J. Coordination Drawings: Comply with requirements specified in Division 01 Section "Project Coordination."
- K. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of Engineers and owners, and other information specified.
- L. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on American Welding Society (AWS) forms. Include names of firms and personnel certified.

- M. **Installer Certificates:** Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- N. **Manufacturer Certificates:** Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- O. **Product Certificates:** Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- P. **Material Certificates:** Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- Q. **Material Test Reports:** Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- R. **Product Test Reports:** Submit written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- S. **Research Reports:** Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - 1. Name of evaluation organization
 - 2. Date of evaluation
 - 3. Time period when report is in effect
 - 4. Product and manufacturers' names
 - 5. Description of product
 - 6. Test procedures and results
 - 7. Limitations of use
- T. **Schedule of Tests and Inspections:** Comply with requirements specified in the Section entitled "Quality Requirements."
- U. **Preconstruction Test Reports:** Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- V. **Compatibility Test Reports:** Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- W. **Field Test Reports:** Submit reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- X. **Maintenance Data:** Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."
- Y. **Design Data:** Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and

calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Engineer.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally-signed PDF electronic file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Engineer.
- B. Project Closeout and Maintenance/Material Submittals: Refer to requirements in the Section entitled "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ENGINEER'S ACTION

- A. General: Engineer will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Engineer will review each submittal, make marks to indicate corrections or modifications required, and return it. Engineer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:
 - 1. "Reviewed," if no change or rejection is made.
 - 2. "Reviewed and Noted," if minor changes or additions are made but resubmittal is not considered necessary.
 - 3. "Resubmit," if the changes requested are extensive. In this case, the Contractor shall resubmit the items after correction.

- 4. "Rejected," if it is considered that the data submitted cannot, with reasonable revision, meet the requirements of the Contract Documents.
- C. Informational Submittals: Engineer will review each submittal and will not return it, or will return it if it does not comply with requirements. Engineer will forward each submittal to appropriate party.
- D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Engineer.
- E. Incomplete submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
- F. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION

SECTION 01 42 00 REFERENCES

PART 1 - GENERAL

1.1 SUMMARY

- A. General: Basic Contract definitions are included in the General Conditions.
- B. "Directed": A command or instruction by Engineer. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- C. "Indicated": Requirements expressed by graphic representations or in written form on Contract Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- D. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- E. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- F. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- G. "Provide": Furnish and install, complete and ready for the intended use.

1.2 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.3 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the United States."
- B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the

following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AA	Aluminum Association, Inc. (The) www.aluminum.org	(703) 358-2960
AAADM	American Association of Automatic Door Manufacturers www.aaadm.com	(216) 241-7333
AABC	Associated Air Balance Council www.aabchq.com	(202) 737-0202
AASHTO	American Association of State Highway and Transportation Officials www.transportation.org	(202) 624-5800
ABAA	Air Barrier Association of America www.airbarrier.org	(866) 956-5888
ABMA	American Bearing Manufacturers Association www.abma-dc.org	(202) 367-1155
ACI	American Concrete Institute www.concrete.org	(248) 848-3700
ACPA	American Concrete Pipe Association www.concrete-pipe.org	(972) 506-7216
AGA	American Gas Association www.aga.org	(202) 824-7000
AGC	Associated General Contractors of America (The) www.agc.org	(703) 548-3118
AHRI	Air-Conditioning, Heating, and Refrigeration Institute www.ahrinet.org	(703) 524-8800
AI	Asphalt Institute www.asphaltinstitute.org	(859) 288-4960
AIA	American Institute of Architects (The) www.aia.org	(800) 242-3837 (202) 626-7300
AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100

AITC	American Institute of Timber Construction www.aitc-glulam.org	(303) 792-9559
ALSC	American Lumber Standard Committee, Incorporated www.alsc.org	(301) 972-1700
AMCA	Air Movement and Control Association International, Inc. www.amca.org	(847) 394-0150
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
APA	Architectural Precast Association www.archprecast.org	(239) 454-6989
API	American Petroleum Institute www.api.org	(202) 682-8000
ARI	Air-Conditioning & Refrigeration Institute (Now AHRI)	
ARMA	Asphalt Roofing Manufacturers Association www.asphaltroofing.org	(202) 207-0917
ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASHRAE	American Society of Heating, Refrigerating and Air- Conditioning Engineers www.ashrae.org	(800) 527-4723 (404) 636-8400
ASME	ASME International (American Society of Mechanical Engineers International) www.asme.org	(800) 843-2763 (973) 882-1170
ASSE	American Society of Safety Engineers www.asse.org	(847) 699-2929
ASSE	American Society of Sanitary Engineering www.asse-plumbing.org	(440) 835-3040
ASTM	ASTM International (American Society for Testing and Materials International) www.astm.org	(610) 832-9500
AWCI	Association of the Wall and Ceiling Industry www.awci.org	(703) 534-8300
AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353

AWWA	American Water Works Association www.awwa.org	(800) 926-7337 (303) 794-7711
BHMA	Builders Hardware Manufacturers Association www.buildershardware.com	(212) 297-2122
CGA	Compressed Gas Association www.cganet.com	(703) 788-2700
CISCA	Ceilings & Interior Systems Construction Association www.cisca.org	(630) 584-1919
CISPI	Cast Iron Soil Pipe Institute www.cispi.org	(423) 892-0137
CLFMI	Chain Link Fence Manufacturers Institute www.chainlinkinfo.org	(301) 596-2583
CPPA	Corrugated Polyethylene Pipe Association www.plasticpipe.org	(800) 510-2772 (202) 462-9607
CRSI	Concrete Reinforcing Steel Institute www.crsi.org	(847) 517-1200
CSI	Cast Stone Institute www.caststone.org	(717) 272-3744
CSI	Construction Specifications Institute (The) www.csinet.org	(800) 689-2900 (703) 684-0300
DHI	Door and Hardware Institute www.dhi.org	(703) 222-2010
EJCDC	Engineers Joint Contract Documents Committee www.ejdc.org	(703) 295-5000
EJMA	Expansion Joint Manufacturers Association, Inc. www.ejma.org	(914) 332-0040
FM Approvals	FM Approvals LLC www.fmglobal.com	(781) 762-4300
FM Global	FM Global (Formerly: FMG - FM Global) www.fmglobal.com	(401) 275-3000
GA	Gypsum Association www.gypsum.org	(202) 289-5440
GANA	Glass Association of North America www.glasswebsite.com	(785) 271-0208

GSI	Geosynthetic Institute www.geosynthetic-institute.org	(610) 522-8440
HI	Hydraulic Institute www.pumps.org	(973) 267-9700
HI	Hydronics Institute www.gamanet.org	(908) 464-8200
HMMA	Hollow Metal Manufacturers Association (Part of NAAMM)	
ICEA	Insulated Cable Engineers Association, Inc. www.icea.net	(770) 830-0369
ICRI	International Concrete Repair Institute, Inc. www.icri.org	(847) 827-0830
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The) www.ieee.org	(212) 419-7900
IES	Illuminating Engineering Society www.ies.org	(212) 248-5000
IGCC	Insulating Glass Certification Council www.igcc.org	(315) 646-2234
IGMA	Insulating Glass Manufacturers Alliance www.igmaonline.org	(613) 233-1510
ISO	International Organization for Standardization www.iso.ch	41 22 749 01 11
KCMA	Kitchen Cabinet Manufacturers Association www.kcma.org	(703) 264-1690
LPI	Lightning Protection Institute www.lightning.org	(800) 488-6864
MFMA	Metal Framing Manufacturers Association, Inc. www.metalframingmfg.org	(312) 644-6610
MHIA	Material Handling Industry of America www.mhia.org	(800) 345-1815 (704) 676-1190
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc. www.mss-hq.com	(703) 281-6613

NAAMM	National Association of Architectural Metal Manufacturers www.naamm.org	(630) 942-6591
NACE	NACE International (National Association of Corrosion Engineers International) www.nace.org	(800) 797-6623 (281) 228-6200
NADCA	National Air Duct Cleaners Association www.nadca.com	(202) 737-2926
NAIMA	North American Insulation Manufacturers Association www.naima.org	(703) 684-0084
NCMA	National Concrete Masonry Association www.ncma.org	(703) 713-1900
NCTA	National Cable & Telecommunications Association www.ncta.com	(202) 775-2300
NECA	National Electrical Contractors Association www.necanet.org	(301) 657-3110
NeLMA	Northeastern Lumber Manufacturers' Association www.nelma.org	(207) 829-6901
NEMA	National Electrical Manufacturers Association www.nema.org	(703) 841-3200
NFPA	NFPA (National Fire Protection Association) www.nfpa.org	(800) 344-3555 (617) 770-3000
NFRC	National Fenestration Rating Council www.nfrc.org	(301) 589-1776
NGA	National Glass Association www.glass.org	(866) 342-5642 (703) 442-4890
NHLA	National Hardwood Lumber Association www.natlhardwood.org	(800) 933-0318 (901) 377-1818
NLGA	National Lumber Grades Authority www.nlga.org	(604) 524-2393
NOMMA	National Ornamental & Miscellaneous Metals Association www.nomma.org	(888) 516-8585
NRCA	National Roofing Contractors Association www.nrca.net	(800) 323-9545 (847) 299-9070

NRMCA	National Ready Mixed Concrete Association www.nrmca.org	(888) 846-7622 (301) 587-1400
NSF	NSF International (National Sanitation Foundation International) www.nsf.org	(800) 673-6275 (734) 769-8010
NSSGA	National Stone, Sand & Gravel Association www.nssga.org	(800) 342-1415 (703) 525-8788
PCI	Precast/Prestressed Concrete Institute www.pci.org	(312) 786-0300
PDI	Plumbing & Drainage Institute www.pdionline.org	(800) 589-8956 (978) 557-0720
PTI	Post-Tensioning Institute www.post-tensioning.org	(602) 870-7540
RCSC	Research Council on Structural Connections www.boltcouncil.org	
RFCI	Resilient Floor Covering Institute www.rfci.com	(301) 340-8580
SAE	SAE International www.sae.org	(877) 606-7323 (724) 776-4841
SCTE	Society of Cable Telecommunications Engineers www.scte.org	(800) 542-5040 (610) 363-6888
SDI	Steel Deck Institute www.sdi.org	(847) 458-4647
SDI	Steel Door Institute www.steeldoor.org	(440) 899-0010
SEFA	Scientific Equipment and Furniture Association www.sefalabs.com	(877) 294-5424 (516) 294-5424
SGCC	Safety Glazing Certification Council www.sgcc.org	(315) 646-2234
SIA	Security Industry Association www.siaonline.org	(866) 817-8888 (703) 683-2075
SJI	Steel Joist Institute www.steeljoist.org	(843) 626-1995

SMACNA	Sheet Metal and Air Conditioning Contractors' National Association www.smacna.org	(703) 803-2980
SPRI	Single Ply Roofing Industry www.spri.org	(781) 647-7026
SSINA	Specialty Steel Industry of North America www.ssina.com	(800) 982-0355 (202) 342-8630
SSPC	SSPC: The Society for Protective Coatings www.sspc.org	(877) 281-7772 (412) 281-2331
STI	Steel Tank Institute www.steeltank.com	(847) 438-8265
SWI	Steel Window Institute www.steelwindows.com	(216) 241-7333
SWRI	Sealant, Waterproofing, & Restoration Institute www.swrionline.org	(816) 472-7974
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance www.tiaonline.org	(703) 907-7700
TMS	The Masonry Society www.masonrysociety.org	(303) 939-9700
TPI	Truss Plate Institute, Inc. www.tpinst.org	(703) 683-1010
TPI	Turfgrass Producers International www.turfgrassod.org	(800) 405-8873 (847) 649-5555
UL	Underwriters Laboratories Inc. www.ul.com	(877) 854-3577 (847) 272-8800
UNI	Uni-Bell PVC Pipe Association www.uni-bell.org	(972) 243-3902
WDMA	Window & Door Manufacturers Association www.wdma.com	(800) 223-2301 (847) 299-5200

- C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

BCNYS Building Code of New York State

ECCNYS Energy Conservation Construction Code of New York State

FCNYS Fire Code of New York State

FGCNYS Fuel Gas Code of New York State

MCNYS Mechanical Code of New York State

PCNYS Plumbing Code of New York State

ICC	International Code Council www.icsafe.org	(888) 422-7233
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- D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CE	Army Corps of Engineers www.usace.army.mil	(202) 761-0011
CPSC	Consumer Product Safety Commission www.cpsc.gov	(800) 638-2772 (301) 504-7923
DOC	Department of Commerce www.commerce.gov	(202) 482-2000
DOD	Department of Defense http://.dodssp.daps.dla.mil	(215) 697-6257
DOE	Department of Energy www.energy.gov	(202) 586-9220
EPA	Environmental Protection Agency www.epa.gov	(202) 272-0167
FAA	Federal Aviation Administration www.faa.gov	(866) 835-5322
FCC	Federal Communications Commission www.fcc.gov	(888) 225-5322
FDA	Food and Drug Administration www.fda.gov	(888) 463-6332
GSA	General Services Administration www.gsa.gov	(800) 488-3111

HUD	Department of Housing and Urban Development www.hud.gov	(202) 708-1112
LBL	Lawrence Berkeley National Laboratory www.lbl.gov	(510) 486-4000
NCHRP	National Cooperative Highway Research Program (See TRB)	
NIST	National Institute of Standards and Technology www.nist.gov	(301) 975-6478
OSHA	Occupational Safety & Health Administration www.osha.gov	(800) 321-6742 (202) 693-1999
PBS	Public Buildings Service (See GSA)	
PHS	Office of Public Health and Science www.hhs.gov/ophs	(202) 690-7694
RUS	Rural Utilities Service (See USDA)	(202) 720-9540
SD	State Department www.state.gov	(202) 647-4000
TRB	Transportation Research Board http://gulliver.trb.org	(202) 334-2934
USDA	Department of Agriculture www.usda.gov	(202) 720-2791
USPS	Postal Service www.usps.com	(202) 268-2000

- E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ADAAG	Americans with Disabilities Act (ADA) Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities Available from U.S. Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080
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CFR	Code of Federal Regulations	(866) 512-1800
	Available from Government Printing Office	(202) 512-1800
	www.gpoaccess.gov/cfr/index.html	
	Available from Department of Defense Single Stock Point	
	http://dodssp.daps.dla.mil	
	Available from Defense Standardization Program	
	www.dps.dla.mil	
	Available from General Services Administration	(202) 619-8925
	www.gsa.gov	
	Available from National Institute of Building Sciences	(202) 289-7800
	www.wbdg.org/ccb	
MILSPEC	Military Specification and Standards	(215) 697-2664
	Available from Department of Defense Single Stock Point	
	http://dodssp.daps.dla.mil	

PART 2 - PRODUCTS (NOT USED)

2.1 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 45 00 QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and -control services required by Engineer, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.2 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Engineer.
- C. Mockups: Full size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
- D. Preconstruction Testing: Tests and inspections performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

- G. **Field Quality-Control Testing:** Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. **Testing Agency:** An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. **Installer/Applicator/Erector:** Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade or trades.
- J. **Experienced:** When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- K. **NRTL:** A nationally recognized testing laboratory according to 29 CFR 1910.7.
- L. **NVLAP:** A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

1.3 CONFLICTING REQUIREMENTS

- A. **Referenced Standards:** If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Engineer for a decision before proceeding.
- B. **Minimum Quantity or Quality Levels:** The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Engineer for a decision before proceeding.

1.4 INFORMATIONAL SUBMITTALS

- A. **Contractor's Quality-Control Plan:** For quality-assurance and quality-control activities and responsibilities.
- B. **Contractor's Quality-Control Manager Qualifications:** For supervisory personnel.
- C. **Testing Agency Qualifications:** For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- D. **Schedule of Tests and Inspections:** Prepare in tabular form and include the following:
 - 1. Specification Section number and title
 - 2. Entity responsible for performing tests and inspections
 - 3. Description of test and inspection
 - 4. Identification of applicable standards
 - 5. Identification of test and inspection methods
 - 6. Number of tests and inspections required

7. Time schedule or time span for tests and inspections
8. Requirements for obtaining samples
9. Unique characteristics of each quality-control service

1.5 CONTRACTOR'S QUALITY-CONTROL PLAN.

- A. Quality-Control Plan, General: Submit quality-control plan within 10 days following Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Engineer. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
 1. Project quality-control manager may also serve as Project superintendent.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: Include in quality-control plan a comprehensive schedule of Work requiring testing or inspection, including the following:
 1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
 2. Owner-performed tests and inspections indicated in the Contract Documents.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements.
- F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Engineer has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.6 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 1. Date of issue
 2. Project title and number
 3. Name, address, and telephone number of testing agency
 4. Dates and locations of samples and tests or inspections
 5. Names of individuals making tests and inspections
 6. Description of the Work and test and inspection method
 7. Identification of product and Specification Section
 8. Complete test or inspection data

9. Test and inspection results and an interpretation of test results
 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting
 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements
 12. Name and signature of laboratory inspector
 13. Recommendations on retesting and reinspecting
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of technical representative making report
 2. Statement on condition of substrates and their acceptability for installation of product
 3. Statement that products at Project site comply with requirements
 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 5. Results of operational and other tests and a statement of whether observed performance complies with requirements
 6. Statement whether conditions, products, and installation will affect warranty
 7. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of factory-authorized service representative making report
 2. Statement that equipment complies with requirements
 3. Results of operational and other tests and a statement of whether observed performance complies with requirements
 4. Statement whether conditions, products, and installation will affect warranty
 5. Other required items indicated in individual Specification Sections
- D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.7 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

- D. **Installer Qualifications:** A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. **Professional Engineer Qualifications:** A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.
- F. **Specialists:** Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
 - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. **Testing Agency Qualifications:** An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
- H. **Manufacturer's Technical Representative Qualifications:** An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. **Factory-Authorized Service Representative Qualifications:** An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. **Preconstruction Testing:** Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
 - 1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Provide sizes and configurations of test assemblies and mockups to adequately demonstrate capability of products to comply with performance requirements.
 - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
 - e. When testing is complete, remove test specimens, assemblies, and mockups, do not reuse products on Project.
 - 2. **Testing Agency Responsibilities:** Submit a certified written report of each test, inspection, and similar quality-assurance service to Engineer with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- K. **Mockups:** Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Engineer.
2. Notify Engineer seven days in advance of dates and times when mockups will be constructed.
3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at the Project.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Obtain Engineer's approval of mockups before starting work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed, unless otherwise indicated.

1.8 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
 2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
 1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."

- D. **Manufacturer's Technical Services:** Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- E. **Retesting/Reinspecting:** Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- F. **Testing Agency Responsibilities:** Cooperate with Engineer and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 - 1. Notify Engineer and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 - 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 - 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 - 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 - 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 - 6. Do not perform any duties of Contractor.
- G. **Associated Services:** Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 - 1. Access to the Work
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections
 - 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 - 4. Facilities for storage and field curing of test samples.
 - 5. Delivery of samples to testing agencies
 - 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 - 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- H. **Coordination:** Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- I. **Schedule of Tests and Inspections:** Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of the Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.

1. Distribution: Distribute schedule to Owner, Engineer, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Prepare a record of tests and inspections. Include the following:
 1. Date test or inspection was conducted.
 2. Description of the Work tested or inspected.
 3. Date test or inspection results were transmitted to Engineer.
 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Engineer's reference during normal working hours.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Division 01 Section "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

SECTION 01 51 00 TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.2 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Price unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's personnel, Engineer, testing agencies, and authorities having jurisdiction.

1.3 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

1.4 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.5 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Chain-Link Fencing: Minimum 2-inch, 0.148-inch thick, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch OD line posts and 2-7/8-inch OD corner and pull posts, with 1-5/8-inch OD top rails, with galvanized barbed-wire top strand.
- B. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10 mils minimum thickness, with flame-spread rating of 15 or less per ASTM E 84.
- C. Dust Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.

2.2 TEMPORARY FACILITIES

- A. Contractors Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Engineer's Field Office: Refer to section entitled "Field Office Trailer"
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
 - 1. Store combustible materials apart from building.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
 - 1. Locate facilities to limit site disturbance as specified in Section entitled "Summary."
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
 - 1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction, and provide NYSDOH-listed backflow preventer.
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- F. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
 - 1. Prior to commencing work, isolate the HVAC system in area where work is to be performed in accordance with approved coordination drawings.

- a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
 - b. Maintain negative air pressure within work area using HEPA-equipped air filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
- 2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust containment devices.
- 3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.
- G. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
 - 1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.
- H. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
- I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
 - 1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
 - 2. Maintain support facilities until Engineer schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Contract Drawings.
 - 1. Provide dust-control treatment that is non-polluting and non-tracking. Reapply treatment as required to minimize dust.
- C. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 - 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- D. Parking: Provide temporary parking areas for construction personnel.

- E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
 - 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.
 - 2. Remove snow and ice as required to minimize accumulations.
- F. Project Signs: Provide Project signs as indicated on the Contract Drawings. Unauthorized signs are not permitted.
 - 1. Temporary Signs: Provide other signs as required to inform public and individuals seeking entrance to Project.
 - a. Provide temporary, directional signs for construction personnel and visitors.
 - 2. Maintain and touchup signs so they are legible at all times.
- G. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with Section entitled "Execution" for progress cleaning requirements.
- H. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
 - 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- I. Use of Owner's Monorails, Hoists, and Other Equipment
 - 1. Contractor may only use the Owner's monorails, hoists, or other equipment at the facility, with the express written approval of the Owner and Engineer and upon execution of the Release and Waiver form attached to this section. If authorized, Contractor shall be fully responsible for confirming the load capacity and/or operability of the equipment. Such confirmation shall be performed by an experienced hoist and monorail service and inspection firm, who shall provide written certification for the operability and capacity of the hoist. Cost for such inspection and certification shall be borne by the Contractor. Should the inspection firm determine that repairs are required to the hoist to make it operable, the Contractor shall have such repairs made prior to utilizing the hoist. Contractor shall bare all costs for such repairs. Contractor shall assume full responsibility as it relates to the use of monorails, hoists, or other Owner owned equipment and any subsequent damage to materials, equipment and/or injury to personnel thereto. A Release and Waiver form found at the end of this section must be filled out and submitted to the Owner.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
 - 1. Comply with work restrictions specified in Section entitled "Summary."
- B. Temporary Erosion and Sedimentation Control: Comply requirements indicated on Contract Drawings.
- C. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

- D. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- E. Temporary Partitions: Provide floor-to-ceiling dustproof partitions where required to limit dust and dirt migration.

3.5 OPERATION, TERMINATION AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 - 1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
 - 2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns and dispose of properly. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
 - 3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section entitled "Closeout Procedures."

END OF SECTION

RELEASE AND WAIVER

In consideration of the Work as part of the Crotonville Pumping Station Rehabilitation, herein referred to as the "Project", more specifically the use of the existing monorails and hoists located at the facility for the loading and unloading of materials and equipment or any other County owned equipment used by the Contractor during the performance of the Work, the Contractor shall assume full responsibility as it relates to the use of the monorails, hoists or other Owner owned equipment and any subsequent damage to materials, equipment and/or injury to personnel thereto, and does hereby agree on behalf of themselves, their heirs, successors and assigns, subcontractors and any third parties who may have claim by, through or against the Contractor, to forever release and discharge the County of Westchester, its officials, representatives, employees, agents, successors and assigns, and O'Brien and Gere Engineers, Inc., from any and all claims, obligations, demands, causes of action, agreements, promises, variances, fees, costs and damages whatsoever, which the Contractor has or may have which relate in any way to the use of any of the monorails, hoists, or any other County owned equipment used by the Contractor in performance of the Work located at the Crotonville Pumping Station, include without limitation failure or inoperability of the equipment while in use by the Contractor during performance of the Work.

IN WITNESS WHEREOF, Contractor has executed this Release and Waiver on

_____.

WITNESS

CONTRACTOR

Date: _____

Date: _____

SECTION 01 52 00
ENVIRONMENTAL REQUIREMENTS FOR CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Prohibited Construction Procedures: Prohibited construction procedures include, but are not limited to:
 - 1. Dumping of soil material into any stream corridor, any wetlands, any surface waters, or unspecified locations including the 100-year floodplain.
 - 2. Indiscriminate, arbitrary, or capricious operation of equipment in any stream corridors, any wetlands, or any water surface.
 - 3. Pumping of silt-laden water from trenches or other excavations into any surface waters, any stream corridors, or any wetlands.
 - 4. Damaging vegetation adjacent to, or outside of, the access road or the right-of-way.
 - 5. Disposal of trees, brush, and other debris in any stream corridors, any wetlands, any surface waters, or at unspecified locations including the 100-year floodplain.
 - 6. Permanent or unspecified alteration of the flow line of the stream.
 - 7. Open burning of all project debris.
- B. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.

1.2 SITE CLEARING AND TOPSOIL STRIPPING AND STOCKPILING

- A. Perform clearing to the limits indicated on the Contract Drawings.
- B. After interfering vegetation has been removed, the Contractor shall strip any and all topsoil from the area to be excavated and stockpile it for future use.

1.3 EROSION AND SEDIMENT CONTROL

- A. Erosion control procedures shall be utilized as shown on the Contract Drawings or as directed. Erosion control shall be undertaken prior to site and access clearing.
- B. Allow sediment to settle out of water that interferes with construction before such waters enter any surface waters. Care should be taken not to damage or kill vegetation to remain during, or as a result of, dewatering operations and/or accumulating silt in the discharge area. Additional settling basins/sediment traps/plastic filter fabric shall be constructed and used as required or specified as necessary to protect vegetation and to achieve environmental objectives. Such facilities shall comply with "New York Standards and Specifications for Erosion and Sediment Control", latest edition.
- C. Minimize amount of bare soil exposed at one time.
- D. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
- E. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
- F. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

- G. Utilize erosion control procedures, including mulching, on site. Furnish erosion control as required and, immediately following (weather permitting), completion of site and access clearing.
- H. Work on this project is subject to the requirements of the New York State Department of Environmental Conservation (NYSDEC) SPDES General Permit for Stormwater Discharges from Construction Activities, Permit No. GP-0-10-001.

1.4 SITE RESTORATION

- A. General: After the completion of grading operations, the area shall be prepared immediately (weather permitting) for restoration of vegetation in all disturbed areas, except pavement areas. Unused topsoil in stockpile(s) shall be left for use by others and shall be temporarily vegetated as directed.
- B. Erosion control measures shall be utilized immediately, and final restoration shall be undertaken as soon as the area is no longer needed for construction, stockpile or access. Excavated stones and boulders too large to be incorporated in backfilling shall be removed from the construction site to a specified location. Excess on-site soil shall be graded or removed, as directed. The temporary access road shall be left in place. Care should be taken to avoid damage to adjacent vegetation.
- C. Vegetation: Whenever the Contractor disturbs private property which has been grassed and is maintained as a lawn, such surface shall be restored in-kind to the satisfaction of the Engineer. Similarly, if formal trees, shrubs or other plantings are disturbed, the Contractor shall make every effort to restore these in-kind.
- D. In areas where shrub growth, that is growth which is completely wild in nature, is disturbed in order to minimize the impact of the construction, the Engineer may order planting of a number of common trees and/or shrubs in cleared portions. Such plantings shall be installed by an approved nursery man.
- E. Seeding: Seed selection for the disturbed areas shall be as specified and approved by the Engineer. Seed mixtures shall be selected that best conform with or are best suited for the particular site conditions.
- F. Seed selection for erosion control shall provide for a quickly-germinating initial growth to prevent erosion and for a secondary growth which will survive without continuing maintenance by the Owner.
- G. Mulching: Mulching shall occur immediately after seeding and in no case more than three days after seeding. Mulching shall be performed as directed by the Engineer.

1.5 PROTECTION OF TREES

- A. Protect trees located beyond clearing limits.
- B. Construction equipment movement in the vicinity of trees to remain shall be kept to a minimum to avoid compaction of the soil around the trunks of the trees. During backfill operations, the Contractor shall avoid excessive tamping of earth around tree roots and trunks and shall apply an approved mulch to the roots during the operation.
- C. Tunnel below trees to remain when the edge of the excavation would fall six feet or closer to trees six-inch and over DBH. The length of the tunnel shall be five feet on each side of the tree trunk. When roots one-inch or larger are encountered, stop open ditching and tunnel. Tunneling shall be by means of jacking, posting, or other approved means.

- D. Contractor shall retain the services of a qualified tree expert to remove, where necessary, branches which interfere with the construction operations, or repair trees having suffered damage by the construction activities.

1.6 DUST CONTROL

- A. Take all necessary measures to control dust resulting from the work.
- B. Provide positive means to prevent air-borne dust from dispersing into atmosphere. This shall include as a minimum, sprinkling and sweeping on paved areas and sprinkling and mulching in unpaved areas. Apply water to control dust at locations and in such quantities and frequencies as required to prevent dust from becoming a nuisance to the surrounding area. Chloride and/or petroleum compounds shall not be used for dust control.
- C. In the event the Contractor does not adequately provide for the control of dust, or should insufficient quantities of dust control agents be placed, and he fails to place additional quantities within four hours of Engineer's direction, the Owner will perform the required work by whatever means deemed expedient and all expenses incurred by Owner will be charged and paid by the Contractor.
- D. Take care in selecting and applying dust control agents so as not to make roadways or walkways slippery, muddy, or hazardous.

1.7 WATER CONTROL

- A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

1.8 SURFACE WATER CROSSINGS

- A. Protect slopes at surface water crossings or drainage ways by installing riprap, sand bags, sod, jute mesh or excelsior blankets as conditions require.
- B. Use water diversion berms, sodding, jute mesh or excelsior blankets on slopes exceeding 15 percent.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 60 00 PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; and special warranties.

1.2 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:
 - 1. Store products to allow for inspection and measurement of quantity or counting of units.
 - 2. Store materials in a manner that will not endanger Project structure.
 - 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 - 4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 - 5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - 6. Protect stored products from damage and liquids from freezing.
 - 7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.3 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations

on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
 3. Refer to individual Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section entitled "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Engineer or Owner will make selection, as indicated.
 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
 6. Substitute Items: Comply with requirements of the General Conditions.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 73 00 EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout
 - 2. Field engineering and surveying
 - 3. Installation of the Work
 - 4. Cutting and patching
 - 5. Requirements for connection to existing pipelines
 - 6. Construction sequence and schedule constraints
 - 7. Progress cleaning
 - 8. Starting and adjusting
 - 9. Protection of installed construction
 - 10. Correction of the Work

1.2 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For licensed land surveyor

1.4 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in New York State and who is experienced in providing land-surveying services of the kind indicated.
- B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
 - 1. Structural Elements: When cutting and patching structural elements, notify Engineer of locations and details of cutting and await directions from the Engineer before proceeding. Shore, brace, and support structural element during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection
 - 2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:

- a. Primary operational systems and equipment
 - b. Fire separation assemblies
 - c. Air or smoke barriers
 - d. Fire-suppression systems
 - e. Mechanical systems piping and ducts
 - f. Control systems
 - g. Communication systems
 - h. Conveying systems
 - i. Electrical wiring systems
 - j. Operating systems of special construction
3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
- a. Water, moisture, or vapor barriers
 - b. Membranes and flashings
 - c. Exterior curtain-wall construction
 - d. Equipment supports
 - e. Piping, ductwork, vessels, and equipment
 - f. Noise- and vibration-control elements and systems
4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Engineer's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

1.5 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to the Engineer for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with installer or applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
 1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
 - a. Description of the Work.
 - b. List of detrimental conditions, including substrates.
 - c. List of unacceptable installation tolerances.
 - d. Recommended corrections.
 2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances, where such work is indicated in the Contract Documents. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Contract Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of the Contractor, submit a request for information to Engineer according to requirements in Section entitled "Project Coordination."

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Contract Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Engineer promptly.
- B. General: Engage a licensed land surveyor to lay out the Work using accepted surveying practices.
 - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 - 2. Establish dimensions within tolerances indicated. Do not scale Contract Drawings to obtain required dimensions.
 - 3. Inform installers of lines and levels to which they must comply.
 - 4. Check the location, level and plumb, of every major element as the Work progresses.
 - 5. Notify Engineer when deviations from required lines and levels exceed allowable tolerances.
 - 6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Engineer.

3.4 FIELD ENGINEERING

- A. Identification: Contract Documents identify existing benchmarks, control points, and property corners.
- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
 - 1. Do not change or relocate existing benchmarks or control points without prior written approval of Engineer. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Engineer before proceeding.

2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 1. Make vertical work plumb and make horizontal work level.
 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
 4. Unless otherwise indicated, maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- G. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Engineer.
 2. Allow for building movement, including thermal expansion and contraction.
 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

- H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Temporary Support: Provide temporary support of work to be cut.
- C. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- D. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements of Section entitled "Summary."
- E. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.
- F. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
 - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - 6. Proceed with patching after construction operations requiring cutting are complete.
- G. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
 - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.
- H. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 REQUIREMENTS FOR CONNECTION TO EXISTING PIPELINES

- A. Minimize duration and risk to Owner associated with connections to existing water supply and distribution piping by the following actions:
1. Make connections during daylight hours on Monday through Friday, excluding official holidays honored by Owner. Work requiring shutdown of pumping operations will only be permitted between hours of 10:00 am and 2:00 pm, following minimum 36-hours of no precipitation and clear weather forecast for expected duration of work.
 2. Prior to preparing shop drawings for pipe fittings and materials required for interconnections to existing piping, excavate and expose existing piping at tie-in locations, and confirm existing pipe condition, material, joint locations, joint types and outside diameter. This preliminary work will be witnessed by Owner and Engineer, and findings shall be documented and reflected in Contractor's shop drawings.
 3. Incorporate all connections to existing pipelines into the work schedule.
 4. At least two (2) weeks prior to any proposed connection, prepare and submit to Engineer and Owner a written work plan. Include detailed description of work involved, detailed schedule of events, names and qualifications of proposed on-site personnel, list of proposed equipment, and list of potential problems and associated contingency plans. Demonstrate to Owner and Engineer's satisfaction, that Contractor has requisite materials, labor, equipment, and planning to successfully perform required interconnections within the specified duration.
 5. At least five (5) days prior to proposed connection, notify Engineer and Owner in writing, to confirm proposed date and time of connection, subject to satisfactory weather and approval of Owner.

6. Forty-eight (48) hours prior to the proposed interconnection, a meeting will be conducted to review the work plan in detail. Meeting shall be attended by Contractor, key Subcontractor(s), Owner and Engineer. All materials and equipment shall be on site for inspection at this meeting.
7. Do not disturb existing piping until all required materials and equipment are on site, proper operation has been verified, and Owner has approved proposed work plan. Cooperate in every way with Owner and Engineer prior to and while making connections to existing pipelines. Drain pipeline and provide temporary bypass pumping or other means for wastewater collection for duration of connection work, as indicated on Contract Drawings and specified elsewhere.
8. Once work has begun, work continuously to complete work to a point where service can be resumed as quickly as possible.

3.8 CONSTRUCTION SEQUENCE AND SCHEDULE CONSTRAINTS

- A. To minimize disruption and adverse impacts to reliability of Owner's wastewater collection and pumping system, plan and schedule work in accordance with the following requirements:
 1. Crotonville Pumping Station
 - a. Construct and test forcemain bypass connection piping prior to need for temporary bypass pumping; maintain connection to existing pumping station discharge piping until permanent discharge piping has been installed;
 - b. Install and test temporary line stop on existing force main and temporary tap and drain valve on discharge pipe inside pumping station. Remove existing pipe with temporary drain between the hours of midnight to 6:00 AM and install new permanent 16" tee, 6" drain valve, 16" discharge isolation gate valve, and a temporary test flange. Test completion plug and remove line stop after testing of 16" discharge isolation valve. Collect drainage and pump sewage to acceptable storage or disposal location throughout installation and removal of temporary line stop. Provide permanent blind flange on drain valve and leave temporary test flange on 16" gate valve until remainder of new discharge piping is to be assembled.
 - c. Close influent sluice gate and implement temporary bypass pumping before initiating demolition or removal work; maintain continuous bypass pumping until structural, mechanical, HVAC and electrical work is Substantially Complete and reliable system performance is demonstrated;
 2. Comply with additional sequence of construction requirements indicated on Electrical drawings.

3.9 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 - a. Utilize containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where more than one installer has worked.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
 1. Remove liquid spills promptly.
 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section entitled "Temporary Facilities and Controls."
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.10 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: Comply with qualification requirements in Section entitled "Quality Requirements."

3.11 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.12 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.
 - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION

SECTION 01 77 00 CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures
 - 2. Final completion procedures
 - 3. Warranties
 - 4. Final cleaning
- B. Requirements in this Section are in addition to those specified in the General Requirements.

1.2 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following.
 - 1. Advise Owner of pending insurance changeover requirements.
 - 2. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 3. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 4. Prepare and submit Project Record Documents, operation and maintenance manuals, damage or settlement surveys, and similar final record information.
 - 5. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
 - 6. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 7. Complete startup testing of systems.
 - 8. Submit test/adjust/balance records.
 - 9. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
 - 10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. A representative of Owner, Engineer, and Contractor will participate in the inspection. Engineer will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items that must be completed or corrected before certificate will be issued.
 - 1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

2. Results of completed inspection will form the basis of requirements for final completion.
- C. Certificate of Substantial Completion will include a list of items to be completed and corrected (punch list), prepared by the Engineer.

1.3 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:
 1. Submit a final Application for Payment according to General Clauses and General Requirements.
 2. Submit certified copy of Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Engineer. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Submit pest-control final inspection report and warranty.
 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings.
 6. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 7. Complete final cleaning requirements, including touchup painting.
 8. Submit the following AIA closeout documents:
 - a. Contractor Release of Liens from Prime and all Sub Contractors
 - b. AIA Document G706 – Contractor's Affidavit of Payment of Debts and Claims
 - c. AIA Document G706A – Contractor's Affidavit of Release of Liens
 - d. AIA Document G706A – Contractor's Affidavit of Release of Liens from all subcontractors and material suppliers
 - e. AIA Document G707 – Consent of Surety Company to Final Payment
- B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
 1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.4 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. List will include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
 1. List of spaces will be organized in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.

2. Items applying to each space will be organized by major element, including categories for ceiling, individual walls, floors, equipment, and systems.
3. List will include the estimated value of each item to be completed or corrected.

1.5 WARRANTIES

- A. Submittal Time: Submit written warranties on request of Engineer for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of the Contract Documents.
 1. Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide table of contents at beginning of document.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.

- e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
 - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - k. Remove labels that are not permanent.
 - l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - 1) Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates.
 - m. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - n. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
 - o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - q. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter upon inspection.
 - 1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report upon completion of cleaning.
 - r. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
 - s. Leave Project clean and ready for occupancy.
- C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare and submit report.
- D. Construction Waste Disposal: Comply with waste disposal requirements in Section entitled "Temporary Facilities and Controls."

END OF SECTION

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation manuals for systems, subsystems, and equipment
 - 2. Product maintenance manuals
 - 3. Systems and equipment maintenance manuals

1.2 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.3 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual specification sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Where applicable, clarify and update reviewed manual content to correspond to modifications and field conditions.
- B. Format: Submit operations and maintenance manuals in the following format:
 - 1. PDF electronic file. Assemble each manual into a composite electronically-indexed file. Submit on digital media acceptable to Engineer.
 - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically-linked operation and maintenance directory.
 - b. Enable inserted reviewer comments on draft submittals.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 60 days before commencing demonstration and training. Engineer will comment on whether general scope and content of manual are acceptable.
- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 30 days before commencing demonstration and training. Engineer will return copy with comments.
 - 1. Correct or modify each manual to comply with Engineer's comments. Submit copies of each corrected manual within 15 days of receipt of Engineer's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 REQUIREMENTS FOR OPERATION AND MAINTENANCE MANUALS

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 - 1. Title page
 - 2. Table of contents
 - 3. Manual contents
- B. Title Page: Include the following information:
 - 1. Subject matter included in manual.
 - 2. Name and address of Project.
 - 3. Name and address of Owner.
 - 4. Date of submittal.
 - 5. Name and contact information for Contractor.
 - 6. Name and contact information for Construction Manager.
 - 7. Name and contact information for Engineer.
 - 8. Names and contact information for major consultants to the Engineer that designed the systems contained in the manuals.
 - 9. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Contract Documents.
 - 1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
 - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 - 2. File Names and Bookmarks: Enable bookmarking of individual documents based upon file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel upon opening file.

2.2 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
 - 1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 - 2. Performance and design criteria if Contractor is delegated design responsibility.
 - 3. Operating standards.
 - 4. Operating procedures.
 - 5. Operating logs.
 - 6. Wiring diagrams.
 - 7. Control diagrams.
 - 8. Piped system diagrams.
 - 9. Precautions against improper use.
 - 10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
 - 1. Product name and model number. Use designations for products indicated on Contract Documents.
 - 2. Manufacturer's name.
 - 3. Equipment identification with serial number of each component.
 - 4. Equipment function.
 - 5. Operating characteristics.
 - 6. Limiting conditions.
 - 7. Performance curves.
 - 8. Engineering data and tests.
 - 9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
 - 1. Startup procedures.
 - 2. Equipment or system break-in procedures.
 - 3. Routine and normal operating instructions.
 - 4. Regulation and control procedures.
 - 5. Instructions on stopping.
 - 6. Normal shutdown instructions.
 - 7. Seasonal and weekend operating instructions.
 - 8. Required sequences for electric or electronic systems.
 - 9. Special operating instructions and procedures.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.3 PRODUCT MAINTENANCE MANUALS

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Product Information: Include the following, as applicable:
 - 1. Product name and model number
 - 2. Manufacturer's name
 - 3. Color, pattern, and texture
 - 4. Material and chemical composition
 - 5. Reordering information for specially manufactured products
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Inspection procedures
 - 2. Types of cleaning agents to be used and methods of cleaning
 - 3. List of cleaning agents and methods of cleaning detrimental to product
 - 4. Schedule for routine cleaning and maintenance
 - 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

2.4 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - 1. Standard maintenance instructions and bulletins.

2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
 1. Test and inspection instructions.
 2. Troubleshooting guide.
 3. Precautions against improper maintenance.
 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 5. Aligning, adjusting, and checking instructions.
 6. Demonstration and training recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
 1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- C. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each

product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- D. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
1. Do not use original project record documents as part of operation and maintenance manuals.
 2. Comply with requirements of newly prepared record Drawings in Section entitled "Project Record Documents."
- E. Comply with Section entitled "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION

SECTION 01 78 40 PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Record Drawings.
 - 2. Miscellaneous record submittals.
- B. Requirements in this Section are in addition to those specified in the General Requirements.

1.2 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit copies of record Drawings as follows:
 - a. Initial Submittal: Submit one paper copy set of marked-up record prints. Engineer will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final Submittal: Submit PDF electronic files of marked-up record prints. Print each Drawing, whether or not changes and additional information were recorded.
- B. Miscellaneous Record Submittals: Refer to other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings.
 - 1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding archive photographic documentation.
 - 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Contract Drawings

- b. Revisions to details shown on Contract Drawings
 - c. Depths of foundations below first floor
 - d. Locations and depths of underground utilities
 - e. Revisions to routing of piping and conduits
 - f. Revisions to electrical circuitry
 - g. Actual equipment locations
 - h. Duct size and routing
 - i. Locations of concealed internal utilities
 - j. Changes made by Change Order
 - k. Changes made following Engineer's written orders
 - l. Details not on the original Contract Drawings
 - m. Field records for variable and concealed conditions
 - n. Record information on the Work that is shown only schematically.
3. Mark the Contract Drawings and Shop Drawings completely and accurately. Utilize personnel proficient at recording graphic information in production of marked-up record prints.
 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 5. Mark important additional information that was either shown schematically or omitted from original Contract Drawings.
 6. Note Change Order numbers, and similar identification, where applicable.
- B. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Engineer determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
 2. Consult Engineer for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.
- C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Format: Annotated PDF electronic file with comment function enabled.
 3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
 4. Identification: As follows:
 - a. Project name
 - b. Date

- c. Designation "PROJECT RECORD DRAWINGS"
- d. Name of Engineer
- e. Name of Contractor

2.2 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as PDF electronic file.
 - 1. Include miscellaneous record submittals directory organized by specification section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and modifications to project record documents as they occur; do not wait until the end of Project.
- B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Engineer's reference during normal working hours.

END OF SECTION

SECTION 01 79 00 DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.

1.2 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
- B. Qualification Data: For facilitator and instructor.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.

1.3 CLOSEOUT SUBMITTALS

- A. At completion of training, submit complete training manual(s) for Owner's use.

1.4 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section entitled "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section entitled "Project Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
 - 1. Inspect and discuss locations and other facilities required for instruction.
 - 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
 - 3. Review required content of instruction.
 - 4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.5 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved operation and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Engineer.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards
 - d. Regulatory requirements
 - e. Equipment function
 - f. Operating characteristics
 - g. Limiting conditions
 - h. Performance curves
 - 2. Documentation: Review the following items in detail:
 - a. Emergency manuals
 - b. Operations manuals
 - c. Maintenance manuals
 - d. Project record documents
 - e. Identification systems
 - f. Warranties and bonds
 - g. Maintenance service agreements and similar continuing commitments.
 - 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.

- d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
- a. Startup procedures
 - b. Equipment or system break-in procedures
 - c. Routine and normal operating instructions
 - d. Regulation and control procedures
 - e. Control sequences
 - f. Safety procedures
 - g. Instructions on stopping
 - h. Normal shutdown instructions
 - i. Operating procedures for emergencies
 - j. Operating procedures for system, subsystem, or equipment failure
 - k. Seasonal and weekend operating instructions
 - l. Required sequences for electric or electronic systems
 - m. Special operating instructions and procedures
5. Adjustments: Include the following:
- a. Alignments
 - b. Checking adjustments
 - c. Noise and vibration adjustments
 - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
- a. Diagnostic instructions
 - b. Test and inspection procedures
7. Maintenance: Include the following:
- a. Inspection procedures
 - b. Types of cleaning agents to be used and methods of cleaning
 - c. List of cleaning agents and methods of cleaning detrimental to product
 - d. Procedures for routine cleaning
 - e. Procedures for preventive maintenance
 - f. Procedures for routine maintenance
 - g. Instruction on use of special tools
8. Repairs: Include the following:
- a. Diagnosis instructions
 - b. Repair instructions

- c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
- d. Instructions for identifying parts and components.
- e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section entitled "Operations and Maintenance Data."
- B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Engineer will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
 - 2. Owner will furnish an instructor to describe Owner's operational philosophy.
 - 3. Owner will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner, through Engineer, with at least fourteen days' advance notice.
- D. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING RECORDINGS

- A. Allow Owner to record demonstration and training sessions, for internal use only.

END OF SECTION

SECTION 02 41 13 SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes demolition and removal of selected portions of existing structures, electrical and mechanical systems, and subsequent patching and repairs.

1.2 QUALITY ASSURANCE

- A. Engage an experienced firm that has successfully completed at least 5 selective demolition works of similar size and scope to that indicated for this Project.
- B. Comply with governing EPA notification regulations before starting selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

1.3 SUBMITTALS

- A. Submit the following in accordance with Specification entitled "Submittal Procedures":
 - 1. Proposed dust-control measures
 - 2. Proposed noise-control measures
 - 3. Schedule of selective demolition activities indicating the following:
 - a. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity
 - b. Interruption of utility services
 - c. Coordination for shutoff, capping, and continuation of utility services
 - d. Detailed sequence of selective demolition and removal work to ensure uninterrupted progress of Owner's on-site operations.
 - e. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
 - f. Locations of temporary partitions and means of egress
 - 4. Closeout Submittals
 - a. Inventory: Submit a list of items that have been removed and salvaged.
 - b. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.4 MATERIALS OWNERSHIP

- A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain the Owner's property, demolished materials shall become the Contractor's property and shall be removed from the site with further disposition at the Contractor's option.

1.5 PROJECT CONDITIONS

- A. Conduct selective demolition so that Owner's operations will not be disrupted. Provide not less than 72 hours notice to Owner of activities that will affect Owner's operations.
- B. Owner assumes no responsibility for actual condition of buildings to be selectively demolished. Notify Engineer and Owner of discrepancies between existing conditions and Contract Drawings before proceeding with selective demolition.
- C. Hazardous materials may be present in areas subject to selective demolition.
 - 1. Where the presence of hazardous materials is known, procedures for handling, protection or remediation are specified on Contract Drawings and elsewhere in the Project Manual.
 - 2. Where unidentified hazardous materials or items suspected of containing hazardous materials are encountered during the Work, immediately notify the Engineer in writing before disturbing such material. The Engineer and Owner will then investigate the suspect material and notify the Contractor of its findings.
 - 3. A hazardous material survey and tank inspection were performed to identify asbestos containing materials (ACM), lead-based paint (LBP), and polychlorinated biphenyls (PCB)-containing materials that are present on exposed surfaces within the Crotonville Pumping Station project areas. Survey results are included for Contractor's reference, but are not part of the Contract Documents.

PART 2 - PRODUCTS

2.1 REPAIR MATERIALS

- A. Use repair materials identical to existing materials.
 - 1. Where identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
 - 2. Use materials whose installed performance equals or surpasses that of existing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped prior to equipment removal.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with the intended function or design are encountered, investigate and measure the nature and extent of the conflict. Promptly submit a written report to the Engineer.
- E. Survey the condition of the building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of the structure or adjacent structures during selective demolition.

- F. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES

- A. Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Do not interrupt existing utilities serving occupied or operating facilities, except when authorized in writing by Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to governing authorities.
 - a. Provide not less than two weeks notice to Owner if shutdown of service is required during changeover.
- B. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services serving portion of building to be selectively demolished.
 - 1. Coordinate shut-off of indicated utility services with Owner and utility.
 - 2. Where utility services are required to be removed, relocated, or abandoned, provide bypass connections to maintain continuity of service to other parts of the building before proceeding with selective demolition.
 - 3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit after bypassing.

3.3 PREPARATION

- A. Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.
- B. Conduct demolition operations and remove debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
- C. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around selective demolition area.
 - 1. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
 - 2. Protect walls, ceilings, floors, and other existing finish work that are to remain and are exposed during selective demolition operations.
 - 3. Cover and protect furniture, furnishings, and equipment that have not been removed.
- D. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
 - 1. Strengthen or add new supports when required during progress of selective demolition.

3.4 POLLUTION CONTROLS

- A. Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations.
 - 1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
- B. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level.
- C. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before start of selective demolition.

3.5 SELECTIVE DEMOLITION

- A. Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete Work within limitations of governing regulations and as follows:
 - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition work above each floor or tier before disturbing supporting members on lower levels.
 - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. To minimize disturbance of adjacent surfaces, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
 - 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
 - 5. Maintain adequate ventilation when using cutting torches.
 - 6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 - 7. Locate selective demolition equipment throughout the structure and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 - 8. Dispose of demolished items and materials promptly. On-site storage or sale of removed items is prohibited.
 - 9. Return elements of construction and surfaces to remain to condition existing before start of selective demolition operations.
- B. Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain, using power-driven masonry saw or hand tools; do not use power-driven impact tools.
- C. Break up and remove concrete slabs on grade, unless otherwise shown to remain.

3.6 PATCHING AND REPAIRS

- A. Promptly patch and repair holes and damaged surfaces caused to adjacent construction by selective demolition operations.
- B. Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.
 - 1. Completely fill holes and depressions in existing masonry walls to remain with an approved masonry patching material, applied according to manufacturer's printed recommendations.
- C. Restore exposed finishes of patched areas and extend finish restoration into adjoining construction to remain in a manner that eliminates evidence of patching and refinishing.
- D. Patch and repair floor and wall surfaces resulting from electrical, mechanical, HVAC or plumbing demolition. Provide a flush and even surface of uniform color and appearance.
 - 1. Closely match texture and finish of existing adjacent surface.
 - 2. Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
 - 3. Where patching smooth painted surfaces, extend final paint coat over entire unbroken surface containing the patch after the surface has received primer and second coat.
 - 4. Patch and repair masonry walls or partitions.
 - 5. Inspect and test patched areas to demonstrate integrity of the installation, where feasible.
 - 6. Patch and repair concrete floors, foundation walls and tank walls.
- E. Patch or repair existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them. Provide landfill ticket/receipt to Engineer and Owner.

3.8 CLEANING

- A. Sweep the building broom clean on completion of selective demolition operation.
- B. Change filters on air-handling equipment on completion of selective demolition operations.

3.9 WIRING REMOVALS

- A. Where wiring is shown, specified or noted for removal, work shall include all conduits, junction boxes, supports, conductors and appurtenances. Where wiring removals include both exposed and concealed conduit in concrete, work shall include removal of exposed conduit flush with concealed conduit. Grout remaining concealed conduit closed.
- B. All wall, floor, ceiling, equipment and panel enclosure openings resulting from wiring or device removal shall be restored to match existing surfaces and finishes.

- C. Where existing circuits are shown to be removed or modified, field verify existing connections and wiring to ensure actual circuits are as shown.
- D. Portions of existing wiring noted to be disconnected and remain shall have conductor ends tapped and tagged to note origin.

END OF SECTION

SECTION 03 30 00 CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, waterstops, mixture design, placement procedures, and finishes, for the following:
 - 1. Flood walls
 - 2. Corbels
 - 3. Equipment pads
 - 4. Caisson foundations

1.2 REFERENCES

- A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications (Contractor shall provide copies of all documents on-site), except where more stringent requirements are specified herein:
 - 1. New York State Uniform Fire Prevention and Building Code, 2016
 - 2. International Building Code (IBC), 2015
 - 3. American Concrete Institute (ACI)
 - a. ACI 117 – Specifications for Tolerances for Concrete Construction and Materials
 - b. ACI 211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete
 - c. ACI 301 – Specification for Structural Concrete
 - d. ACI 302 – Guide for Concrete Floor and Slab Construction
 - e. ACI 304 – Guide for Measuring, Mixing, Transporting and Placing Concrete
 - f. ACI 305R - Hot Weather Concreting
 - g. ACI 306R - Cold Weather Concreting
 - h. ACI 308 - Standard Practice for Curing Concrete
 - i. ACI 318 - Building Code Requirements for Structural Concrete
 - j. ACI 350 – Environmental Engineering Concrete Structures
 - k. ACI 350.1 and 350.1R – Tightness Testing of Environmental Engineering Concrete Structures and Commentary
 - l. ACI 350.3R – Seismic Design of Liquid Containing Concrete Structures and Commentary
 - 4. American National Standards Institute (ANSI)
 - a. ANSI/ASTM A185 – Welded Steel Wire Fabric for Concrete Reinforcement
 - 5. American Society for Testing and Materials (ASTM)
 - a. ASTM A615 - Deformed and Plain Billet Steel for Concrete Reinforcement
 - b. ASTM C33 - Concrete Aggregates

- c. ASTM C94 - Ready-Mixed Concrete
- d. ASTM C150 - Portland Cement
- e. ASTM C260 - Air Entraining Admixtures for Concrete
- f. ASTM C494 - Chemical Admixtures for Concrete
- 6. Concrete Reinforcing Steel Institute (CRSI)
 - a. Manual of Standard Practice
 - b. Design Handbook

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 SUBMITTALS

- A. Submit the following in accordance with the General Requirements:
 - 1. Scheduling: Submit concrete placement schedule before start of placement operations. Include locations of all joints including construction joints.
 - 2. Product Data: Provide product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, fiber reinforcement, curing materials, floor and slab treatments, bonding agents and others if requested by Owner's Representative. Written mix design shall be based on field experience or trial mixture. Submit documentation in accordance with ACI 301, Section 4.
 - a. Indicate amounts of mixing water to be withheld at batching facility for later addition at Project site.
 - 3. Shop drawings for detailing, fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, bent bar diagrams, arrangement, and support of concrete reinforcement. Include special reinforcing required for openings through concrete structures.
 - 4. Certificates: Material certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.
 - 5. Manufacturer Instructions: Provide manufacturers literature for admixtures use in concrete mix.
 - 6. Source Quality Control Submittals: Provide certificates of source of cementitious materials and aggregate used in concrete mix.
 - 7. Special Procedure Submittals: Proposed method of concrete curing.
 - 8. Construction and Control Joints: Construction and control joints shall be located by the Contractor based on details and spacing limitations shown on the Contract Drawings. Shop drawings showing Contractors proposed joint location of construction and control joints and concrete placement sequencing shall be submitted to the Engineer for review prior to the preparation of reinforcement shop drawings and placement of concrete.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
 - 2. Personnel performing laboratory tests shall be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
- C. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specification for Structural Concrete".
- D. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures. Coordinate the material evaluation testing with the Owner's Special Inspection program.
- E. Pre-installation Conference: Conduct a concrete pre-installation conference at Project site.
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Owner's representative
 - b. Contractor's superintendent
 - c. Independent testing agency responsible for concrete design mixtures
 - d. Ready-mix concrete manufacturer
 - e. Cast-in-place concrete subcontractor
 - 2. Review concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction joints, forms and form-removal limitations, reinforcement accessory installation, concrete repair procedures, and protection of cast-in-place concrete.
- F. Qualifications
 - 1. Manufacturer's Factory Qualifications: Manufacturing facilities shall have accreditation to ISO 9000:2000 or an equivalent quality management system acceptable to the Engineer.
 - 2. Testing Firm Qualifications: An independent firm, with experience and capability to conduct specified tests, and is a NRTL as defined by OSHA in 19 CFR 1910.7.
 - 3. Testing Firm's Field Supervisor Qualifications: person currently certified by NETA or NICET to supervise on-site testing specified in Part 3.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, and handle steel reinforcement to prevent bending and damage.
- B. Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. General: Comply with Division 03 Section "Cast-In-Place Concrete" for formwork and other form-facing material requirements.
- B. Form-Facing Panels for As-Cast Finishes: Exterior-grade plywood panels, non-absorptive, that will provide continuous, true, and smooth concrete surfaces, medium-density overlay, Class 1, or better, mill-applied release agent and edge sealed, complying with DOC PS 1.
- C. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.
- D. Form Liners: Units of face design, texture, arrangement, and configuration indicated. Furnish with manufacturer's recommended liquid-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent surface treatments of concrete.
- E. Rustication Strips: Metal, rigid plastic or dressed wood with sides beveled and back kerfed; non-staining; in longest practicable lengths.
- F. Chamfer Strips: Metal, rigid plastic, elastomeric rubber, or dressed wood, 3/4 by 3/4 inch minimum; non-staining; in longest practicable lengths.
- G. Form Joint Tape: Compressible foam tape; pressure sensitive; AAMA 800, "Specification 810.1, Expanded Cellular Glazing Tape"; minimum 1/4 inch thick.
- H. Form Joint Sealant: Elastomeric sealant complying with ASTM C 920, Type M or S, Grade NS that adheres to form joint substrates.
- I. Sealer: Penetrating, clear, polyurethane wood form sealer formulated to reduce absorption of bleed water and prevent migration of set-retarding chemicals from wood.
- J. Form-Release Agent: Commercially formulated colorless form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of those surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- K. Surface Retarder: Chemical liquid set retarder, for application on form-facing materials, capable of temporarily delaying final hardening of newly placed concrete surface to depth of reveal specified.
- L. Form Ties: Factory-fabricated, ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish ties that, when removed, will leave holes 1 inch (25 mm) in diameter on concrete surface.
 - 2. Furnish internally disconnecting ties that will leave no metal closer than 1-1/2 inches (38 mm) from the concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, Type I/II, gray. Supplement with the following:
 - a. Fly Ash: ASTM C 618, Class F
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120
 - c. Silica Fume: ASTM C 1240, amorphous silica

For cast-in-place concrete exposed to water, wastewater or groundwater, limit percentage, by weight, of cementitious materials other than Portland cement according to ACI 301, 318 and 350 requirements. Use fly ash, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of Portland cement, which would otherwise be used, by a minimum of 25 percent. Use one cement combination for the same application throughout the Project unless otherwise acceptable to Engineer.
- B. Normal-Weight Aggregates: ASTM C 33, Class 5S coarse aggregate or better, graded. Provide aggregates from a single source.
 - 1. Maximum Coarse Aggregate Size: 1 inch
- C. Normal-Weight Fine Aggregate: ASTM C 33, manufactured or natural sand, from same source for entire Project.
- D. Water: Potable, complying with ASTM C 94 except free of wash water from mixer washout operations.

2.3 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494, Type A
 - 2. Retarding Admixture: ASTM C 494, Type B
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II

2.4 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
 - 1. For concrete indicated to be sealed, curing compound shall be compatible with sealer.

2.5 REPAIR MATERIALS

- A. Bonding Agent: ASTM C 1059, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- B. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements.

2.6 CONCRETE MIXTURES

- A. Prepare design mixtures for each type and strength of cast-in-place concrete proportioned on basis of laboratory trial mixture or field test data, or both, according to ACI 301, Section 4. Use a qualified independent testing agency for preparing and reporting proposed design mixtures based on laboratory trial mixtures.
- B. Cementitious Materials: For cast-in-place concrete exposed to deicers, limit percentage, by weight, of cementitious materials other than Portland cement according to ACI 301, 318 and 350 requirements. Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of Portland cement, which would otherwise be used, by not less than 25 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Follow manufacturer's strict instructions for addition of crystalline waterproofing admixture during the batching process.
- E. Concrete Design Mixes:
 - 1. Type A: Interior concrete
 - a. Minimum Compressive Strength (28 Days): 4000 psi
 - b. Maximum Water-Cementitious Materials Ratio: 0.45
 - c. Maximum Aggregate Size: 1-inch
 - d. Slump Limit: 8 inches for concrete with verified slump of 2 to 4 inches before addition of high-range water-reducing admixture or plasticizing admixture.
 - e. Air Content: 1% (+/-1%)
 - 2. Type B: Exterior exposed concrete
 - a. Minimum Compressive Strength (28 Days): 4500 psi
 - b. Maximum Water-Cementitious Materials Ratio: 0.42
 - c. Maximum Aggregate Size: 1-inch
 - d. Slump Limit: 8 inches for concrete with verified slump of 2 to 4 inches before addition of high-range water-reducing admixture or plasticizing admixture.
 - e. Air Content:
 - 1) For concrete exposed to freeze and thaw conditions or subjected to de-icing salts, provide total air content of 6 percent, plus or minus 1 percent at point of delivery for 1-inch nominal maximum aggregate size.
 - 2) Do not apply a hard trowel finish to concrete with air entrainment.

2.7 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and furnish batch ticket information.
 - 1. Clean equipment used to mix and deliver cast-in-place concrete to prevent contamination from other concrete.
 - 2. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

2.8 STEEL REINFORCEMENT AND ACCESSORIES

- A. Reinforcing bars shall be ASTM A615, Grade 60, deformed. Reinforcing bars to be welded shall be ASTM A706.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire fabric in place; manufacture according to CRSI's "Manual of Standard Practice."
 - 1. Where legs of wire bar supports contact forms, use CRSI Class 1, gray, plastic-protected bar supports.

2.9 NON-METALLIC FIBER REINFORCEMENT

- A. Fiber reinforcement shall be as scheduled below as manufactured or approved equivalent. Dosage rate shall be as specified by the manufacturer. Use in strict accordance with the manufacturer's instructions. Supply in concrete identified on Drawings as "Fiber-Reinforced Concrete".
 - 1. Fiber reinforcement for fiber-reinforced concrete shall be a blended fiber product such as Novomesh® 950, or equal, applied at the application rate of 5.0 lbs. per cubic yard of concrete.

2.10 WATERSTOPS

- A. Standard waterstops shall be ribbed polyvinyl chloride (PVC) waterstops by the Paul Murphy Plastics Co., Vinylex Corporation, Greenstreak Co. or equal, at construction joints and control joints as indicated. Waterstops at expansion joints in new construction shall be ribbed, center-bulb type PVC. Waterstops for connection to future construction shall be ribbed or split-ribbed PVC. Thickness shall be 3/8-inch. Width shall be as indicated on the Contract Drawings. PVC waterstops shall meet Corps of Engineers CRD C572. Use in strict accordance with manufacturer's instructions. PVC waterstops shall be provided with integral hog rings to facilitate tie-off to reinforcing bars.
- B. Waterstops for use in chemical retaining structures shall be ribbed, center-bulb type thermoplastic rubber by Westec Barrier Technologies, or equal, at construction joints and control joints as indicated on the Contract Drawings. Thickness shall be 3/16-inch. Width shall be as indicated on the Contract Drawings.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Limit deflection of form-facing panels to not exceed ACI 347 requirements.

- B. In addition to ACI 347 limits on form-facing panel deflection, limit cast-in-place concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch
- C. Fabricate forms to result in cast-in-place concrete that complies with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-in-place surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood rustications, keyways, reglets, recesses, and the like, for easy removal.
 - 1. Seal form joints and penetrations at form ties with form joint tape or form joint sealant to prevent cement paste leakage.
 - 2. Do not use rust-stained steel form-facing material.
- E. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- F. Chamfer exterior corners and edges of cast-in-place concrete.
- G. Coat contact surfaces of wood rustications and chamfer strips with sealer before placing reinforcement, anchoring devices, and embedded items.
- H. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- I. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- J. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment
- K. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 REINFORCEMENT AND INSERTS

- A. Securely fasten steel reinforcement and wire ties against shifting during concrete placement.
- B. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

3.3 REMOVING AND REUSING FORMS

- A. Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
 - 1. Schedule form removal to maintain surface appearance that matches approved field sample panels.
 - 2. Cut off and grind glass-fiber-reinforced plastic form ties flush with surface of concrete.
- B. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 75 percent of 28-day design

compressive strength. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

- C. Clean and repair surfaces of forms to be reused in the Work. Do not use split, frayed, delaminated, or otherwise damaged form-facing material. Apply new form-release agent.
- D. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for cast-in-place concrete surfaces.

3.4 JOINTS

- A. Construction and control joints shall be located by the Contractor based on details and spacing limitations shown on the Contract Drawings. Shop drawings showing Contractors proposed joint location of construction and control joints and concrete placement sequencing shall be submitted to the Engineer for review prior to the preparation of reinforcement shop drawings and placement of concrete.
- B. Construction Joints: Install construction joints true to line with faces perpendicular to surface plane of cast-in-place concrete so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 - 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 - 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 - 5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 - 6. Use bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Control Joints: Form weakened-plane control joints true to line with faces perpendicular to surface plane of cast-in-place concrete so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.

3.5 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, form-release agent, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Engineer.
- C. Before test sampling and placing concrete, water may be added at Project site, up to the limits of the specified water-cement ratio and slump, subject to limitations of ACI 301. This presumes that not all mixing water is added at the batching plant.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

- D. Deposit concrete continuously between construction joints. Deposit concrete to avoid segregation.
 - 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. Do not permit vibrators to contact forms.
- E. Cold-Weather Placement: Comply with ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents.
 - 4. Do not use chemical accelerators unless otherwise specified and approved in design mixtures.
- F. Hot-Weather Placement: Comply with ACI 305 and as follows:
 - 1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.6 QUALITY CONTROL DURING CONSTRUCTION

- A. The Contractor shall employ a testing agency, approved by the Engineer, to perform tests and to submit test reports. Field testing to be performed by an ACI certified concrete field testing technician grade I. Coordinate this testing with the Owner's Special Inspection program.
- B. Sampling and testing for quality control during concrete placement may include the following, as directed by Engineer.
 - 1. Sampling Fresh Concrete: ASTM C172, except modified for slump to comply with ASTM C94.
 - a. Slump testing shall be in accordance with ASTM C143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
 - b. Air content testing shall be in accordance with ASTM C173, volumetric method for lightweight or normal weight concrete; ASTM C231, pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.

- c. Testing of concrete temperature shall be in accordance with ASTM C1064; one test hourly when air temperature is 40 deg F and below, when 80 deg F and above, and one test for each set of compressive-strength specimens.
 - d. Molding of cylinders for compression testing shall be in accordance with ASTM C31; one set of five standard 6-inch dia. cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
 - e. Compressive-strength testing shall be in accordance with ASTM C 39; one set for each 100 cu. yd. or fraction thereof, of each concrete mix placed in any one day; one specimen tested at 7 days, three specimens tested at 28 days, and one specimen retained in reserve for later testing if required.
- 2. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.
 - 3. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
 - 4. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.
- C. Test results will be reported in writing to Engineer, ready-mix producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.
 - D. Nondestructive testing shall consist of impact hammer, sonoscope, or other nondestructive device but shall not be used as the sole basis for acceptance or rejection.
 - E. The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Engineer. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed.

3.7 REMOVING FORMS

- A. Formwork not supporting the weight of concrete, such as sides of walls, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, concrete is able to support its own weight and provided curing and protection operations are maintained.
- B. Formwork supporting the weight of concrete, such as slabs and other structural elements, may be removed in less than 14 days but in no case until concrete has attained at least 75 percent of design minimum compressive strength at 28 days, unless otherwise noted. Determine representative compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.

- C. Form-facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

3.8 REUSING FORMS

- A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.
- B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use patched forms for exposed concrete surfaces except as acceptable to Owner's Representative.

3.9 CONCRETE SURFACE REPAIRS

- A. Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to Owner's Representative.
- B. Mix dry-pack mortar, consisting of 1 part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing.
 - 1. Cut out honeycombs, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. Place patching mortar before bonding agent has dried.
 - 2. For surfaces exposed to view, blend white Portland cement, standard Portland cement, and waterproofing admixture (where applicable) so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.
- C. Remove and replace formed concrete having defective surfaces if defects cannot be repaired to satisfaction of Owner's Representative. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.
 - 1. Repair concealed formed surfaces, where possible, containing defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.
- D. Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.
 - 1. Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01 inches wide or that penetrate to the reinforcement or completely through non-reinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.

2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.
 3. Correct low areas in unformed surfaces during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Owner's Representative.
 4. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
- E. Repair isolated random cracks and single holes 1 inch or less in diameter by dry-pack method. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Place dry-pack before bonding agent has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- F. Perform structural repairs with prior acceptance by Owner's Representative for method and procedure, using specified epoxy adhesive and mortar.
- G. Repair methods not specified above may be used, subject to acceptance of Owner's Representative.

3.10 FINISHES, GENERAL

- A. Concrete Finish: Provide a rough-formed finish on exterior formed concrete surfaces located below grade in the finished Work or permanently concealed by other construction. Provide smooth-rubbed finish on exterior formed concrete surfaces located above grade. Provide smooth-rubbed finish on interior formed concrete surfaces including exposed surfaces of tank walls.
- B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces.
1. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.
- C. Monolithic Slab Finishes
1. Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as specified; slab surfaces to be covered with membrane or waterproofing; and where indicated.
 2. After screening, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Finish surfaces to tolerances of F/F 18 (floor flatness) and F/L 15 (floor levelness) measured according to ASTM E 1155. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

3. Apply a trowel finish to interior monolithic slab surfaces exposed to view not subjected to moist conditions during normal operation and slab surfaces to be covered with paint or another thin film-finish coating system.
4. After floating, begin first trowel-finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and finish surfaces to tolerances of F/F 20 (floor flatness) and F/L 17 (floor levelness) measured according to ASTM E1155. Grind smooth any surface defects that would telegraph through applied floor covering system.

3.11 AS-CAST FORMED FINISHES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections exceeding specified limits on formed-surface irregularities.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Remove fins and other projections exceeding specified limits on formed-surface irregularities. Repair and patch tie holes and defects.
- C. Rubbed Finish: Apply the following smooth-form-finished as-cast concrete on exposed concrete surfaces:
 1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or other abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process. Repeat smooth-rubbed finish for concrete repairs.
 2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part Portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white Portland cement in amounts determined by trial patches so color of dry grout will match surrounding concrete. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
 3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part Portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white Portland cement in amounts determined by trial patches so color of dry grout will match surrounding concrete. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float

3.12 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306 for cold-weather protection and with ACI 305 for hot-weather protection during curing.
- B. Begin curing cast-in-place concrete immediately after application of final finishing of concrete. Cure according to ACI 308.1, by one or a combination of the following methods that will not mottle, discolor, or stain concrete:
 1. Moisture Curing: Keep exposed surfaces of cast-in-place concrete continuously moist for not less than seven days with the following materials:

- a. Water
 - b. Continuous water-fog spray
 - c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period; use cover material and waterproof tape.
 3. Curing Compound: Mist concrete surfaces with water. Apply curing compound uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.13 LEAKAGE TESTING

- A. Leakage testing of fluid containing structures shall be conducted in accordance with the Section "Leakage Test for Hydraulic Concrete Structures".
- B. Structures that fail the leak test shall be repaired and re-tested.

END OF SECTION

SECTION 05 50 00 METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes miscellaneous metal fabrications as shown on the Contract Drawings, complete including fabrication, shop finishing and installation.

1.2 REFERENCES

- A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements are specified herein:
1. American Society for Testing and Materials (ASTM)
 - a. ASTM A36 - Carbon Structural Steel
 - b. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 - c. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - d. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - e. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
 - f. ASTM A193 - Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature or High Pressure Service and Other Special Purpose Applications
 - g. ASTM A194 - Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
 - h. ASTM A269 - Seamless and Welded Austenitic Stainless Steel Tubing for General Service
 - i. ASTM A276 - Stainless Steel Bars and Shapes
 - j. ASTM A283 - Low and Intermediate Tensile Strength Carbon Steel Plates
 - k. ASTM A307 - Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
 - l. ASTM A325 - Structural Bolts, Steel, Heat Treated, 120/105 KSI Minimum Tensile Strength
 - m. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes
 - n. ASTM A992 - Structural Steel Shapes
 - o. ASTM B177 - Engineering Chromium Electroplating
 - p. ASTM B221 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
 - q. ASTM B308 - Aluminum-Alloy 6061-T6 Standard Structural Profiles
 - r. ASTM F1554 - Anchor bolts, Steel, 36, 55, and 105-KSI Yield Strength
 2. American Welding Society (AWS)

- a. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination
- b. AWS D1.1 - Structural Welding Code-Steel
- c. AWS D1.2 - Structural Welding Code-Aluminum
- 3. SSPC - Steel Structures Painting Council

1.3 SUBMITTALS

- A. In addition to those submittals identified in the General Provisions, the following items shall also be submitted:
 - 1. Shop drawings indicating profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
 - 2. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

1.4 QUALITY ASSURANCE

- A. Perform work in accordance with the following:
 - 1. Prepare shop drawings under direct supervision of a Professional Engineer experienced in design of this work and licensed in the State of New York.
 - 2. Use certified welders employed on the Work, with verification of AWS qualification within the previous 12 months.

1.5 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.

PART 2 - PRODUCTS

2.1 MATERIALS AND CONSTRUCTION

- A. Structural steel W-shapes shall be ASTM A992, Grade 50.
- B. Steel M, S, C, MC and L-shapes, plates and threaded rods shall be ASTM A36.
- C. Steel anchor bolts shall be ASTM F1554, Grade 36.
- D. Aluminum sections shall be ASTM B308, Alloy 6061-T6.
- E. Steel tubing shall be ASTM A500, Grade B.
- F. Steel pipe shall be ASTM A53, Grade B, Schedule 40. Bollards shall be Schedule 80.
- G. Bolts, nuts, and washers for structural steel connections shall be ASTM A325, galvanized to ASTM A153 for galvanized components.
- H. Stainless steel extrusions shall comply with ASTM A269, Type 304 or 316.
- I. Stainless steel bolts shall be ASTM A193, Type 304 or 316, grade B8 or B8M.
- J. Stainless steel nuts shall be ASTM A194, Type 304 or 316, grade 8 or 8M.
- K. Stainless steel washers shall be ANSI B18.22.1.

- L. Welding materials shall comply with AWS D1.1 or AWS D1.2; type required for materials being welded.
- M. Primer for steel shall be fast-curing, lead and chromate free, universal primer with good resistance to normal atmospheric corrosion, complying with performance requirements of FS-TT-P-664. Primer shall be compatible with finish paint system.
- N. Adhesive anchors for solid base substrates shall be a two-component adhesive system supplied in manufacturer's standard side-by-side or co-axial cartridge dispensed through a static mixing nozzle. System shall be capable of anchoring internally threaded inserts, threaded rods and steel reinforcing. Adhesive anchor system shall be one of the following:
 - 1. For applications above 40°F, use one of the following:
 - a. HIT- HY 200 or HIT RE 500 Injection Adhesive system by HILTI, Inc.
 - b. SET High Strength Epoxy system by Simpson Strong-Tie
 - 2. For applications below 40°F, use one of the following:
 - a. HIT-ICE Injection Adhesive system by HILTI, Inc.
 - b. ACRYLIC-TIE system by Simpson Strong-Tie
- O. Adhesive anchors for hollow base substrates shall be a two-component adhesive system supplied in manufacturer's standard side-by-side or co-axial cartridge dispensed through a static mixing nozzle. System shall be capable of anchoring internally threaded inserts, threaded rods and steel reinforcing. Adhesive anchor system shall be one of the following:
 - 1. For applications above 40°F, use one of the following:
 - a. HIT- HY 70 Injection Adhesive system with screen tube by HILTI, Inc.
 - b. SET High Strength Epoxy system with screen tube by Simpson Strong-Tie
 - 2. For applications below 40°F, consult manufacturer for recommendation.
- P. Expansion bolts shall be HSL Expansion anchors by HILTI, Inc. or WEDGE-ALL wedge anchors by Simpson Strong-Tie.

2.2 FABRICATION

- A. Fit and shop assemble in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- D. Exposed mechanical fastenings shall consist of flush countersunk screws or bolts, unobtrusively located, consistent with design of component, except where specifically noted otherwise.
- E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.3 FINISHES

- A. Surface preparation, primer and finish coatings shall be as specified in the Section entitled "Painting."
- B. Do not prime surfaces in direct contact with concrete or where field welding is required.

- C. Items to be galvanized shall be given a minimum 2.0 oz/sq ft zinc coating in accordance with ASTM A123.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examination
 - 1. Verify that field conditions are acceptable and are ready to receive work.
 - 2. Beginning of installation means erector accepts existing conditions.
- B. Preparation
 - 1. Clean and strip primed steel items to bare metal where site welding is required.
 - 2. Supply items required to be cast into concrete or embedded in masonry with setting templates.
- C. Erection
 - 1. Install items plumb and level, accurately fitted, free from distortion or defects.
 - 2. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
 - 3. Field weld components indicated on shop drawings.
 - 4. Perform field welding in accordance with AWS D1.1 or AWS D1.2.
- D. Erection Tolerances
 - 1. Maximum variation from plumb shall be 1/4 inch per 10 feet, non-cumulative.
 - 2. Maximum offset from true alignment shall be 1/4 inch.
- E. Schedule
 - 1. Bollards shall be steel pipe, concrete filled, crowned cap, size as detailed; galvanized.
 - 2. Ledge and shelf angles, channels and plates not attached to structural framing shall be steel, prime painted.
 - 3. Lintels shall be galvanized steel, as detailed and prime painted.
 - 4. Overhead door frames and wall openings shall be steel channel sections, prime painted.
 - 5. Fixed metal ladders shall be aluminum, mill finish, unless indicated otherwise on the Contract Drawings.
- F. Aluminum structural shapes shall be mill finish.

END OF SECTION

SECTION 05 52 13 PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section Includes the following as shown on the Contract Drawings, complete including fabrication, shop finishing and installation.
 - 1. Aluminum pipe and tube railings

1.2 REFERENCES

- A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements are specified herein.
 - 1. American Society for Testing and Materials (ASTM)
 - a. ASTM A 36 - Carbon Structural Steel
 - b. ASTM A 47 - Ferritic Malleable Iron Castings
 - c. ASTM A 48 - Gray Iron Castings
 - d. ASTM A 53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 - e. ASTM A 123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - f. ASTM A 153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - g. ASTM A 325 - Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
 - h. ASTM A 500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes
 - i. ASTM C 1107 - Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
 - 2. American Welding Society (AWS)
 - a. AWS D1.1 - Structural Welding Code – Steel
 - 3. Federal Specification
 - a. FS TT-P-664D - Primer Coating, Alkyd, Corrosion-Inhibiting, Lead and Chromate Free, VOC-Compliant
 - 4. National Association of Architectural Metal Manufacturers
 - a. Metal Finishes Manual for Architectural and Metal Products
 - 5. Steel Structures Painting Council (SSPC)
 - 6. Occupational Safety and Health Administration (OSHA), Department of Labor
 - a. Code of Federal Regulations (CFR) 29, Part 1910 – Occupational Safety and Health Standards

1.3 PERFORMANCE REQUIREMENTS

- A. All railings shall be in accordance with applicable OSHA regulations.

- B. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
 - 1. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.
- D. Structural Performance: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. applied in any direction
 - b. Concentrated load of 200 lbf applied in any direction
 - c. Uniform and concentrated loads need not be assumed to act concurrently
 - 2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
 - b. Infill load and other loads need not be assumed to act concurrently
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces
- F. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.4 QUALITY ASSURANCE

- A. Obtain each type of handrail and railing through one source from a single manufacturer.
- B. Welding Qualifications: Quality procedures and personnel according to the following:
 - 1. AWS D1.2, "Structural Welding Code – Aluminum"

1.5 SUBMITTALS

- A. In addition to those submittals identified in the General Provisions, the following shall also be submitted.
 - 1. Shop Drawings indicating fabrication and installation of handrails and railings. Include plans, elevations, sections, component details, and attachments to other Work.
 - a. Indicate welded connection using standard AWS A2.0 welding symbols. Indicate net weld lengths.
 - b. Welding certificates.
 - 2. Grout, anchoring cement, and paint products.

1.6 STORAGE

- A. Store handrails and railings in a dry, well-ventilated, away from uncured concrete and masonry and protected from weather, moisture, soiling, abrasion extreme temperature and humidity.

1.7 PROJECT CONDITIONS

- A. Where handrails and railing systems are indicated to fit to other construction, check actual dimensions of other construction by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.8 COORDINATION AND SCHEDULING

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Aluminum Pipe and Tube Railings:
 - a. ATR Technologies, Inc.
 - b. Blum, Julius & Co., Inc.
 - c. Braun, J. G., Company; a division of the Wagner Companies
 - d. CraneVeyor Corp.
 - e. Hollaender Manufacturing Company
 - f. Kee Industrial Products, Inc.
 - g. Moultrie Manufacturing Company
 - h. Pisor Industries, Inc.
 - i. Sterling Dula Architectural Products, Inc.; Div. of Kane Manufacturing
 - j. Superior Aluminum Products, Inc.
 - k. Thompson Fabricating, LLC
 - l. Tri Tech, Inc.
 - m. Tubular Specialties Manufacturing, Inc.

- n. Tuttle Railing Systems; Div. of Tuttle Aluminum & Bronze, Inc.
- o. Wagner, R & B, Inc.; a division of the Wagner Companies

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

2.3 ALUMINUM

- A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.
- B. Extruded Bars and Tubing: ASTM B 221, Alloy 6063-T5/T52.
- C. Extruded Structural Pipe and Round Tubing: ASTM B 429, Alloy 6063-T6.
 - 1. Provide Standard Weight (Schedule 40) pipe, unless otherwise indicated.
- D. Drawn Seamless Tubing: ASTM B 210, Alloy 6063-T832.
- E. Plate and Sheet: ASTM B 209, Alloy 6061-T6.
- F. Die and Hand Forgings: ASTM B 247, Alloy 6061-T6.
- G. Castings: ASTM B 26, Alloy A356.0-T6.

2.4 FASTENERS

- A. General: Provide the following:
 - 1. Aluminum Railings: Type 304 stainless-steel fasteners.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
 - 1. For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- B. Shop Primers: Provide primers that comply with Division 09 painting Sections.
- C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- D. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- G. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

2.6 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove flux immediately.
 - 4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- H. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.
- I. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 - 1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.
- J. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- K. Close exposed ends of railing members with prefabricated end fittings.

- L. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
- M. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
 - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- N. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- O. For railing posts set in concrete, provide aluminum sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.
- P. For removable railing posts, fabricate slip-fit sockets from aluminum tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.
- Q. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.7 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.8 ALUMINUM FINISHES

- A. Mechanical Finish: AA-M12 (Mechanical Finish: nonspecular as fabricated).
- B. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- C. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.2 RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.
- B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.
- C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.3 ANCHORING POSTS

- A. Use metal sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
- C. Cover anchorage joint with flange of same metal as post, attached to post with set screws.
- D. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
1. For aluminum pipe railings, attach posts using fittings designed and engineered for this purpose.
 2. For stainless-steel pipe railings, weld flanges to post and bolt to supporting surfaces.
 3. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.
- E. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.4 ATTACHING RAILINGS

- A. Anchor railing ends at walls with round flanges anchored to wall construction and welded to railing ends or connected to railing ends using nonwelded connections.
- B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends or connected to railing ends using nonwelded connections.

3.5 ADJUSTING AND CLEANING

- A. Clean aluminum by washing thoroughly with clean water and soap and rinsing with clean water.
- B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.6 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION

SECTION 05 53 00 METAL GRATING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section Includes the Following:
 - 1. Metal bar gratings
 - 2. Metal frames and supports for gratings

1.2 REFERENCES

- A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements are specified herein:
 - 1. National Association of Architectural Metal Manufacturer's (NAAMM)
 - a. NAAMM MBG 531 - Metal Bar Grating Manual for Steel, Stainless Steel and Aluminum Gratings and Stair Treads
 - b. NAAMM MBG 532 - Heavy-Duty Metal Bar Grating Manual for Structural Carbon Steel and Stainless Steel
 - c. Metal Finishes Manual for Architectural and Metal Products
 - 2. American Welding Society (AWS)
 - a. AWS D1.1 - Structural Welding Code – Steel
 - b. ASW D1.2 - Structural Welding Code – Aluminum
 - c. AWS D1.3 - Structural Welding Code – Sheet Steel
 - 3. American Society for Testing and Materials (ASTM)
 - a. ASTM A36 - Carbon Structural Steel
 - b. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - c. ASTM A510 - General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel
 - d. ASTM A1011 - Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
 - e. ASTM A653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - f. ASTM A780 - Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
 - g. ASTM B633 - Electrodeposited Coatings of Zinc on Iron and Steel
 - h. ASTM F1267 - Metal, Expanded, Steel
 - i. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate
 - j. ASTM B221 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

1.3 QUALITY ASSURANCE

- A. Fabricator shall be experienced in producing gratings similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Metal Bar Grating Standards: Comply with applicable requirements of the following:
 - 1. Non-Heavy-Duty Metal Bar Gratings: Comply with NAAMM MBG 531, "Metal Bar Grating Manual for Steel, Stainless Steel, and Aluminum Gratings and Stair Treads."
- C. Comply with applicable provisions of AWS D1.1 "Structural Welding Code – Steel", AWS D1.2 "Structural Welding Code – Aluminum", and AWS D1.3 "Structural Welding Code – Sheet Steel".
 - 1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.4 SUBMITTALS

- A. Submit the following in accordance with the General Provisions:
 - 1. Product Data
 - a. Metal bar gratings
 - b. Clips and anchorage devices for gratings
 - 2. Shop Drawings detailing fabrication and erection of gratings. Include plans, elevations, sections, and details of connections. Show areas of fixed and removable sections, anchorage, accessory items, and load tables. Provide templates for anchors and bolts specified for installation under other Sections.
 - 3. Welding Certificates: Copies of certificates for welding procedures and personnel.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with gratings by field measurements before fabrication.

1.6 COORDINATION

- A. Coordinate installation of anchorages for gratings, grating frames, and supports. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS**2.1 ALUMINUM**

- A. Aluminum, General: Provide alloy and temper recommended by aluminum producer for type of use indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.
- B. Extruded Bars and Shapes: ASTM B 221, alloys as follows:
 - 1. 6061-T6 or 6063-T6, for bearing bars of gratings and shapes
 - 2. 6061-T1, for grating crossbars

- C. Aluminum Sheet: ASTM B 209, Alloy 5052-H32.

2.2 FASTENERS

- A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless-steel fasteners for fastening aluminum.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts, and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1 (A1).
- D. Plain Washers: Round, ASME B18.22.1.
- E. Lock Washers: Helical, spring type, ASME B18.21.1.

2.3 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy that is welded.
- B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.4 FABRICATION

- A. Shop Assembly: Fabricate grating sections in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.
- D. Fit exposed connections accurately together to form hairline joints.
- E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.

2.5 METAL BAR GRATINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. IKG Industries; a division of Harsco Corporation
 - 2. Ohio Gratings, Inc.

3. Klemp Corp
- B. Pressure-Locked, Rectangular Bar Aluminum Grating: Fabricated by pressing rectangular flush-top crossbars into slotted bearing bars or [swaging crossbars between bearing bars.
 1. Bearing Bar Spacing: 1-3/16 inches o.c.
 2. Bearing Bar Depth: As indicated on the Contract Drawings
 3. Bearing Bar Thickness: 3/16 inch
 4. Crossbar Spacing: 4 inches o.c.
 5. Traffic Surface: As indicated
 6. Aluminum Finish: Class I, clear, anodized finish
- C. Removable Grating Sections: Fabricate with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated or, if not indicated, as recommended by manufacturer for attaching to supports.
 1. Provide no fewer than four weld lugs for each heavy-duty grating section, with each lug shop welded to two bearing bars.
 2. Usually retain first subparagraph below for non-heavy-duty gratings with rectangular crossbars spaced 15/16 inch or more o.c. Saddle clips hook over the tops of two adjacent bearing bars and have a hole for inserting a fastener.
 3. Provide no fewer than four saddle clips for each grating section composed of rectangular bearing bars 3/16 inch or less in thickness and spaced 15/16 inch or more o.c., with each clip designed and fabricated to fit over two bearing bars.
 4. Provide no fewer than four weld lugs for each grating section composed of rectangular bearing bars 3/16 inch or less in thickness and spaced less than 15/16 inch o.c., with each lug shop welded to three or more bearing bars. Interrupt intermediate bearing bars as necessary for fasteners securing grating to supports.
 5. Furnish threaded bolts with nuts and washers for securing grating to supports.
 6. Furnish self-drilling fasteners with washers for securing grating to supports.
 7. Furnish galvanized malleable-iron flange clamp with galvanized bolt for securing grating to supports. Furnish as a system designed to be installed from above grating by one person.
 - a. Products: Subject to compliance with requirements, provide the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Kee Industrial Products, Inc.; Grating Clip
 - 2) Lindapter North America, Inc.; Grate-Fast
 - D. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.
 1. Edge-band openings in grating that interrupt four or more bearing bars with bars of same size and material as bearing bars.
 - E. Do not notch bearing bars at supports to maintain elevation.

2.6 GRATING FRAMES AND SUPPORTS

- A. Frames and Supports for Metal Gratings: Fabricate from metal shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive

gratings. Miter and weld connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.

1. Unless otherwise indicated, fabricate from same basic metal as gratings.
2. Equip units indicated to be cast into concrete or built into masonry with integrally welded anchors. Unless otherwise indicated, space anchors 24 inches o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches wide by 1/4-inch thick by 8 inches long.

2.7 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: Nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 1. Perform all cutting and fitting required for installation. Grating shall be placed such that cross bars align.
 2. Wherever grating is pierced by pipes, ducts and structural members, cut openings neatly and accurately to size and weld a rectangular band bar of the same height and material as bearing bars.
 3. Cutouts for circular obstructions are to be at least 2 inches larger in diameter than the obstruction. Cutouts for al piping 4 inches or less shall be made in the field.
 4. All rectangular cutouts are to be made to the next bearing bar beyond the penetration with a clearance not to exceed bearing bar spacing.
 5. Utilize standard panel widths wherever possible.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.
- D. Fit exposed connections accurately together to form hairline joints.
 1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- E. Field Welding: Comply with the following requirements:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.2 INSTALLING METAL BAR GRATINGS

- A. General: Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.
- B. Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.
- C. Attach nonremovable units to supporting members by welding where both materials are same; otherwise, fasten by bolting as indicated above.

3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 06 10 00 ROUGH CARPENTRY

1.1 GENERAL

1.2 SUMMARY

- A. This Section includes the following as shown on the Contract Drawings.
 - 1. Wood blocking and nailers.

1.3 DEFINITIONS

- A. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - 1. NeLMA: Northeastern Lumber Manufacturers' Association.
 - 2. NLGA: National Lumber Grades Authority.
 - 3. RIS: Redwood Inspection Service.
 - 4. SPIB: The Southern Pine Inspection Bureau.
 - 5. WCLIB: West Coast Lumber Inspection Bureau.
 - 6. WWPA: Western Wood Products Association.

1.4 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 - 3. For fire-retardant treatments specified to be High-Temperature (HT) type, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
 - 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 - 5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
- B. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

- C. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
 - 1. Fire-retardant-treated wood.
 - 2. Power-driven fasteners.
 - 3. Expansion anchors.
 - 4. Metal framing anchors.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Engineered Wood Products: Obtain each type of engineered wood product through one source from a single manufacturer.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
 - 3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.

2.2 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Comply with performance requirements in AWPAC20 (lumber) and AWPAC27 (plywood).
 - 1. Use Exterior type plywood at all locations where fire treated wood is specified.
 - 2. Use Interior type blocking at locations below roof system
- B. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
- C. Application: Treat all rough carpentry, unless otherwise indicated.
 - 1. Concealed blocking.
 - 2. Soffit framing.
 - 3. Roof sub-fascia.
 - 4. Plywood backing panels.

2.3 DIMENSION LUMBER FRAMING

- A. Maximum Moisture Content: 15 percent or less.
- B. Soffit framing and sub-fascia: Construction or No. 2 grade and any of the following species:
 - 1. Douglas fir-larch; WCLIB or WWPA.
 - 2. Spruce-pine-fir; NLGA.

2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 15 percent maximum moisture content of any species.
 - 1. Spruce-pine-fir; NLGA.
- C. For concealed boards, provide lumber with 15 percent maximum moisture content and the following species and grades:
 - 1. Spruce-pine-fir (south) or spruce-pine-fir, Construction or 2 Common; NLGA, WCLIB, or WWPA.
- D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 PLYWOOD BACKING PANELS

- A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

2.6 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
 - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A ; with ASTM A 563 hex nuts and, where indicated, flat washers.
- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed

in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

2.7 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.
- B. Flexible Flashing: Self-adhesive, rubberized-asphalt compound, bonded to a high-density, polyethylene film to produce an overall thickness of not less than 0.025 inch.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- C. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.
- E. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions.
- F. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.
- G. Do not splice structural members between supports, unless otherwise indicated.
- H. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
 2. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.
- I. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- J. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
 2. Use copper naphthenate for items not continuously protected from liquid water.
- K. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
1. NES NER-272 for power-driven fasteners.
 2. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in ICBO's Uniform Building Code.
 3. Table 2305.2, "Fastening Schedule," in BOCA's BOCA National Building Code.
 4. Table 2306.1, "Fastening Schedule," in SBCCI's Standard Building Code.
 5. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
 6. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in ICC's International One- and Two-Family Dwelling Code.
- L. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.

3.2 WOOD SLEEPER, BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.
- C. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- D. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 WOOD FURRING INSTALLATION

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
- B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal- size furring vertically at 24 inches o.c.

3.4 SOFFIT FRAMING INSTALLATION

- A. Soffit Joists: Install soffit joists with crown edge up and complying with requirements specified above for floor joists. Face nail to ends of parallel rafters.
 1. Where soffit joists are at right angles to rafters, provide additional short joists parallel to rafters from wall plate to first joist; nail to ends of rafters and to top plate and nail to first joist or anchor with framing anchors or metal straps. Provide 1-by-8-inch nominal-

size or 2-by-4-inch nominal- size stringers spaced 48 inches o.c. crosswise over main ceiling joists.

- B. Provide special framing as indicated for eaves, overhangs, and similar conditions, if any.

3.5 CLEANING

- A. On completion of installation, inspect interior and exterior of equipment. Remove dust, dirt, paint splatters and other spots from exterior and wipe down with damp cotton cloth. Touch up exposed surfaces to match original finish. Vacuum interior "white glove clean", removing all dirt and debris while taking care to protect static-sensitive and fragile parts from damage. Do not use compressed air to assist in cleaning.

3.6 PROTECTION

- A. Protect installed equipment from damage through Substantial Completion.
- B. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- C. B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

SECTION 07 01 50 PREPARATION FOR RE-ROOFING

PART 1 - GENERAL

1.1 SECTION INCLUDES

1. Roof tear-off.
2. Temporary roofing membrane. (At contractors option)
3. Roof re-cover preparation.
4. Removal of base flashings.

1.2 MATERIALS OWNERSHIP

- A. Except for items or materials indicated to be reused, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.

1.3 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.
- B. Existing Membrane Roofing System: Single ply roofmembrane, roof insulation, surfacing, and components and accessories between deck and roofing membrane.
- C. Roof Tear-Off: Removal of existing membrane roofing system from deck.
- D. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and reinstalled.
- E. Existing to Remain: Existing items of construction that are not indicated to be removed.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Temporary Roofing (At contractors option): Include Product Data and description of temporary roofing system. If temporary roof will remain in place, submit surface preparation requirements needed to receive permanent roof, and submit a letter from roofing membrane manufacturer stating acceptance of the temporary membrane and that its inclusion will not adversely affect the roofing system's resistance to fire and wind or its FM Global rating.
- C. Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including exterior and interior finish surfaces, that might be misconstrued as having been damaged by reroofing operations. Submit before Work begins.
- D. Landfill Records: Indicate receipt and acceptance of hazardous wastes, such as asbestos-containing material, by a landfill facility licensed to accept hazardous wastes.
- E. Qualification Data: For Installer including certificate that Installer is licensed to perform asbestos abatement.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Installer of new membrane roofing system, licensed to perform asbestos abatement in the State or jurisdiction where Project is located.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning membrane roofing removal. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Reroofing Conference: Conduct conference at Project site.
 - 1. Meet with Owner; Architect; Owner's insurer if applicable; testing and inspecting agency representative; roofing system manufacturer's representative; deck Installer; roofing Installer including project manager, superintendent, and foreman; and installers whose work interfaces with or affects reroofing including installers of roof accessories and roof-mounted equipment.
 - 2. Review methods and procedures related to roofing system tear-off and replacement including, but not limited to, the following:
 - a. Reroofing preparation, including membrane roofing system manufacturer's written instructions.
 - b. Temporary protection requirements for existing roofing system that is to remain during and after installation.
 - c. Existing roof drains and roof drainage during each stage of reroofing, and roof drain plugging and plug removal requirements.
 - d. Construction schedule and availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - e. Existing deck removal procedures and Owner notifications.
 - f. Condition and acceptance of existing roof deck and base flashing substrate for reuse.
 - g. Structural loading limitations of deck during reroofing.
 - h. Base flashings, special roofing details, drainage, penetrations, equipment curbs, and condition of other construction that will affect reroofing.
 - i. HVAC shutdown and sealing of air intakes.
 - j. Shutdown of fire-suppression, -protection, and -alarm and -detection systems.
 - k. Asbestos removal and discovery of asbestos-containing materials.
 - l. Governing regulations and requirements for insurance and certificates if applicable.
 - m. Existing conditions that may require notification of Architect before proceeding.

1.6 PROJECT CONDITIONS

- A. Owner will occupy portions of building immediately below reroofing area. Conduct reroofing so Owner's operations will not be disrupted. Provide Owner with not less than 48 hours' notice of activities that may affect Owner's operations.
 - 1. Coordinate work activities daily with Owner so Owner can place protective dust or water leakage covers over sensitive equipment or furnishings, shut down HVAC and fire-alarm or -detection equipment if needed, and evacuate occupants from below the work area.
- B. Protect building to be reroofed, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from reroofing operations.

- C. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.
- D. Conditions existing at time of inspection for bidding will be maintained by Owner as far as practical.
- E. Weather Limitations: Proceed with reroofing preparation only when existing and forecasted weather conditions permit Work to proceed without water entering existing roofing system or building.
- F. Hazardous Materials: Present in building to be reroofed. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.
 - 1. Hazardous material remediation is specified elsewhere in the Contract Documents.
 - 2. Do not disturb hazardous materials or items suspected of containing hazardous materials except according to procedures specified elsewhere in the Contract Documents.

PART 2 - PRODUCTS

2.1 TEMPORARY ROOFING MATERIALS (AT CONTRACTORS OPTION)

- A. Design and selection of materials for temporary roofing are responsibilities of Contractor.
- B. Base Sheet: ASTM D 4601, Type II, non-perforated, asphalt-impregnated and -coated, glass-fiber sheet.
- C. Glass-Fiber Felts: ASTM D 2178, Type IV, asphalt-impregnated, glass-fiber felt.
- D. Retain first paragraph below if priming concrete deck before placing temporary roofing.
- E. Asphalt Primer: ASTM D 41.
- F. Roofing Asphalt: ASTM D 312, Type III.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate with Owner to shut down air-intake equipment in the vicinity of the Work. Cover air-intake louvers before proceeding with reroofing work that could affect indoor air quality or activate smoke detectors in the ductwork.
- B. During removal operations, have sufficient and suitable materials on-site to facilitate rapid installation of temporary protection in the event of unexpected rain.
- C. Maintain roof drains in functioning condition to ensure roof drainage at end of each workday. Prevent debris from entering or blocking roof drains and conductors. Use roof-drain plugs specifically designed for this purpose. Remove roof-drain plugs at end of each workday, when no work is taking place, or when rain is forecast.
 - 1. If roof drains are temporarily blocked or unserviceable due to roofing system removal or partial installation of new membrane roofing system, provide alternative drainage method to remove water and eliminate ponding. Do not permit water to enter into or under existing membrane roofing system components that are to remain.
- D. Verify that rooftop utilities and service piping have been shut off before beginning the Work.

3.2 ROOF TEAR-OFF

- A. General: Notify Owner each day of extent of roof tear-off proposed for that day and obtain authorization to proceed.
- B. Roof Tear-Off: Remove existing roofing membrane and other membrane roofing system components down to the deck.
 - 1. Remove cover boards, roof insulation and substrate boards.
 - 2. Remove excess asphalt coal tar from concrete deck.

3.3 DECK PREPARATION

- A. Inspect deck after tear-off of membrane roofing system.
- B. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263 or by pouring **1 pint** of hot roofing asphalt on deck at start of each day's work and at start of each roof area or plane. Do not proceed with roofing work if moisture condenses under the plastic sheet or if asphalt test sample foams or can be easily and cleanly stripped after cooling.
- C. If broken or loose fasteners that secure deck panels to one another or to structure are observed or if deck appears or feels inadequately attached, immediately notify Owners representative. Do not proceed with installation until directed by Owners representative.
- D. If deck surface is not suitable for receiving new roofing or if structural integrity of deck is suspect, immediately notify Owners representative. Do not proceed with installation until directed by Owners representative.
- E. Provide deck repair as directed by owners representative.

3.4 TEMPORARY ROOFING MEMBRANE (AT CONTRACTORS OPTION)

- A. Install approved temporary roofing membrane over area to be reroofed.
- B. Remove temporary roofing membrane before installing new roofing membrane.

3.5 DISPOSAL

- A. Collect demolished materials and place in containers. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
 - 1. Storage or sale of demolished items or materials on-site is not permitted.
 Transport and legally dispose of demolished materials off Owner's property

END OF SECTION

SECTION 07 21 00 THERMAL INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Section Includes:
 - 1. Foam-plastic board insulation.
 - 2. Vapor Retarders

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

1.3 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
 - 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 FOAM-PLASTIC BOARD INSULATION (CAVITY WALL APPLICATIONS)

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Owens Corning. - Foamular CW25
 - b. DiversiFoam Products.

- c. Dow Chemical Company (The).
 - d. Pactiv Building Products.
- 2. Type IV, 25 psi. 1.55 pcf density, R-5/ inch min.
- B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

2.2 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
 - b. Gemco; Spindle Type.
 - c. Or Equal.
 - 2. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - 3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.
- B. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. AGM Industries, Inc.
 - b. Gemco
 - c. Or equal.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

- D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF BELOW-GRADE INSULATION

- A. On vertical footing and foundation wall surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
 - 1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.
- B. On horizontal surfaces under slabs, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
 - 1. If not otherwise indicated, extend insulation a minimum of 24 inches in from exterior walls.

3.4 INSTALLATION OF CAVITY-WALL INSULATION

- A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face, and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.

3.5 INSTALLATION OF INSULATION FOR CONCRETE SUBSTRATES

- A. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
 - 1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.
 - 2. Apply insulation standoffs to each spindle to create cavity width indicated between concrete substrate and insulation.
 - 3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.
 - 4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

3.6 INSTALLATION OF VAPOR RETARDERS

- A. Place vapor retarders on side of construction indicated on Drawings. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives or other anchorage system as indicated. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- B. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs.

1. Before installing vapor retarders, apply urethane sealant to flanges of metal framing including runner tracks, metal studs, and framing around door and window openings. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.
 2. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacturer.
- C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.
- D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.7 PROTECTION

- A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 07 27 26
FLUID APPLIED WEATHER BARRIER

PART 1 - GENERAL

1.1 SUMMARY

- A. Fluid-applied, vapor permeable weather barrier membrane. Joint Treatment:
 - 1. Joint Tape
 - 2. Joint Compound
- B. Flashing:
 - 1. Vapor Permeable Fluid-Applied Elastomeric Flashing brush Grade.
 - 2. Flexible Flashing.
 - 3. Sheet Flashing.
- C. Sealant
- D. Primers for flexible flashing and sheet flashing.

1.2 REFERENCES

- A. ASTM International
 - 1. ASTM C 1250 – Standard Test Method for Nonvolatile Content of Cold Liquid-Applied Elastomeric Waterproofing Membranes.
 - 2. ASTM D 412 – Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension.
 - 3. ASTM D 2240 – Standard Test Method for Rubber Property – Durometer Hardness.
 - 4. ASTM D 4541 – Standard Test Method for Pull-off Strength of Coatings Using Portable Adhesion Testers.
 - 5. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 6. ASTM E 96 - Test Method for Water Vapor Transmission of Materials
 - 7. ASTM E 283 – Standard Test Method for Determining the Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences Across the Specimen.
 - 8. ASTM E 331 – Standard Test Method for Water Penetration of Exterior Windows, Skylight, Doors and Curtain Walls by Uniform Static Air Pressure Differences.
 - 9. ASTM E 779 – Standard Test Method for Determining Air Leakage Rate by Fan Pressurization.
 - 10. ASTM E 783 – Standard Test Method for Field Measurement of Air Leakage through Installed Exterior Windows and Doors.
 - 11. ASTM E 1105 – Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.

12. ASTM E 1186 – Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems.
 13. ASTM E 1677 - Specification for Air Retarder Material or System for Framed Building Walls.
 14. ASTM E 2178 – Standard Test Method for Air Permeance of Building Materials
 15. ASTM E 2357 – Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.
 16. ASTM G155 – Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials.
 17. ASTM C 1305 - Standard Test Method for Crack Bridging Ability of Liquid-Applied Waterproofing Membrane.
- B. AATCC – American Association of Textile Chemists & Colorists
1. Test Method 127 Water Resistance: Hydrostatic Pressure Test.
- C. TAPPI
1. Test Method T-460; Air Resistance of Paper (Gurley Hill Method).

1.3 SUBMITTALS

- A. Submit the following in accordance with Specification 01 35 29 Submittal Procedures.
- B. Product Data: Submit manufacturer's current technical literature for each component.
- C. Quality Assurance Submittals:
1. Design Data, Test Reports: Provide manufacturer test reports indicating product compliance with indicated requirements.
 2. Manufacturer Instructions: Provide manufacturer's written installation instructions.
- D. Closeout Submittals:
1. Weather Barrier Warranty: Manufacturer's executed warranty form with authorized signatures and endorsements indicating date of Substantial Completion.

1.4 QUALITY ASSURANCE

- A. Qualifications:
1. Installer shall have experience with installation of commercial fluid-applied weather barrier assemblies under similar conditions.
 2. Installer shall be trained and certified for installation by manufacturer.
- B. Installation shall be in accordance with manufacturer's installation guidelines and recommendations.
- C. Source Limitations: Provide weather barrier and accessory materials produced by single manufacturer.
- D. Mock-up:
1. Install mock-up using approved weather barrier system including membrane, flashing, joint and detailing compound and related weather barrier accessories according to weather barrier manufacturer's current printed instructions and recommendations.
 - a. Mock-up may remain as part of the work.

2. Contact manufacturer's designated representative prior to weather barrier system installation, to perform required mock-up visual inspection and analysis as required for warranty.
- E. Pre-installation Meeting
1. Hold a pre-installation conference, two weeks prior to start of weather barrier installation. Attendees shall include Contractor, Engineer, certified installer, Owner's Representative, and weather barrier manufacturer's designated field representative.
 2. Review all related project requirements and submittals, status of substrate work and preparation, areas of potential conflict and interface, availability of weather barrier system materials and components, installer's training requirements, equipment, facilities and scaffolding, and coordinate methods, procedures and sequencing requirements for full and proper installation, integration and protection.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver weather barrier materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact.
- B. Store weather barrier materials as recommended by manufacturer.

1.6 SCHEDULING

- A. Review requirements for sequencing of installation of weather barrier system with installation of windows, doors, louvers and flashings to provide a weather-tight barrier system.
- B. Schedule installation of exterior cladding within nine months of weather barrier system installation.

1.7 WARRANTY

- A. Limited Warranty
 1. Manufacturer's warranty for weather barrier for a period of ten (10) years from date of Purchase.
 2. Pre-installation meeting and jobsite observations by weather barrier manufacturer for warranty are required.

PART 2 - PRODUCTS

2.1 WEATHER BARRIER

- A. Manufacturer: Basis of design: DuPont Building Innovations; 4417 Lancaster Pike, Chestnut Run Plaza 728, Wilmington, DE 19805; 1.800.44TYVEK (8-9835) or comparable products by one of the following;
 - a. Grace Construction Products
 - b. W.R. Meadows, Inc.
 - c. Tremco Commercial Sealant & Waterproofing, an RPM Company
 - d. Or approved equal.

2. Description: A single-component, low VOC, 25 mil thick synthetic polymer fluid-applied product with superior elasticity and flexibility providing resistance to air flow, bulk water and wind driven rain yet allows moisture vapor to escape.
 3. Basis of Design: DuPont™ Tyvek® Fluid Applied WB System; including DuPont™ Tyvek® Fluid Applied WB, DuPont™ Tyvek® Fluid Applied Flashing and Joint Compound, DuPont™ Tyvek® Fluid Applied Flashing – Brush Grade and DuPont™ Sealant for Tyvek® Fluid Applied Systems.
- B. Performance Characteristics:
1. Air Penetration Resistance (Material):
 - a. 0.0002 cfm/ft² at 75 Pa, when tested in accordance with ASTM E 2178.
 - b. Air infiltration greater than 10,000 seconds per 100cc, when tested in accordance with TAPPI Test Method T-460.
 2. Air Penetration Resistance (System / Assembly):
 - a. ≤ 0.01 cfm/ft² at 75 Pa, when tested in accordance with ASTM E 2357.
 - b. ≤ 0.01 cfm/ft² at 75 Pa, Type I Air Barrier, when tested in accordance with ASTM E 1677.
 3. Water Vapor Transmission: 25 perms, when tested in accordance with ASTM E 96, Method B at 25 mils DFT (Dry Film Thickness).
 4. Water Penetration Resistance: Greater than 1000 cm when tested in accordance with AATCC Test Method 127. No leakage at 15 psf when tested in accordance with ASTM E 331.
 5. Tensile Strength: Minimum 169 lbs/in², when tested in accordance with ASTM D 412.
 6. Estimated Elongation: 420% in accordance with ASTM D 412.
 7. Hardness: Passes at a Shore A hardness of 71, when tested in accordance with ASTM D 2240.
 8. Surface Burning Characteristics: per Class A, when tested in accordance with ASTM E 84. Flame Spread: 25, Smoke Developed: 25.
 9. UV Resistance: 9 months
 10. Volatile Organic Content (VOC): Less than 2% (25-30 g/L) when measured in accordance with ASTM C 1250.
 11. Adhesion Strength (Concrete): Greater than 33 psi when measured in accordance with ASTM D 4541.
 12. Low Temperature Crack Bridging: Pass, when tested in accordance with ASTM C 1305.

2.2 ACCESSORIES

- A. Joint Treatment:
1. Joint Tape:
 - a. Product: Self-adhered fiberglass mesh tape as recommended by weather barrier manufacturer.
 2. Joint Compound: Fluid-applied, vapor permeable, elastomeric flashing material; trowel applied.

- a. Product: DuPont™ Tyvek® Fluid Applied Flashing and Joint Compound
- B. Flashing:
 - 1. Vapor permeable fluid-applied elastomeric flashing:
 - a. Product: DuPont™ Tyvek® Fluid Applied Flashing – Brush Grade, as manufactured by DuPont™.
 - b. Location: At perimeter of wall openings
 - 2. Flexible flashing with butyl adhesive layer.
 - a. Product: DuPont™ FlexWrap™ NF.
 - 3. Sheet flashing with butyl adhesive layer.
 - a. Product: DuPont™ StraightFlash™.
 - b. Location: At transitions between wall material and at building corners
- C. Sealant: Elastomeric; non-vapor permeable sealant; compatible with weather barrier.
 - 1. Product: DuPont™ Sealant for Tyvek® Fluid Applied Systems.
- D. Primers for flexible flashing and sheet flashing:
 - 1. Provide flashing manufacturer recommended primer to assist in adhesion between substrate and flashing.
 - 2. Products:
 - a. 3M High Strength 90
 - b. Denso Butyl Spray
 - c. Or approved equal

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify substrate and surface conditions are in accordance with weather barrier manufacturer recommended tolerances prior to installation of weather barrier and accessories.

3.2 PREPARATION

- A. Complete surface preparation, priming, flashing and detailing of openings, cracks, and material transitions prior to beginning installation of fluid-applied weather barrier system.
- B. Surfaces shall be clean and free of frost, oil, grease, mold and efflorescence prior to application of fluid-applied weather barrier system.

3.3 INSTALLATION - DETAILING

- A. Corners: Apply primer to outside and inside corners, extend 2 inches on each side of corner. Center sheet flashing over corner and press firmly in place per manufacturer's recommendations.
- B. Joint treatment:
 - 1. Non-movement joints in masonry and transitions to columns and beams:

- a. Joints 1/4 to 1/2 inch: Apply primer 2 inches on each side of joint. Center sheet flashing over joint and press firmly in place per manufacturer's recommendations.
- C. Apply fluid-applied joint compound to cladding anchors prior to installation of weather barrier membrane per manufacturer's instructions.
- D. Apply fluid-applied joint compound around penetrations in exterior walls forming a fillet bead minimum 1/2 inch onto each surface.
- E. Installation – Vapor permeable fluid-applied elastomeric flashing at openings:
 - 1. At jambs and head of rough opening: Apply 25 mil thickness of fluid-applied flashing to full depth of opening and 2 inches onto outside face of opening.
 - 2. At sills: Apply primer to substrates as recommended by manufacturer. Cut sheet flashing to fit directly between jambs of opening. Install sheet flashing to full width of sill opening and down onto outside face of opening a minimum of 2 inches. Cover sheet flashing with 25 mil thickness of vapor permeable fluid-applied elastomeric flashing per fluid-applied weather barrier manufacturer's instructions.
- F. Allow Fluid-Applied Flashing, Joint Compound and Sealant to cure for minimum 24 hours before coating with Fluid-applied Weather Barrier.

3.4 INSTALLATION - FLUID-APPLIED WEATHER BARRIER

- A. Install fluid-applied weather barrier prior to installation of windows, doors, and louvers.
- B. Mask and protect any adjacent finished surfaces from fluid-applied weather barrier material.
- C. Install fluid-applied weather barrier over exterior face of required exterior wall substrates in accordance with weather barrier manufacturer recommendations and instructions.
- D. Install fluid-applied weather barrier by power-rolling method or spray and backrolling method to achieve 25 mils providing a consistent and uniform thickness.
- E. Repair any voids, holidays, or non-uniform installations or damage by other trades to proper mil thickness prior to installation of final cladding assemblies.

3.5 FIELD QUALITY CONTROL

- A. Notify weather barrier manufacturer's designated representative to obtain required periodic observations of weather barrier system installation.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections as required in Contract Documents.
- C. Inspections: Weather barrier materials, accessories, and installation are subject to inspection for compliance with performance requirements.
- D. Weather barriers assemblies will be considered defective upon failure of inspections and specific project testing required.
 - 1. Apply additional fluid-applied weather barrier material, in accordance with manufacturer's instructions, where inspection results indicate insufficient thickness, voids, skips, pinholes or other defects as recommended by weather barrier manufacturer.
 - 2. Remove and replace deficient weather barrier system components for retesting as specified above.
- E. Repair damage to weather barriers caused by destructive testing; follow manufacturer's written instructions.

3.6 PROTECTION AND CLEANING

- A. Protect weather barrier from contact with incompatible materials and sealants not approved per weather barrier manufacturer's recommendation.
- B. Protect installed weather barrier system from damage during construction prior to cladding installation.
 - 1. If damaged or exposed to UV beyond nine (9) months, clean and prepare surfaces and install additional, full-thickness, fluid-applied weather barrier application in accordance with weather barrier manufacturer's instructions.
- C. Remove masking materials and adjacent protection after weather barrier installation.

END OF SECTION

SECTION 07 53 23

EPDM ROOFING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Section Includes
 - 1. Adhered EPDM membrane roofing system.
 - 2. Vapor retarder.
 - 3. Roof insulation

1.2 DEFINITIONS

- A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.
- C. Retain first paragraph below if membrane roofing system is to be designed to withstand uplift pressure established by ASCE/SEI 7. Revise design uplift pressures if local building code requirements are more stringent than ASCE/SEI 7. Retain with "FM Approvals Listing" Paragraph below if both ASCE/SEI 7 and FM Approvals criteria apply. Indicate dimensions of corners, perimeter, and field of roof on Drawings. Delete below if a loosely laid and ballasted membrane roofing system is required.
- D. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.
 - 1. Corner Uplift Pressure: 120 PSF.
 - 2. Perimeter Uplift Pressure: 90 PSF.
 - 3. Field-of-Roof Uplift Pressure: 60 PSF.
- E. FM Approvals Listing: Provide membrane roofing, base flashings, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a membrane roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals' markings.
 - 1. Fire/Windstorm Classification: Class 1A-90.
 - 2. Hail Resistance: SH.

- F. Energy Performance: Provide roofing system with initial Solar Reflectance Index not less than 78 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.
- G. Energy Performance: Provide roofing system that is listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.
- H. Usually retain paragraph below for roofs that must comply with California Energy Commission's CEC-Title 24. Options are values required for low-slope roofs by prescriptive approach; insert other values if required for building-envelope trade-off approach or whole-building performance approach. A list of products tested according to CRRC-1 with their test values is available in PDF at www.coolroofs.org.
- I. Energy Performance: Provide roofing system with initial solar reflectance not less than 0.70 and emissivity not less than 0.75 when tested according to CRRC-1.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Base flashings and membrane terminations.
 - 2. Tapered insulation, including slopes.
 - 3. Roof plan showing orientation of steel roof deck and orientation of membrane roofing and fastening spacings and patterns for mechanically fastened membrane roofing.
 - 4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
- C. Samples for Verification: For the following products, in manufacturer's standard sizes:
- D. Qualification Data: For qualified Installer and manufacturer.
- E. Manufacturer Certificate: Signed by roofing manufacturer certifying that membrane roofing system complies with requirements specified in "Performance Requirements" Article.
 - 1. Submit evidence of complying with performance requirements.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of membrane roofing system.
- G. Research/Evaluation Reports: For components of membrane roofing system, from the ICC-ES.
- H. Retain first paragraph below if Contractor is responsible for field quality-control testing and inspecting.
- I. Field quality-control reports.
- J. Maintenance Data: For membrane roofing system to include in maintenance manuals.
- K. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is UL listed for membrane roofing system identical to that used for this Project.

- B. **Installer Qualifications:** A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
- C. **Source Limitations:** Obtain components including roof insulation, fasteners for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.
- D. **Exterior Fire-Test Exposure:** ASTM E 108, Class C; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.
- E. Consider retaining first paragraph below if roofing installation is large and complicated. A preliminary roofing conference would precede a preinstallation conference and focus on roof deck construction and planning activities of roofing Installer.
- F. **Preliminary Roofing Conference:** Before starting roof deck construction, conduct conference at Project site.
 - 1. Meet with Owner, Engineer, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
 - 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 - 3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review requirements for deck substrate conditions and finishes, including flatness and fastening.
 - 5. Review structural loading limitations of roof deck during and after roofing.
 - 6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
 - 7. Review governing regulations and requirements for insurance and certificates if applicable.
 - 8. Review temporary protection requirements for roofing system during and after installation.
 - 9. Review roof observation and repair procedures after roofing installation.
- G. **Preinstallation Roofing Conference:** Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
 - 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 - 3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
 - 5. Review structural loading limitations of roof deck during and after roofing.

6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.7 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.8 WARRANTY

- A. When warranties are required, verify with Owner's counsel that special warranties stated in this article are not less than remedies available to Owner under prevailing local laws.
- B. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.
 1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, cover boards, substrate board, roofing accessories, and other components of membrane roofing system.
 2. Verify available warranties and warranty periods for roofing system with manufacturers listed in Part 2 articles.
 3. Warranty Period: 20 years from date of Substantial Completion.
- C. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering Work of this Section, including all components of membrane roofing system such as membrane roofing, base flashing, roof insulation,

fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EPDM MEMBRANE ROOFING

- A. EPDM: ASTM D 4637, Type I, non-reinforced uniform, flexible EPDM sheet.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlisle SynTec Incorporated.
 - b. Firestone Building Products.
 - c. GAF Materials Corporation.
 - d. GenFlex Roofing Systems.
 - e. Johns Manville.
 - f. Versico Incorporated.
 - g. Or equal.
 2. Thickness: 60 mils, nominal.
 3. Exposed Face Color: White.

2.2 AUXILIARY MEMBRANE ROOFING MATERIALS

- A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
 1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
 2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.
 - c. Multipurpose Construction Adhesives: 70 g/L.
 - d. Fiberglass Adhesives: 80 g/L.
 - e. Contact Adhesive: 80 g/L.
 - f. Single-Ply Roof Membrane Sealants: 450 g/L.
 - g. Nonmembrane Roof Sealants: 300 g/L.
 - h. Sealant Primers for Nonporous Substrates: 250 g/L.
 - i. Sealant Primers for Porous Substrates: 775 g/L.
 - j. Other Adhesives and Sealants: 250 g/L.
- B. Sheet Flashing: 60-mil- thick EPDM, partially cured or cured, according to application.

- C. Protection Sheet: Epichlorohydrin or neoprene non-reinforced flexible sheet, 55- to 60-mil-thick, recommended by EPDM manufacturer for resistance to hydrocarbons, non-aromatic solvents, grease, and oil.
- D. Bonding Adhesive: Manufacturer's standard water based.
- E. Modified Asphaltic Fabric-Backed Membrane Adhesive: Roofing system manufacturer's standard modified asphalt, asbestos-free, cold-applied adhesive formulated for compatibility and use with fabric-backed membrane roofing.
- F. Water-Based, Fabric-Backed Membrane Adhesive: Roofing system manufacturer's standard water-based, cold-applied adhesive formulated for compatibility and use with fabric-backed membrane roofing.
- G. Low-Rise, Urethane, Fabric-Backed Membrane Adhesive: Roof system manufacturer's standard spray-applied, low-rise, two-component urethane adhesive formulated for compatibility and use with fabric-backed membrane roofing.
- H. Seaming Material: Manufacturer's standard, synthetic-rubber polymer primer and 3-inch-wide minimum, butyl splice tape with release film].
- I. Lap Sealant: Manufacturer's standard, single-component sealant[, colored to match membrane roofing].
- J. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.
- K. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
- L. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, prepunched.
- M. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to roofing system manufacturer.
- N. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

2.3 VAPOR RETARDER

- A. Self-Adhering-Sheet Vapor Retarder: ASTM D 1970, polyethylene film laminated to layer of rubberized asphalt adhesive, minimum 40-mil total thickness; maximum permeance rating of 0.1 perm; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.

2.4 ROOF INSULATION

- A. Roofing system manufacturers may require use of their own insulations or limit approvals to some insulation manufacturers. Retain second option in first paragraph below if FM Approvals approval is required.
- B. General: Preformed roof insulation boards manufactured[or approved] by EPDM membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated[and that produce FM Approvals-approved roof insulation].

- C. Polyisocyanurate Board Insulation: ASTM C 1289 Type II, Class I, Grade 3, felt or glass-fiber mat facer on both major surfaces.
- D. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches unless otherwise indicated.
- E. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.5 INSULATION ACCESSORIES

- A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.
- B. Bead-Applied Insulation Adhesive: Insulation manufacturer's recommended bead-applied, low-rise, one- or multicomponent urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.
- C. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 5/8 inch thick, factory primed.
 - 1. Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. Georgia-Pacific Corporation - Dens Deck DuraGuard.
 - b. Or Approved Equal.
- D. Protection mats in paragraph below may be placed on membrane roofing as protection from roof pavers or crushed-aggregate ballast.
- E. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric, water permeable and resistant to UV degradation, type and weight as recommended by roofing system manufacturer for application.

2.6 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch thick, and acceptable to membrane roofing system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
 - 1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
 - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - 3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 05 Section "Steel Decking."
 - 4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.

5. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 6. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- D. Install acoustical roof deck rib insulation strips, specified in Division 05 Section "Steel Decking," according to acoustical roof deck manufacturer's written instructions, immediately before installation of overlying construction and to remain dry.

3.3 VAPOR-RETARDER INSTALLATION

- A. Laminate Sheet: Install laminate-sheet vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches and 6 inches, respectively. Bond vapor retarder to substrate as follows:
 1. Apply adhesive at rate recommended by vapor-retarder manufacturer. Seal laps with adhesive.
 2. Apply ribbons of hot roofing asphalt at spacing, temperature, and rate recommended by vapor-retarder manufacturer. Seal laps with hot roofing asphalt.
- B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into membrane roofing system.

3.4 INSULATION INSTALLATION

- A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.
- C. Install tapered insulation under area of roofing to conform to slopes indicated.
- D. Insulation manufacturers usually recommend thickness in first paragraph below as maximum thickness of single insulation layer.
- E. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

1. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
- F. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- G. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
 1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
- H. Adhered Insulation: Install first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 1. Fasten first layer of insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
 2. Fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.
 3. Set each subsequent layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F of equiviscous temperature.
 4. Set each subsequent layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
 5. Set each subsequent layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
- I. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together[and fasten to roof deck].
 1. Fasten cover boards according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
 2. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.

3.5 ADHERED MEMBRANE ROOFING INSTALLATION

- A. Adhere membrane roofing over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll membrane roofing and allow to relax before installing.
- B. Retain first paragraph below if applicable.
- C. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.
- D. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- E. Bonding Adhesive: Apply to substrate and underside of membrane roofing at rate required by manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing.
- F. Hot Roofing Asphalt: Apply a solid mopping of hot roofing asphalt to substrate at temperature and rate required by manufacturer and install fabric-backed membrane roofing. Do not apply to splice area of membrane roofing.

- G. Fabric-Backed Membrane Adhesive: Apply to substrate at rate required by manufacturer and install fabric-backed membrane roofing.
- H. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeters.
- I. Apply membrane roofing with side laps shingled with slope of roof deck where possible.
- J. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement, and firmly roll side and end laps of overlapping membrane roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of membrane roofing terminations.
 - 1. Apply a continuous bead of in-seam sealant before closing splice if required by membrane roofing system manufacturer.
- K. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping membrane roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of membrane roofing terminations.
- L. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.
- M. Spread sealant or mastic bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.
- N. Install membrane roofing and auxiliary materials to tie in to existing membrane roofing to maintain weather-tightness of transition [and to not void warranty for existing membrane roofing system].
- O. Adhere protection sheet over membrane roofing at locations indicated.

3.6 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.
- E. Terminate and seal top of sheet flashings[and mechanically anchor to substrate through termination bars].

3.7 COATING INSTALLATION

- A. Apply coatings to [membrane roofing] [base flashings] according to manufacturer's written recommendations, by spray, roller, or other suitable application method.

3.8 WALKWAY INSTALLATION

- A. Retain this article if walkways are required.

- B. Flexible Walkways: Install walkway products in locations indicated. Adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.
- C. Roof-Paver Walkways: Install walkway roof pavers according to manufacturer's written instructions in locations indicated, to form walkways. Leave 3 inches of space between adjacent roof pavers.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: [Owner will engage] [Engage] a qualified independent testing agency to perform inspections.
- B. A roof inspection is required by manufacturer before warranty issue. Revise scope of inspection and source of report to a qualified roofing consultant or an independent testing and inspecting agency if preferred.
- C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
- D. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.
- E. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.10 PROTECTING AND CLEANING

- A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.11 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS <Insert name> of <Insert address>, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
 1. Owner: <Insert name of Owner.>
 2. Address: <Insert address.>
 3. Building Name/Type: <Insert information.>
 4. Address: <Insert address.>
 5. Area of Work: <Insert information.>
 6. Acceptance Date: <Insert date.>
 7. Warranty Period: <Insert time.>
 8. Expiration Date: <Insert date.>

- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
 - 1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - a. Lightning;
 - b. Peak gust wind speed exceeding <Insert wind speed> mph;
 - c. Fire;
 - d. Failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. Faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - f. Vapor condensation on bottom of roofing; and
 - g. Activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
 - 2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 - 3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
 - 4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
 - 5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
 - 6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.

7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.
- E. IN WITNESS THEREOF, this instrument has been duly executed this <Insert day> day of <Insert month>, <Insert year>.
1. Authorized Signature: <Insert signature>.
 2. Name: <Insert name>.
 3. Title: <Insert title>.

END OF SECTION

SECTION 07 72 00 ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Section Includes:
 - 1. Roof curbs.
 - 2. Preformed flashing sleeves

1.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

1.3 SUBMITTALS

- A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For roof accessories. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.
- C. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
 - 1. Size and location of roof accessories specified in this Section.
 - 2. Method of attaching roof accessories to roof or building structure.
 - 3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
 - 4. Required clearances.
- D. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.
- E. Warranty: Sample of special warranty.

1.4 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
- B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.5 WARRANTY

- A. When warranties are required, verify with Owner's counsel that special warranties stated in this article are not less than remedies available to Owner under prevailing local laws.

- B. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 METAL MATERIALS

- A. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, AZ50 coated.
 - 1. Exposed Coil-Coated Finish: Prepainted by the coil-coating process to comply with ASTM A 755/A 755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil for topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.
- B. Aluminum Sheet: ASTM B 209, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.
 - 1. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
 - 2. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
 - 3. Exposed Coil-Coated Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer Finish: AAMA 620. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
 - 4. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
- C. Stainless-Steel Sheet and Shapes: ASTM A 240/A 240M or ASTM A 666, Type 304.
- D. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized according to ASTM A 123/A 123M unless otherwise indicated.
- E. Steel Tube: ASTM A 500, round tube.
- F. Galvanized-Steel Tube: ASTM A 500, round tube, hot-dip galvanized according to ASTM A 123/A 123M.
- G. Steel Pipe: ASTM A 53/A 53M, galvanized.

2.2 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Acrylic Glazing: ASTM D 4802, thermoformable, monolithic sheet, manufacturer's standard, Type UVA (formulated with UV absorber), Finish 1 (smooth or polished).
- C. Polycarbonate Glazing: Thermoformable, monolithic polycarbonate sheets manufactured by extrusion process, burglar-resistance rated according to UL 972 with an average impact strength of 12 to 16 ft-lbf/in. of width when tested according to ASTM D 256, Method A (Izod).
- D. Cellulosic-Fiber Board Insulation: ASTM C 208, Type II, Grade 1, thickness as indicated.
- E. Glass-Fiber Board Insulation: ASTM C 726, thickness as indicated.
- F. Polyisocyanurate Board Insulation: ASTM C 1289, thickness as indicated.
- G. See the Evaluations in Division 06 Section "Rough Carpentry" for information about waterborne preservatives.
- H. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches thick.
- I. Underlayment:
 - 1. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
 - 2. Polyethylene Sheet: 6-mil- thick polyethylene sheets complying with ASTM D 4397.
 - 3. Slip Sheet: Building paper, 3-lb/100 sq. ft. minimum, rosin sized.
- J. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
 - 1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.
 - 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 - 3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
- K. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.
- L. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.
- M. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

2.3 ROOF CURBS

- A. Roof Curbs: Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints and integrally formed deck-mounting flange at perimeter bottom.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Greenheck Fan Corporation.
 - b. LM Curbs.
 - c. Metallic Products Corp.
 - d. Roof Products, Inc.
 - e. Or equal.
- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.
- C. Material: Aluminum sheet, 0.090 inch thick.
 1. Finish: Mill.
 2. Color: As selected by Engineer from manufacturer's full range
- D. Construction:
 1. Insulation: Factory insulated with 1-1/2-inch- thick cellulosic-fiber board insulation.
 2. Liner: Same material as curb, of manufacturer's standard thickness and finish.
 3. Factory-installed wood nailer at top of curb, continuous around curb perimeter.
 4. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
 5. Curb height in first subparagraph below may be determined by adding thickness of roof insulation to the minimum base flashing height recommended by roofing membrane manufacturer or established by office practice.
 6. Fabricate curbs to minimum height of 12 inches unless otherwise indicated.
 7. Top Surface at Mechanical Equipment: Level around perimeter with roof slope accommodated by sloping the deck-mounting flange.
 8. Top Surface at Skylights: Sloped around perimeter matching skylight slope and sloped at the bottom flange of curb to accommodate roof slope.
 9. Sloping Roofs: Where roof slope exceeds 1:48, fabricate curb with perimeter curb height tapered to accommodate roof slope so that top surface of perimeter curb is level. Equip unit with water diverter or cricket on side that obstructs water flow.

2.4 PREFORMED FLASHING SLEEVES

- A. Exhaust Vent Flashing: Double-walled metal flashing sleeve or boot, insulation filled, with integral deck flange, 12 inches high, with removable metal hood and slotted metal collar.
 1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Custom Solution Roof and Metal Products.
 - b. Thaler Metal USA Inc.

- c. Or equal.
- 3. Metal: Aluminum sheet, 0.063 inch thick.
- 4. Diameter: As indicated.
- 5. Finish: Manufacturer's standard.
- B. Vent Stack Flashing: Metal flashing sleeve, uninsulated, with integral deck flange.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. Custom Solution Roof and Metal Products.
 - b. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
 - c. Thaler Metal USA Inc.
 - d. Or equal.
 - 2. Metal: Aluminum sheet, 0.063 inch thick.
 - a. Height: 13 inches.
 - b. Diameter: As indicated.
 - c. Finish: Manufacturer's standard.

2.5 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- C. Verify dimensions of roof openings for roof accessories.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install roof accessories according to manufacturer's written instructions.
 - 1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
 - 2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.

3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
 4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
1. Coat concealed side of uncoated aluminum and stainless-steel roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene sheet.
 3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.
- C. Roof Curb Installation: Install each roof curb so top surface is level at mechanical equipment.
- D. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.
- E. Heat and Smoke Vent Installation:
1. Install heat and smoke vent so top perimeter surfaces are level.
 2. Install and test heat and smoke vents and their components for proper operation according to NFPA 204.
- F. Gravity Ventilator Installation: Verify that gravity ventilators operate properly and have unrestricted airflow. Clean, lubricate, and adjust operating mechanisms.
- G. Pipe Support Installation: Install pipe supports so top surfaces are in contact with and provide equally distributed support along length of supported item.
- H. Roof Walkway Installation:
1. Verify that locations of access and servicing points for roof-mounted equipment are served by locations of roof walkways.
 2. Remove ballast from top surface of low-slope roofing at locations of contact with roof-walkway supports.
 3. Install roof walkway support pads prior to placement of roof walkway support stands onto low-slope roofing.
 4. Redistribute removed ballast after installation of support pads.
- I. Preformed Flashing-Sleeve Installation: Secure flashing sleeve to roof membrane according to flashing-sleeve manufacturer's written instructions.
- J. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780.

- B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Division 09 painting Sections.
- C. Clean exposed surfaces according to manufacturer's written instructions.
- D. Clean off excess sealants.

Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures

END OF SECTION

SECTION 07 92 00 JOINT SEALANTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Work furnished and installed.
 - 1. Preparing substrate surfaces.
 - 2. Sealant and joint backing.
 - 3. Sealant accessories.
 - 4. Non-fire-rated through wall penetrations.

1.2 REFERENCES

- A. ANSI/ASTM D1056 – Flexible Cellular Materials – Sponge or Expanded Rubber.
- B. ANSI/ASTM D1565 – Flexible Cellular Materials – Vinyl Chloride Polymers and Copolymers (Open – Cell Foam).
- C. ASTM C790 – Use of Latex Sealing Compounds.
- D. ASTM C804 – Use of Solvent Release Type Sealants.
- E. ASTM C834 – Latex Sealing Compounds.
- F. FS TT –S-001657 – Sealing Compound, Single Component, Butyl Rubber Based, Solvent Release Type.
- G. FS TT-S-00227 – Sealing Compound: Elastomeric Type, Multi- Component.
- H. FS TT-S-00230 – Sealing Compound: Elastomeric Type, Single Component.
- I. FS TT-S- 001543 – Sealing Compound, Silicone Rubber Base.
- J. SWRI (Sealing, Waterproofing and Restoration Institute) – Sealant and Caulking Guide Specification.
- K. ASTM C920 – Elastomeric Joint Sealants.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. Provide joint sealants for exterior applications that have been produced and installed to establish and maintain watertight and airtight continuous seals without causing staining or deterioration of joint substrates.
- B. Provide joint sealants for interior applications that have been produced and installed to establish and maintain airtight continuous seals that are water resistant and cause no staining or deterioration of joint substrates.

1.4 QUALITY ASSURANCE

- A. Engage an experienced Installer who has completed joint sealant applications similar in material, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.

- B. Obtain joint sealant materials from a single manufacturer for each different product required.

1.5 SUBMITTALS

- A. In addition to those submittals identified in the General Provisions, the following items shall also be submitted:
 - 1. Product data from manufacturers for each joint sealant product required.
 - 2. Certification by joint sealant manufacturer that sealants plus the primers and cleaners required for sealant installation comply with local regulations controlling use of volatile organic compounds.
 - 3. Samples for initial selection purposes in form of manufacturer's standard bead samples, consisting of strips of actual products showing full range of colors available, for each product exposed to view.
 - 4. Certificates from manufacturers of joint sealants attesting that their products comply with specification requirements and are suitable for the use indicated.
 - 5. Qualification data complying with requirements specified in "Quality Assurance" article. Include list of completed projects with project names addresses, names of Owner's Representatives and Owners, plus other information specified.
 - 6. Compatibility and adhesion test reports from elastomeric sealant manufacturer indicating that materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.
 - 7. Product test reports for each type of joint sealants indicated, evidencing compliance with requirements specified.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.7 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer or below 40 deg F.
 - 2. When joint substrates are wet.
- B. Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.
- C. Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

1.8 WARRANTY

- A. Provide five (5) year manufacturer's warranty.
- B. Warranty: Include coverage for replacement of installed sealants and accessories which fail to achieve air tight seal, watertight seal, exhibit loss of adhesion or cohesion, or do not cure. Include loss of color fastness.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. Acceptable Manufacturers:
 - 1. Sonneborn Building Products.
 - 2. Tremco.
 - 3. Dow Corning.

2.2 MATERIALS

- A. Type 1 Sealant: Urethane, single component, non-sag.
 - 1. ASTM C920, Type S, Grade NS, Class 25, uses NT,M,A,O.
 - 2. TT-S-00230C (COM-NBS) Interim Federal Specification for sealing compound: Elastomeric Type, Single Component for Caulking, Sealing, and Glazing
 - 3. Joint Movement Capability: plus or minus 25%.
 - 4. Sonneborn Sonolastic NP 1, Tremco Dymonic, or equal.
- B. Type 2 Sealant: Silicone sealant.
 - 1. ASTM C920, Type S, Grade NS, Class 25, uses NT,G,A,O.
 - 2. TT-S-00230C (COM-NBS) Interim Federal Specification for Sealing Compound: Silicone Rubber Base for Caulking, Sealing, and Glazing.
 - 3. Joint Movement capability: plus or minus 25%.
 - 4. Sonneborn Omniseal, General Electric Silpruf or equal.
- C. Type 3 Sealant: Urethane Sealant (cold weather sealant)
 - 1. ASTM C920, Type M, Grade NS, Class 25, uses NT, M, A, O.
 - 2. TT-S-00227E (COM-NBS) Interim Federal Specification for sealing compound: Elastomeric type, Multi-component for caulking, sealing, and glazing.
 - 3. Joint movement capability: Plus or minus 25%.
 - 4. Sonolastic NP-2 or equal.

2.3 JOINT SEALANT BACKING

- A. Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

- B. Provide plastic foam joint fillers consisting of preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding strips of flexible plastic foam of material indicated below and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
 - 1. Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, nonoutgassing in unruptured state.
 - 2. Proprietary, reticulated, closed-cell polymeric foam, nonoutgassing, with a density of 2.5 pcf and tensile strength of 35 psi per ASTM D 1623, and with water absorption less than 0.02 gms/cc per ASTM C 1083.
- C. Provide bond-breaker tape consisting of polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.4 MISCELLANEOUS MATERIALS

- A. Primer material shall be as recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealant-substrate tests and field tests.
- B. Cleaners for nonporous surfaces shall be chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming in any way joint substrates and adjacent nonporous surfaces, and formulated to promote optimum adhesion of sealants with joint substrates.
- C. Masking tape shall be nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint sealant performance. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean concrete, masonry, unglazed surfaces of ceramic tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
 - 3. Remove laitance and form release agents from concrete.

4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on preconstruction joint sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. Comply with joint sealant manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.
- B. Comply with recommendations of ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings to comply with the following requirements:
 1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - a. Do not leave gaps between ends of joint fillers.
 - b. Do not stretch, twist, puncture, or tear joint fillers.
 - c. Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.
 2. Install bond breaker tape between sealants where backer rods are not used between sealants and joint fillers or back of joints.
- D. Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.
- E. Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
 1. Provide concave joint configuration per Figure 5A in ASTM C1193, unless otherwise indicated.
 2. Provide flush joint configuration, per Figure 5B in ASTM C1193, where indicated.
 - a. Use masking tape to protect adjacent surfaces of recessed tooled joints.
 3. Provide recessed joint configuration, per Figure 5C in ASTM C1193, of recess depth and at locations indicated.

- F. Install each length of preformed foam sealants immediately after removing protective wrapping, taking care not to pull or stretch material, and to comply with sealant manufacturer's directions for installation methods, materials, and tools that produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in conformance with sealant manufacturer's recommendations.

3.4 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so that and installations with repaired areas are indistinguishable from original work.

3.6 SCHEDULE

<u>LOCATION</u>	<u>TYPE</u>
a. Perimeter of exterior openings where aluminum meet masonry and concrete	1 or 3
b. Other locations shown on drawings for sealant, joint sealer or caulk	1
c. Metal to metal	2

END OF SECTION

SECTION 08 45 00 INSULATED TRANSLUCENT PANELS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Furnish and install pre-engineered, factory prefabricated flat wall panels and skylight units with light transmission, insulation, and chemical resistance characteristics as listed herein. Complete with aluminum framing, flashings, fasteners, trim and accessories to allow the installation of the insulated translucent panels as weathertight, wind load resistant, and removable systems, in accordance with the Contract Documents
 - 1. Factory fabricated, thermally broken wall panels of insulated translucent sandwich panel system.
 - 2. Factory fabricated, thermally broken roof panel (skylight) units of insulated translucent sandwich panel system.

1.2 RELATED SECTIONS

- A. Section 01 33 00 - SUBMITTALS
- B. Section 01 78 39 - RECORD DOCUMENTS
- C. Section 03 30 00 - CAST-IN-PLACE CONCRETE
- D. Section 04 20 00 - UNIT MASONRY SYSTEM
- E. Section 05 50 00 - MISCELLANEOUS FABRICATIONS
- F. Section 06 10 00 - FRAMING AND SHEATHING
- G. Section 07 26 00 - VAPOR AND AIR BARRIERS
- H. Section 07 92 00 - JOINT SEALERS

1.3 REFERENCES

AAMA 2605	Voluntary Specifications, Performance Requirements, and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels
ASTM C297	Standard Test Method for Flatwise Tensile Strength of Sandwich Constructions
ASTM C518	Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
ASTM C1199	Standard Test Method for Measuring the Steady-State Thermal Transmittance of Fenestration Systems Using Hot Box Methods
ASTM D635	Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
ASTM D1037	Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials
ASTM D2244	Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials

ASTM E283	Standard Test Method for Determining Rate of Air Leakage Through "Exterior Windows, Curtain Walls, and Doors Under Specified Pressure
ASTM E330	Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
UL 723	Test for Surface Burning Characteristics of Building Materials

1.4 PERFORMANCE REQUIREMENTS

- A. Thermal Performance
 - 1. 4-Inch Roof Panels - "U" value of 0.08 or less as measured by ASTM C518 or ASTM C1199.
 - 2. 2-3/4-Inch thickness Wall Panels - "U" value of 0.23 or less as measured by ASTM C518 or ASTM C1199.
 - 3. 4-Inch Wall Panels - "U" value of 0.08 or less as measured by ASTM C518 or ASTM C1199.
- B. Light Transmission
 - 1. 4-inch Roof Panels - 8 percent.
 - 2. 2-3/4-inch Wall Panels - 30 percent.
- C. Structural Performance – Assembly as a whole shall withstand wind and other structural loads as specified in the structural design requirements on the structural drawings (see Drawing S01).
 - 1. Panels shall meet the requirements of 1609.5.1 of 780 CMR for protection of openings in windborne debris regions, which references the Large Missile Test of ASTM E1996.
 - 2. Configuration of both roof and wall panels shall meet all relevant performance requirements listed herein. When requested, include structural analysis data signed and sealed by the qualified professional engineer (currently licensed to practice in the State of New York) responsible for their preparation. Panel system shall have less than 0.01 cfm/sf air leakage by ASTM E283 at 6.24 psf (50 mph) and no water penetration by ASTM E331 at 15 psf, and structural testing by ASTM E330.
 - 3. Provide system capable of handling the loads identified on the Structural Design Criteria Table on the Contract Drawings.
- D. Means of Attachment – insulated translucent wall panels shall be attached to the top, sides and bottom of the masonry opening in such a manner that they may be removed without damage to the remainder of the building, and without damage to the panels themselves. Removal in such a way that requires reinstallation of perimeter sealants or fasteners shall not be considered damage to the panels. After removal, it shall be possible to reinstall the panels as a weathertight system.
- E. Insulated translucent roof panels (skylights) shall be attached in such a manner that they are removable as a unit from roof curb without compromising roof weathertightness. Panel manufacturer shall design and incorporate supporting structure that meets the structural performance requirements of paragraph 1.04.C. Similar to the wall panels, removal in such a way that requires reinstallation of perimeter sealants or fasteners shall not be considered damage to the panels. After removal, it shall be possible to reinstall the skylight unit as a weathertight system.
- F. Interior Face Sheet Flame Spread and Smoke Developed – Flame spread rating of no greater than 25 and smoke developed of no greater than 250 when tested per ASTM E84.

- G. Interior Face Sheet Burn Rate – No greater than 1 inch per minute when tested per ASTM D635.
- H. Exterior Face Sheet Weathering – Darkening or change of color shall not exceed more than 4.0 Delta E units after five years of outdoor South Florida weathering at either 5 degrees or 45 degrees facing south, per ASTM D2244.
- I. Adhesive Tensile Strength – Not less than 750 psi per ASTM C297 after accelerated aging per ASTM D1037.

1.5 SUBMITTALS

- A. Provide in accordance with Section 01 33 00 and as supplemented herein. Submittals shall include, but not be limited to, the following:
 - 1. Manufacturer's Certification – Letter from assembly manufacturer stating the thermal performance and light transmission values achieved by the assembly, and the insulated translucent panel assembly meets the performance requirements of this section.
 - 2. Test Reports – The manufacturer shall submit certified test reports made by an independent testing organization. These reports shall verify that the panel system will meet all performance requirements of this specification. Previously completed test reports will be acceptable if they are for the current manufacturer and are indicative of the products to be used on this project. Test reports required are:
 - a. ASTM C297 after aging by ASTM D1037
 - b. ASTM D635
 - c. ASTM D2244
 - d. ASTM E84
 - e. ASTM C518 or C1199
 - 3. Shop Drawings – Showing sizes and configurations of panels, layout of internal and external framing elements, profiles of all components used in the assembly, locations and types of fasteners, and wind loads for which the assembly was designed. Sealed by a professional engineer licensed and with current registration to practice in New York.
 - a. Submit project-specific details for anchorage and weatherseal, including, but not limited to:
 - 1) Perimeter conditions, including eave, rake and ridge. Conditions at structural supports.
 - 4. Samples – A representative corner of the insulated translucent panel assembly showing insulating, light-transmitting, and framing components. Sample to be submitted after Engineer has made colors choices from options within the manufacturer's standard line that meet specified performance requirements.

1.6 WARRANTY

- A. Warrant insulated translucent panel assembly against failure of weathertightness, discoloration, or deterioration of surface finish for a period of five years following substantial completion. Any panels that fail within the warranty period shall be removed and replaced with new material at the Contractor's expense.
 - 1. Manufacturer's extended warranty to cover materials and workmanship for a period of five years.

PART 2 - PRODUCTS**2.1 MANUFACTURERS AND SYSTEMS**

Manufacturer	System
Kalwall Corporation, Manchester, NH	Kalwall 2-3/4-inch thickness panel (wall)

- A. Or equal system when submitted under Section 01 33 00 and approved by the Engineer.

2.2 PANEL CONSTRUCTION

- A. Configuration
1. Thickness
 - a. Kalwall Standard wall panels; 2.75-inch thickness.
 2. Grid Size – 12 inches by 24 inches; pattern to be centered on opening; long dimension to be oriented as shown on the Drawings.
 3. Interior and exterior sections of frame members are to be separated by thermal break material, minimum thermal break of 1-inch.
- B. Face Sheets
1. ICBO listed.
 2. Thickness
 - a. 0.070 inches thick at exterior face.
 - b. 0.045 inches thick at interior face.
 3. Fiberglass reinforced.
 4. Color –Crystal inside and out.
- C. Frame Finish - 70 Percent PVDF
1. Comply with requirements of AAMA 2605.
 2. Color – Aluminum # 79.
- D. 2.75-Inch Insulated Translucent Fiberglas Sandwich Panel Wall system.
1. Uniform Thickness – 2.75 inches.
 2. "U" Value - 0.05 (R-20).
 3. Light Transmission - 20 percent.
 4. Shading Coefficient - 0.22
 5. Standard panels shall deflect no more than 1.9 inch at 30 PSF in 10 foot 0-inch span without a supporting frame by ASTM E72.
 6. Performance Requirements
 - a. The manufacturer shall be responsible for the configuration and fabrication of the complete panel system.
 - b. Standard panel system shall have less than 0.01 cfm/ft² air leakage by ASTM E283 at 6.24 PSF (50 mph) and no water penetration by ASTM E331 at 15 PSF.

- c. Structural testing by ASTM E330; manufacturer to include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- d. Structural Loads - Provide system capable of handling the loads as required by Code and as indicated on Drawings, Sheet S00-001 (Structural General Notes and Abbreviations).
- e. Corrosive Resistance - Provide high performance fluoropolymer resins architectural coating for corrosion-resistant finish. Color to be selected by the Engineer.
- f. Standard panels shall withstand 1,200 degrees F fire for minimum 1 hour without collapse or exterior flaming.
- g. Thermally Broken Panels - Minimum condensation resistance factor of 85 by AAMA 1503 measured on the bond line.
- h. Warranty - Provide 10-year warranty.

PART 3 - EXAMINATION

3.1 EXAMINATION

- A. Examine areas to receive translucent wall panel and skylight system panels, with installer and manufacturer's representative present. Examine supporting structure, substrate, and other relevant components for dimensions, tolerances, material conditions, support, and other factors that may affect the performance of the installed system.
- B. Notify the Engineer immediately of conditions that would adversely affect installation or subsequent utilization of wall panel and/or skylight systems. Do not proceed with installation until unsatisfactory conditions are corrected and the Engineer has given permission to proceed.

3.2 PREPARATION

- A. Ensure supports to receive translucent wall panel and skylight systems are clean, level, plumb, true and square.
- B. Isolate aluminum from dissimilar metals or cement-containing materials by coating with bituminous paint or separating with a nonabsorbent isolator.

3.3 INSTALLATION

- A. Install translucent wall panels and skylight systems in strict accordance with approved shop drawings and the manufacturer's instructions.
- B. Anchor wall panels and skylight systems securely to supporting structure. Use attachment methods permitting adjustment for construction tolerances, irregularities, alignment, and expansion and contraction.
- C. Install wall panel and skylight panel systems including flashings, fasteners, hardware, sealants, and glazing materials required for a complete, weathertight installation.

3.4 CLEANING

- A. Clean work per manufacturer's instructions and in accordance with Section 01 78 39, Record Documents.

3.5 PROTECTION

- A. Protect work from continuing construction activity and per manufacturer's instructions.

END OF SECTION

SECTION 08 90 00 LOUVERS AND VENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes fixed, extruded aluminum louvers.

1.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance - Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
 - 1. Wind Loads - Determine loads based on pressures as indicated on Drawings.
- B. Thermal Movements - Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, overstressing of components, failure of connections, or other detrimental effects.
 - 1. Temperature Change (Range) - 120 degrees F, ambient; 180 degrees F, material surfaces.
- C. Louver Performance Ratings - Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

1.3 SUBMITTALS

- A. Product Data - For each type of product indicated.
 - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings - For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
 - 1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
 - 2. Show mullion profiles and locations.
 - 3. Wiring Diagrams - For power, signal, and control wiring for motorized adjustable louvers.
- C. Samples for Initial Selection - For units with factory-applied color finishes.
- D. Samples for Verification - For each type of metal finish required.
- E. Product Test Reports - Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

1.4 QUALITY ASSURANCE

- A. Source Limitations - Obtain louvers and vents from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.
- B. Welding - Qualify procedures and personnel according to the following:
 - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - 2. AWS D1.3, "Structural Welding Code - Sheet Steel."
 - 3. AWS D1.6, "Structural Welding Code - Stainless Steel."
- C. SMACNA Standard - Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.
- D. UL and NEMA Compliance - Provide motors and related components for motor-operated louvers that are listed and labeled by UL and comply with applicable NEMA standards.

1.5 PROJECT CONDITIONS

- A. Field Measurements - Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Extrusions - ASTM B221, Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet - ASTM B209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Aluminum Castings - ASTM B26/B26M, Alloy 319.
- D. Fasteners - Use types and sizes to suit unit installation conditions.
 - 1. Use hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.
 - 2. For fastening stainless steel, use 300 series stainless-steel fasteners.
 - 3. For color-finished louvers, use fasteners with heads that match color of louvers.
- E. Post-Installed Fasteners for Concrete and Masonry - Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to four times the loads imposed, for concrete, or six times the load imposed, for masonry, as determined by testing per ASTM E488, conducted by a qualified independent testing agency.
- F. Bituminous Paint - Cold-applied asphalt emulsion complying with ASTM D1187.

2.2 FABRICATION, GENERAL

- A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Vertical Assemblies - Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.

- C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.
- D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
 - 1. Frame Type - Channel unless otherwise indicated.
- E. Include supports, anchorages, and accessories required for complete assembly.
 - 1. Exterior Corners - Prefabricated corner units with mitered and welded blades and with fully recessed mullions at corners.
- F. Provide extended sills for recessed louvers.
- G. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.3 FIXED, EXTRUDED ALUMINUM LOUVERS

- A. Horizontal, Drainable-Blade Louver
 - 1. Manufacturers - Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
 - a. Airolite Company, LLC (The).
 - b. Construction Specialties, Inc.
 - c. Ruskin Company; Tomkins PLC.
 - d. Or approved equal.
 - 2. Louver Depth - 6 inches.
 - 3. Blade Type - Every louver blade shall be drainable type.
 - 4. Frame and Blade Nominal Thickness - Not less than 0.060 inch for blades and 0.080 inch for frames.
 - 5. Mullion Type - Exposed.
 - 6. Louver Performance Ratings
 - a. Free Area - Not less than 7.0 sq. ft. for 48-inch wide by 48-inch high louver.
 - b. Point of Beginning Water Penetration - Not less than 1000 fpm.
 - c. Air Performance - Not more than 0.10-inch wg static pressure drop at 850-fpm free area exhaust and intake velocity.
 - 7. AMCA Seal - Mark units with AMCA Certified Ratings Seal.

2.4 LOUVER SCREENS

- A. General - Provide screen at each exterior louver.
 - 1. Screen Location for Fixed Louvers - Interior face.
 - 2. Screening Type - Bird screening
- B. Secure screen frames to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

- C. Louver Screen Frames - Fabricate with mitered corners to louver sizes indicated.
 - 1. Metal - Same kind and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
 - 2. Finish - Same finish as louver frames to which louver screens are attached.
 - 3. Type - Non-rewirable, U-shaped frames.
- D. Louver Screening for Aluminum Louvers
 - 1. Bird Screening - Aluminum, 1/2-inch square mesh, 0.063-inch wire.

2.5 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2.6 ALUMINUM FINISHES

- A. High-Performance Organic Finish - Two-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss - Shall match adjoining surfaces as selected by Architect from manufacturer's full range of all colors (custom or standard colors and finishes)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

- A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

- E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
- F. Protect unpainted galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 07 92 00, Joint Sealers, for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

- A. Test operation of adjustable louvers and adjust as needed to produce fully functioning units that comply with requirements.
- B. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- C. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- D. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
- E. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION

**SECTION 09 90 00
FIELD PAINTING**

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes Field Painting of all work indicated on the Contract Drawings and specified herein.

1.2 REFERENCES

- A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American Society for Testing and Materials (ASTM)
 - a. C2246 - Freeze-Thaw Test
 - b. D2247 - Humidity Test
 - c. B117 - Salt Spray Test
 - d. E84 - Surface Burning Characteristics Test
 - e. D16 - Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products
 - f. D2805 - Contrast Ratio
 - g. D1308 - Stain Resistance
 - h. D4060 - Abrasion
 - i. D4541 - Adhesion
 - j. D522 - Conical Mandrel Elongation
 - 2. Standards of the Society for Protective Coatings (SSPC)
 - 3. National Association of Corrosion Engineers (NACE)

1.3 QUALITY ASSURANCE

- A. All materials shall remain in their original containers with manufacturer's label intact. Manufacturer's name, product name and number, and color and batch number, shall appear on the label.
- B. Manufacturer's representative shall be available to advise applicator on proper application techniques and procedures.

1.4 SUBMITTALS

- A. All field painting shall be by an approved painting subcontractor. Submit painting experience record of proposed subcontractor/Contractor for approval.
- B. In addition to conforming to the requirements described in the General Conditions, submit a complete schedule of paint systems and surface preparation proposed.
 - 1. List all interior and exterior surfaces and all major equipment to be painted.
 - 2. The schedule is to reflect the approved manufacturer's recommendations. Schedule shall include certification that a qualified manufacturer's representative has reviewed and approved the schedule. The qualified manufacturer's representative shall hold current

NACE certification as a Coating Inspector, Protective Coatings Specialist, or Materials Selection/Design Specialist.

3. As a minimum, schedule shall itemize each painted item or surface and shall contain the following information in tabular format:
 - a. Type of surface preparation (note whether shop or field preparation).
 - b. Paint system (generic name).
 - c. Prime coat (product, number of coats, dry mil thickness per coat, square feet coverage per gallon).
 - d. Intermediate coat, if required (product, number of coats, dry mil thickness per coat, square feet coverage per gallon).
 - e. Finish coat (product, number of coats, color, dry mil thickness per coat, square feet coverage per gallon).
 - f. Painting status at time of installation.
 - g. Remarks (any special treatment or application requirements, etc.)
4. The schedule shall follow the sample format attached to the end of this section. It shall also contain the name of the paint manufacturer and name, address, and telephone number of the manufacturer's representative who will inspect the work. The schedule shall be in conformance with the criteria of Tables A-1, A-2, and A-3 and the schedules contained in the architectural drawings. Manufacturer's recommended dry mil thickness shall be incorporated into the schedule. Schedule shall be submitted to the Engineer as soon as possible following the award of Contract so that the approved schedule may be used to identify colors and to specify shop paint systems for fabricated equipment.
5. Submit color chips for selection. Color names and/or numbers shall be identified according to the appropriate color chart provided by the manufacturer.
6. Manufacturer's descriptive data fully describing each product to include solids by volume and VOC ratings.
7. Manufacturer's certification that all materials furnished are in compliance with the applicable requirements of the referenced standards and this specification.
8. Manufacturer's application instructions.
9. Color charts illustrating range of colors available for selection.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The following manufacturers are named to establish a standard of quality necessary for the Project:
 1. Sherwin Williams Company
 2. PPG Paints
 3. Tnemec Company

2.2 MATERIAL

- A. Paint – Refer to Table A-1. Coating Systems Schedule.
- B. All materials which will be in contact with potable water shall be approved by the national Sanitation Foundation and appropriate state and local health departments. Contractor shall submit evidence of approval for all applicable materials.

- C. All materials used on this project, whether shop applied by equipment manufacturer or field applied by Contractor, shall comply with all current federal, state and local Clean Air Act-related regulations. It shall be the responsibility of equipment manufacturers to comply with laws in effect at their painting facilities. Where laws or regulations prohibit field applications of any scheduled paint product, Contractor shall submit for Engineer's approval, an alternate product of similar performance characteristics which complies with those laws. If approved, those products shall be provided at no additional cost to the Owner.

2.3 EXTRA STOCK

- A. One gallon of unopened paint, in each type and color specified, shall be furnished to the Owner. Multi-component paints shall be supplied as a complete kit.

PART 3 - EXECUTION

3.1 PRE-APPLICATION

- A. Examine surfaces to be coated and report any conditions that would adversely affect the appearance or performance of the coating systems, and which cannot be put into an acceptable condition by the preparatory work specified.
- B. The Contractor sure that moisture content of surfaces is within manufacturer's recommendations.
- C. Do not apply coatings when relative humidity is above 85 percent or when temperatures are less than 5 degrees F above the dew point. Do not apply coatings to damp or wet surfaces unless product is specifically formulated to do so.

3.2 SURFACE PREPARATION

- A. All surface to be painted shall be prepared with the objective of obtaining a clean and dry surface free from dust, rust, scale and all foreign matter. No painting shall be done before surfaces meet requirements of paint manufacturer.
 - 1. Remove dust and loose material by dusting, sweeping, vacuuming, or blowing with high-pressure air.
 - 2. Remove oil, wax, and grease in accordance with the manufacturer's recommendations.
 - 3. Verify with Engineer that all surfaces to be coated are dry, clean, and free from dirt, dust, wax, grease, or other contaminants.
 - 4. Remove electrical plates, hardware, light fixtures, trim, and fittings prior to preparing surfaces.
 - 5. Shellac and/or seal marks which may bleed through surface finishes that could not be removed.
- B. Metals
 - 1. All ferrous metal to be primed shall have all rust, dust, and scale removed by abrasive blast cleaning in accordance with SSPC (The Society of Protective Coatings) & NACE (National Association of Corrosion Engineers) procedures designated in the Specifications or on Contract Drawings. Cleaned metal shall be primed or pretreated immediately after cleaning to prevent rusting. If rusting beyond ASTM Rust Grade 8 occurs in the field, rusted portions of shop-primed ferrous metals shall be field-cleaned in accordance with SSPC/NACE blast cleaning specification appropriate for service and immediately field primed.

2. All ferrous metals not primed in shop shall be abrasive blast cleaned to SSPC-SP10/NACE 2 Near White Blast or an SSPC-SP6/NACE 3 Commercial Blast, depending on exposure, prior to application of any primer, pretreatment, or paint.
- C. Nonferrous Metals - All nonferrous metals, whether shop or field primed, shall be solvent cleaned (SSPC-SP1) prior to application of primer.
- D. Concrete - All concrete surfaces shall be cleaned of all dust, form oil, curing compounds, and other foreign matter before paints or coating are applied. Poured concrete and submerged surfaces to be painted shall be prepared using the following method:
1. Blasting - Brush-off abrasive blast-cleaning of concrete shall be described as lightly abrading the surface without entirely removing surface or exposing underlying aggregate. Brush-off abrasive blasting shall open up subsurface holes and voids and etch the surface sufficiently for coatings to bond and adhere satisfactorily. Care shall be taken during blasting that concrete is not eroded unnecessarily.
 - a. Dry abrasive blasting equipment with a compressed air blast nozzle shall be used for blasting concrete. After blast cleaning is completed, abrasive dust and loose particles shall be removed from surface by vacuuming and blowing off with high pressure air. Voids and cracks that will cause discontinuities in coatings or unsightly appearance shall be patched in accordance with Section 03 35 00.
 - b. All floor and tank drains subject to abrasive spray shall be plugged prior to blasting. After blasting is completed, all abrasive shall be removed from area prior to opening drains. Under no circumstances shall abrasive be allowed to enter tank or floor drains.
- E. Wood - Wood surfaces shall be thoroughly cleaned and free of all foreign matter, with cracks, nail holes and other defects properly filled and smoothed. Wood trim shall be sandpapered lightly when dry, before a second coat of paint or stain is applied. All wood trim shall be primed and backprimed before being set in place; all end grain and cut wood shall be thoroughly saturated with sealer before priming. After the prime coat on woodwork has dried, all nail holes, cracks, open joints, and other small holes shall be filled neatly with approved spackling putty. Exposed nails and other ferrous metals on surfaces to be painted with water-thinned paints shall be spot primed with aluminum paint.
- F. Prior Coating - Old paint surfaces on concrete, ferrous metal, and nonferrous metal shall be prepared by abrasive blast cleaning in accordance with proper SSPC/NACE method for the service.
- G. Touchup - Any abraded areas of shop or field applied coatings shall be touched up with the same type of shop or field applied coating, even to the extent of applying an entire coating, if necessary. Touchup coatings and surface preparations shall be in addition to and not considered as the first field coat.
- H. Casting (cast ferrous and nonferrous metals) - Surfaces of castings shall be prepared for painting by using a brush-applied filler and/or knife-applied filler, as required. These fillers are not to be used to conceal cracks, gas holes, or excessive porosity. Casting shall receive one coat of primer with a minimum thickness of 2 mils. Sufficient drying time must be allowed before further handling.
- I. Masonry - All masonry to be painted shall receive damproofing, water repellent treatment, filler or protective coatings, depending upon exposure.
1. Gypsum Board and Plaster - All gypsum board and plaster surfaces shall be sanded to remove rough edges and protrusions. Paint shall not be applied to plaster surfaces until surfaces have aged the minimum period of time prescribed by paint manufacturer supplying paint for this application. Before painting, such surfaces shall be dry, clean and free from grit, loose plaster and surface irregularities. Cracks and holes shall be repaired

with approved patching materials, properly keyed to existing surfaces and sandpapered smooth.

3.3 APPLICATION

- A. Contractor shall be responsible for cleanliness of all painting operations and use covers and masking tape to protect work. Contractor shall protect not only his own work, but also all adjacent work and materials by adequate covering with drop cloths.
- B. Contractor shall maintain a daily epoxy coatings induction record (log) showing each epoxy paint mixing event in the format demonstrated at the end of this section. A signed copy of this log shall be turned over to the Engineer's field representative before the end of each working day during which epoxy coatings are mixed or applied.
- C. Any unwanted paint shall be carefully removed without damage to finished paint or surface. If damage does occur, the entire surface adjacent to and including damaged area shall be repainted without visible lap marks.
- D. Do not use plumbing fixture or waste piping for mixing of paint or disposal of any refuse material. All waste shall be disposed of properly into a suitable receptacle located outside of building.
- E. All paint shall be applied without runs, sags, thin spots, or unacceptable marks. Paint shall be applied at the rate specified to achieve minimum dry mil thickness required. Additional coats of paint shall be applied, if necessary, to obtain dry film thickness specified.
- F. Application shall be by spraying where recommended by manufacturer. If material has thickened or must be diluted for application by spray gun, each coat shall be built up to the same film thickness achieved with undiluted brushed-on material. Where thinning is necessary, such thinning shall be done in strict accordance with manufacturer's instructions.
- G. A minimum of 24 hours drying time shall elapse between application of any two coats of paint on a particular surface, unless otherwise recommended by coating manufacturer. Longer drying times may be required for abnormal conditions in concert with manufacturer's recommendations.
- H. No painting whatsoever shall be accomplished in rainy or excessively damp weather when the relative humidity exceeds 85 percent, or when the general air temperature cannot be maintained at 50 degrees F (10 degrees C) or above throughout entire drying period.
- I. Apply color coding to all new plant piping, in accordance with Table A-3, Piping Color and Label Schedule. Plant piping shall be painted solid colors unless otherwise specified.
- J. On piping designated to receive identification bands, such band shall be 6 inches wide, neatly made by masking, and spaced at intervals of 30 inches on center, regardless of diameter of pipe being painted. Use approved precut and prefinished metal or plastic bands on piping in lieu of marked and painted bands, if approved by Engineer. PVC pipe shall be banded with colored bands in lieu of painting.
- K. Apply identification labels to all types and sections of piping, as outlined herein. Such labels shall be in form of plain Gothic Capital, upper case block lettering giving name of pipe content in full and showing direction of flow by arrows. Arrow to match letter type and size. All lettering shall have an overall height in inches, in accordance with the following table:

Diameter of Pipe or Pipe Covering	Height of Lettering
3/4 to 1-3/8 inches	1/2 inch
1-1/2 to 2-3/8 inches	3/4 inch
2-1/2 to 7-7/8 inches	1-1/2 inches
8 to 10 inches	2-1/2 inches

Over 10 inches

3 inches

- L. Piping labels shall be located as follows:
1. Adjacent to each valve and fitting (except at pump suction and discharge connections where labels are required on headers only).
 2. At each branch and riser take-off.
 3. At each pipe passage through wall, floor or ceiling.
 4. Maximum distance between labels shall be 10 feet on all non-potable water, chemical piping, and on all chlorine solution lines with a minimum of two labels in each room, gallery, or tunnel. Maximum distance between labels on all other piping runs shall be 20 feet.
- M. Identification lettering shall be located midway between color coding bands where possible and shall be properly inclined to pipe axis to facilitate easy reading. In the event lettering and arrow identifications are required for piping less than 3/4-inch in diameter, the Contractor shall furnish and attach approved color coded tags where instructed.

3.4 FINISHING SHOP PAINTED MECHANICAL AND ELECTRICAL EQUIPMENT

- A. All fabricated steel work and equipment delivered to job site shall receive at factory at least one shop coat of approved prime paint in concert with paint system required by these specifications. Surface preparation prior to shop painting shall be scheduled in Table A-1. All shop-painted items shall be properly packaged and stored until they are incorporated in work. Any painted surfaces that are damaged during handling, transportation, storage, or installation shall be cleaned, scraped, and patched before field painting begins so that work shall be equal to original painting at shop. Equipment or steel work that is to be assembled on the site shall likewise receive a minimum of one shop coat of paint at factory. Paint and surface preparation used for shop coating shall be identified on equipment shop drawings submitted to Engineer.
- B. Where exact identity of shop primer cannot be determined, or where primer differs from that specified, Contractor shall perform blast cleaning appropriate for service, followed by specified paint system. In lieu of above, Contractor has the option of shipping bare metal to job site and performing appropriate blast cleaning, followed by field prime coat of specified material immediately thereafter.

3.5 FIELD QUALITY CONTROL

- A. Prior to receiving a Certificate of Substantial Completion, Contractor shall arrange for manufacturer to inspect the application of his product and shall submit his report to Engineer identifying products used and verifying that said products were properly applied and that paint systems were proper for the exposure and service. The manufacturer's representative shall also certify that all coats in each system are compatible with one another.
- B. Each field coat of priming and finishing paint shall be inspected by the Engineer or his authorized representative before the succeeding coat is applied. The Contractor shall follow a system of tinting successive paint coats so that no two coats for a given surface are exactly the same color. Areas to receive black protective coatings shall be tick-marked with white or actually gauged as to thickness when finished.

3.6 SHOP PAINTING

- A. Shop painting of manufactured items (such as lockers, furnishings, and electrical and mechanical equipment) is not included in the scope of this work, unless specifically scheduled; as in the case of fabricated steel items (steel stairs, structural and miscellaneous

steel), steel doors and frames). Manufactured items shall be finished as noted in the specification section related to that item.

3.7 DESCRIPTION OF WORK

- A. The Interior and Exterior Coating System Schedules (Table A-1) and Piping Color and Label Schedule (Table A-2) are not intended to list every structure or equipment item to be painted or labeled. All new and existing structures, equipment, and appurtenances including all items furnished under the contract shall be painted by the Contractor, in accordance with the most applicable category from Table A-1. New and existing concrete tanks are not to be painted unless specifically identified on the Drawings.
- For application and curing of epoxy products at temperatures of 35 to 50 degrees F, use N69F Hi-Build Epoxoline II in lieu of N69 Hi-Build Epoxoline II and N140F Pota-Pox Plus in lieu of N140 Pota-Pox Plus.

TABLE A-1
COATING SYSTEM SCHEDULE

Non-Submerged Concrete Walls and Ceilings – Interior (paint only when scheduled in Table A-2 or in the architectural drawings)

SYSTEM C-1	SHERWIN-WILLIAMS	PPG	TNEMEC	REMARKS
Surface preparation	Clean and dry CONSIDER SSPC-SP 13/NACE 6	Clean and dry	Clean and dry	Allow concrete to cure 28 days prior to beginning coating operations
Prime coat	--	--	--	--
Intermediate coat	Seaguard 6100 3.5-5.0 mils/coat	Amerlock 2 / 400 4.0-8.0 mils /coat	Series N69 Hi-Build Epoxoline II 3.5-5.0 mils/coat	--
Finish coat	Seaguard 6100 3.5-5.0 mils/coat	Amerlock 2 /400 4.0-8.0 mils/coat	Series N69 Hi-Build Epoxoline II 3.5-5.0 mils/coat	Total DFT – 8. mils, minimum

Concrete in Contact with Sewage (paint only when scheduled in Table A-2 or in the architectural drawings)

SYSTEM C-2	SHERWIN-WILLIAMS	PPG	TNEMEC	REMARKS
Surface preparation	SSPC-SP 13/NACE #6 Surface Preparation of Concrete	SSPC-SP 13/NACE #6 Surface Preparation of Concrete	SSPC-SP 13/NACE #6 Surface Preparation of Concrete	Allow concrete to cure 28 days prior to beginning coating operations

Prime coat	Macropoxy 646 FC B67 W00235 3.5-5.0 mils/coat	Amerlock 2/400 4.0-8.0 mils/coat	Series N69 Hi-Build Epoxoline II 3.0-5.0 mils/coat	--
Intermediate coat	--	--	--	--
Finish coat	TarguardCoal Tar Epoxy B69B00040	Amercoat 78HB 12.0-16.0 mils/coat	46H-413 Hi-Build Tneme-Tar 16.0-20.0 mils	Top of wall to 3 ft. below water line. Total DFT-16 mils minimum

Concrete Block, Open Porous or Rough Masonry - Interior

SYSTEM C-3	SHERWIN-WILLIAMS	PPG	TNEMEC	REMARKS
Surface preparation	ASTM D4261 Standard Practice for Surface Cleaning Concrete Masonry Units for Coating			Allow mortar joints to cure 28 days prior to beginning coating operations
Prime coat	Cement-Plex 875 Acrylic Block Filler	Amerlock 400 BF 10.0-20.0 mils	130-6602 Enviro-Fill 100-120 sf/gal	Fill all voids.
Intermediate coat	Macropoxy 646 FC 3.0-5.0 mils	Amerlock 2/400 4.0-8.0/mils/coat	Series N69 Hi-Build Epoxoline II 3.0-5.0 mils	--
Finish coat	Macropoxy 646 FC 3.0-5.0 mils	Amerlock 2/400 4.0-8.0 mils/coat	Series N69 Hi-Build Epoxoline II 3.0-5.0 mils	Total DFT – 16 mils minimum

Concrete – Exterior (paint only when scheduled in Table A-2 or in the architectural drawings)

SYSTEM C-4	SHERWIN-WILLIAMS	PPG	TNEMEC	REMARKS
Surface preparation	Clean and dry	Clean and dry	Clean and dry	Allow concrete to cure 28 days prior to beginning coating operations
Prime coat	ConFlex XL Textured High Build Coating A05W00800	Pitt Flex 4-110XI Series	Series 157-Color Enviro-crete 111-148 sf/gal	--
Intermediate coat	--	--	--	--
Finish coat	ConFlex XL Textured High Build Coating	Pitt-Flex 4-110XI Series	Series 157-Color Enviro-crete	Total DFT – 12 mils minimum

SYSTEM C-4	SHERWIN-WILLIAMS	PPG	TNEMEC	REMARKS
	A05W00800		111-148 sf/gal	

Concrete in Contact with Raw or Potable Water (paint only when scheduled in Table A-2 or in the architectural drawings)

SYSTEM C-5	SHERWIN-WILLIAMS	PPG	TNEMEC	REMARKS
Surface preparation	SSPC-SP 13/NACE #6 Surface Preparation of Concrete	SSPC-SP 13/NACE #6 Surface Preparation of Concrete	SSPC-SP 13/NACE #6 Surface Preparation of Concrete	Allow concrete to cure 28 days prior to beginning coating operations
Prime coat	Macropoxy 646 PW Epoxy B58Wx610 – Mill White	Amerlock 2	Series N149-15BL Pota-Pox Plus 214-357 sf/gal	Fill all voids.
Intermediate coat	B58Wx600 – Light Blue B58VX600 – Hardener	Amerlock 2	Series N140-1255 Pota-Pox Plus 178-268 sf/gal	--
Finish coat	B58VX605 (3-coats, total DFT – 14 mils minimum)	Amerlock 2 Total DFT-4 mils minimum	Series N140-1255 Pota-Pox Plus 178-268 sf/gal	Total DFT – 14 mils minimum

Non-Submerged Masonry Walls – Glazed Wall Finish - Interior

SYSTEM C-6	SHERWIN-WILLIAMS	PPG	TNEMEC	REMARKS
Surface preparation	ASTM D4261 Standard Practice for Surface Cleaning Concrete Masonry Units for Coating	ASTM D4261 Standard Practice for Surface Cleaning Concrete Masonry Units for Coating	ASTM D4261 Standard Practice for Surface Cleaning Concrete Masonry Units for Coating	Allow concrete to cure 28 days prior to beginning coating operations
Prime coat	Macropoxy 646 Fast Cure Epoxy B58W00610	Amerlock 2/400	Series 104-color HS epoxy 110-125 sf/gal	--
Intermediate coat	--	--	--	--
Finish coat	Macropoxy 646 Fast Cure Epoxy B58W00610	Amerlock 2/400 Total DFT 16.0	Series 104-color HS epoxy 125-150 sf/gal	Total DFT – 16 mils minimum

SYSTEM C-6	SHERWIN-WILLIAMS	PPG	TNEMEC	REMARKS
		mils		

Non-Submerged Ferrous Metal

SYSTEM M-1	SHERWIN-WILLIAMS	PPG	TNEMEC	REMARKS
Surface preparation	SSPC-SP6/NACE No.3 Commercial Blast Cleaning	SSPC-SP6/NACE No.3 Commercial Blast Cleaning	SSPC-SP6/NACE No.3 Commercial Blast Cleaning	Shop
Prime coat	High Solids Alkyd Metal Primer B50WZ0003	Devguard 4180 Primer 2.0-3.0 mils	Series V10 Tnemec Primer, 2.0-3.0 mils	Shop
Intermediate coat	Sher-Cryl HPA-High Performance Acrylic B66W00350	Pitt Tech Plus 4216 1.5-4.0 mils	Series 1029-Color Enduratone, 2.0-3.0 mils	--
Finish coat	Macropoxy 646 Fast Cure Epoxy B58W00610	Pitt Tech Plus 1.5-4.0 mils	Series 1029-Color Enduratone, 2.0-3.0 mils	Total DFT – 7.5 mils minimum

General Ferrous Metal - Interior

SYSTEM M-2	SHERWIN-WILLIAMS	PPG	TNEMEC	REMARKS
Surface preparation	SSPC-SP6/NACE No.3 Commercial Blast Cleaning	SSPC-SP6/NACE No.3 Commercial Blast Cleaning	SSPC-SP6/NACE No.3 Commercial Blast Cleaning	Shop
Prime coat	Macropoxy 646 FC B67W00235	Amerlock 2/400	Series N69-1211 Hi-Build Epoxoline II 3.0-5.0 mils	Shop
Intermediate coat	Macropoxy 646 FC B67W00235	Amerlock 2/400	Series N69-Color Hi-Build Epoxoline II 3.0-5.0 mils	--
Finish coat	Macropoxy 646 FC B67W00235	Amerlock 2/400 Total DFT-12 mils minimum	Series N69-Color Hi-Build Epoxoline II 3.0-5.0 mils	Total DFT – 12 mils minimum

Submerged Ferrous Metal – SEWAGE WATER

SYSTEM M-3	SHERWIN-WILLIAMS	PPG	TNEMEC	REMARKS
Surface preparation	SSPC-SP10 /NACE No.2 Near white blast	SSPC-SP10 /NACE No.2 Near white blast	SSPC-SP10 /NACE No.2 Near white blast	--
Prime coat	Macropoxy 5500 B67W00235	Amercoat 240 4.0-12.0 mils/coat	Series N69-1211 Hi-Build Epoxoline II 3.0-5.0 mils	Shop
Intermediate coat	Macropoxy 5500 B67W00235	Amercoat 240 4.0-12.0 mils/coat	Series N69-Color Hi-Build Epoxoline II 3.0-5.0 mils	--
Finish coat	Macropoxy 5500 B67W00235	Amercoat 240 4.0-12.0 mils/coat	Series N69-Color Hi-Build Epoxoline II 3.0-5.0 mils	Total DFT – 12 mils minimum

General Ferrous Metal – Exterior

SYSTEM M-4	SHERWIN-WILLIAMS	PPG	TNEMEC	REMARKS
Surface preparation	SSPC-SP6/NACE No.3 Commercial Blast Cleaning	SSPC-SP6/NACE No.3 Commercial Blast Cleaning	SSPC-SP6/NACE No.3 Commercial Blast Cleaning	Shop
Prime coat	Macropoxy 646 FC	Amerlock 2/400 4.0-8.0 mils/coat	Series N69-1211 Hi-Build Epoxoline II 3.0-5.0 mils	Shop
Intermediate coat	Macropoxy 646 FC	Amerlock 2/400 4.0-8.0 mils/coat	Series N69-Color Hi-Build Epoxoline II 3.0-5.0 mils	--
Finish coat	Hi-Solids Polyurethane 250	Pitthane Ultra 2.0-3.0 mils	Series N75-Color Endura-Shield II 2.0-3.0 mils	Total DFT – 10.5 mils minimum

Ferrous Metal – Below Grade

SYSTEM M-5	SHERWIN-WILLIAMS	PPG	TNEMEC	REMARKS
Surface	SSPC-SP6/NACE	SSPC-SP6/NACE	SSPC-SP6/NACE	--

preparation	No.3 Commercial Blast Cleaning	No.3 Commercial Blast Cleaning	No.3 Commercial Blast Cleaning	
Prime coat	--	--	--	--
Intermediate coat	--	--	--	--
Finish coat	TarguardCoal Tar Epoxy B69B00040	Amercoat 78HB 12.0-16.0 mils	46H-413 Hi-Build Tneme-Tar 16.0-20.0 mils	Total DFT – 16.0 mils minimum

Ferrous Metal Moving Parts Submerged in Sewage

SYSTEM M-6	SHERWIN-WILLIAMS	PPG	TNEMEC	REMARKS
Surface preparation	Near-White Metal Blast Cleaning SSPC-SP10/NACE #2	Near-White Metal Blast Cleaning SSPC-SP10/NACE #2	Near-White Metal Blast Cleaning SSPC-SP10/NACE #2	Shop
Prime coat	Macropoxy 5500 @ 4.0 – 6.0 mils B67W00235	Amercoat 240 4.0-12.0 mils/coat	Series N69-1211 (Red) Hi-Build Epoxoline II 3.0-5.0 mils	--
Intermediate coat	--	--	--	--
Finish coat	-- Macropoxy 5500 @ 4.0 – 6.0 mils	--	--	Total DFT – 4. mils, minimum

Ferrous Metal Submerged in Raw or Potable Water

SYSTEM M-7	SHERWIN-WILLIAMS	PPG	TNEMEC	REMARKS
Surface preparation	SSPC-SP10 /NACE No.2 Near white blast	SSPC-SP10 /NACE No.2 Near white blast	SSPC-SP10 /NACE No.2 Near white blast	--
Prime coat	Macropoxy 646 PW Epoxy B58LX610 – Mill White	Amerlock 2 4.0-8.0 mils/coat	Series N140-15BL Pota-Pox Plus 3.0-5.0 mils	--
Intermediate coat	B58VX600 – Light Blue B58VX600 – Hardener	Amerlock 2 4.0-8.0 mils/coat	Series N140-1255 Pota-Pox Plus 4.0-6.0 mils	--
Finish coat	B58VX605-OAP Hardener (3-coats, total	Amerlock 2 4.0-8.0	Series N140-15BL Pota-Pox Plus 4.0-6.0 mils	Total DFT – 14.0 mils, minimum

SYSTEM M-7	SHERWIN-WILLIAMS	PPG	TNEMEC	REMARKS
	DFT – 14 mils minimum	mils/coat		

Uncertain Base Coat

SYSTEM M-8	SHERWIN WILLIAMS	PPG	TNEMEC	REMARKS
Surface preparation	SSPC-SP1 Solvent cleaning & SSPC-2 Hand tool cleaning	SSPC-SP1 Solvent cleaning & SSPC-2 Hand tool cleaning	SSPC-SP1 Solvent cleaning & SSPC-2 Hand tool cleaning	Remove grease and oil. Scuff sand to dull gloss.
Prime coat	Macropoxy 5000 @ 1.0 – 1.5 mils DRY	Amerlock 2/400 4.0-8.0 mils/coat	Series 1 Omnithane 2.5-3.5 mils	Follow with appropriate system for exposure.
Intermediate coat	--	--	--	Delete normal specified primer
Finish coat	Macropoxy 646 FC @ 3.0 – 5.0 mils dry--	Amerlock 2/400 4.0-8.0 mils/coat	--	--

Aluminum Surfaces in Contact with Concrete

SYSTEM M-9	SHERWIN WILLIAMS	PPG	TNEMEC	REMARKS
Surface preparation	SSPC SP 16 "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-ferrous Metals"	SSPC SP 16 "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-ferrous Metals"	SSPC SP 16 "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-ferrous Metals"	--
Prime coat	Macropoxy 646 FC B67W00235	Amerlock 2/400 4.0-8.0 mils	Series N69-Color Hi-Build Epoxoline II 3.0-5.0 mils	--.
Intermediate coat	--	--	--	--
Finish coat	--	--	--	Total DFT – 5.0 mils minimum

Interior Insulated Piping

SYSTEM M-10	SHERWIN WILLIAMS	PPG	TNEMEC	REMARKS
Surface preparation	Clean and dry	Clean and dry	Clean and dry	--
Prime coat	DTM Acrylic Primer/Finish B66W00001	Pitt Tech Plus 4216 1.5-4.0 mils	Series 6-Color Tneme-Cryl 2.0-3.0 mils	--.
Intermediate coat	--	--	--	--
Finish coat	DTM Acrylic Primer/Finish B66W00001	Pitt Tech Plus 4216 1.5-4.0 mils	Series 6-Color Tneme-Cryl 2.0-3.0 mils	Total DFT – 5.0 mils minimum

Non-Submerged Ferrous Metal – Extra Corrosion Protection - Exterior

SYSTEM M-11	SHERWIN WILLIAMS	PPG	TNEMEC	REMARKS
Surface preparation	SSPC-SP6/NACE No.3 Commercial Blast Cleaning	SSPC-SP6/NACE No.3 Commercial Blast Cleaning	SSPC-SP6/NACE No.3 Commercial Blast Cleaning	Shop
Prime coat	Corothane 1 Gal-Va-Pac Zinc Primer B65G00010	Amercoat 68HS 2.5.0-5.0 mils	90-97 Tneme-Zinc 2.5-3.5 mils	Shop
Intermediate coat	Macropoxy 646 FC B67W00235	Amerlock 2/400 4.0-8.0 mils	Series N69-Color Hi-Build Epoxoline II 3.0-5.0 mils	--
Finish coat	Hi-Solids Polyurethane 250	Pitthane Ultra 2.0-3.0 mils	Series 1075-Color Endura-Shield II 2.0-3.0 mils	Total DFT – 9.5 mils minimum

Non-Ferrous Metal - Interior

SYSTEM M-12	SHERWIN WILLIAMS	PPG	TNEMEC	REMARKS
Surface preparation	SSPC-SP 16	SSPC-SP1 Solvent Cleaning	SSPC-SP1 Solvent Cleaning	--
Prime coat	Macropoxy 646 FC @ 2.0 – 3.0 mils B67W00235	Amerlock 2/400 4.0-8.0 mils	Series N69-Color Hi-Build Epoxoline II 3.0-5.0 mils	--
Intermediate coat	--	--	--	--

SYSTEM M-12	SHERWIN WILLIAMS	PPG	TNEMEC	REMARKS
Finish coat	Macropoxy 646 FC @ 2.0 – 3.0 mils B67W00235	Amerlock 2/400 4.0-8.0 mils	Series N69-Color Hi-Build Epoxoline II 3.0-5.0 mils	Total DFT – 8.0 mils minimum

Non-Ferrous Metal - Exterior

SYSTEM M-13	SHERWIN WILLIAMS	PPG	TNEMEC	REMARKS
Surface preparation	SSPC-SP 16	SSPC-SP 16	SSPC-SP 16	--
Prime coat	Macropoxy 646 FC B67W00235	Amerlock 2/400 4.0-8.0 mils	Series N69-Color Hi-Build Epoxoline II 3.0-5.0 mils	--
Intermediate coat	--	--	--	--
Finish coat	Hi-Solids Polyurethane 250	Pitthane Ultra 2.0-3.0 mils	Series 1075- Color Endura- Shield II 2.0-3.0 mils	Total DFT – 6.5 mils minimum

Galvanized Steel - Exterior

SYSTEM M-14	SHERWIN WILLIAMS	PPG	TNEMEC	REMARKS
Surface preparation	SSPC-SP 16	SSPC-SP 16	SSPC-SP 16	
Prime coat	Corothane 1 Gal-Va-Pac Zinc Primer B65G00010	Amercoat 68 HS 2.5-3.5 mils	90-97 Tneme-Zinc 2.5-3.5 mils	--
Intermediate coat	Macropoxy 646 FC B67W00235	Amerlock 2/400 4.0-8.0 mils	Series N69-Color Hi-Build Epoxoline II 3.0-5.0 mils	--
Finish coat	Hi-Solids Polyurethane 250	Pitthane Ultra 2.0-3.0 mils	Series 1075-Color Endura-Shield II 2.0-3.0 mils	Total DFT – 6.5 mils minimum

Galvanized Steel - Interior

SYSTEM M-15	SHERWIN WILLIAMS	PPG	TNEMEC	REMARKS
Surface preparation	. SSPC SP 16 "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-ferrous Metals"	SSPC SP 16 "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-ferrous Metals"	SSPC SP 16 "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-ferrous Metals"	--
Prime coat	Macropoxy 646 FC B67W00235	Amerlock 2/400 4.0-8.0 mils	Series N69-Color Hi-Build Epoxoline II 3.0-5.0 mils	--
Intermediate coat	--	--	--	--
Finish coat	Macropoxy 646 FC B67W00235	Amerlock 2/400 4.0-8.0 mils	Series N69-Color Hi-Build Epoxoline II 3.0-5.0 mils	Total DFT – 8.0 mils minimum

Gypsum Board or Plaster Walls, Ceilings and Soffits – Interior/Exterior

SYSTEM G-1	SHERWIN WILLIAMS	PPG		REMARKS
Surface preparation	Clean and Dry	Clean and Dry	Clean and Dry	--
Prime coat	DTM Acrylic Primer/Finish	Pitt Tech Plus 4216 1.5-4.0 mils	Series 6 Tneme-Cryl 2.0-3.0 mils	--
Intermediate coat	--	--	--	--
Finish coat	DTM Acrylic Primer/Finish	Pitt Tech Plus 4216 1.5-4.0 mils	Series 6 Tneme-Cryl 2.0-3.0 mils	Total DFT – 5.0 mils minimum

Gypsum Board Walls, Ceilings, and Soffits. High Performance - Interior

SYSTEM G-2	SHERWIN WILLIAMS	PPG		REMARKS
Surface preparation	Clean and Dry	Clean and Dry	Clean and Dry	--
Prime coat	Pro Industrial High Performance Epoxy B67W00235	Amerlock 2/400 4.0-8.0-mils	Series N69-Color Hi- Build Epoxoline II 3.0-5.0 mils	--

SYSTEM G-2	SHERWIN WILLIAMS	PPG		REMARKS
Intermediate coat	--	--	--	--
Finish coat	Pro Industrial High Performance Epoxy B67W00235	Amerlock 2/400 4.0-8.0 mils	Series N69-Color Hi- Build Epoxoline II 3.0-5.0 mils	Total DFT – 6.5 mils minimum

Natural Wood - Interior

SYSTEM W-1	SHERWIN WILLIAMS	PPG		REMARKS
Surface preparation	Clean and Dry	Clean and Dry	Clean and Dry	--
Prime coat	--	--	Varmor CF	--
Intermediate coat	Minwax PolyAcrylic 710920000	Deft DFT 159	Varmor CF Satin	--
Finish coat	Minwax PolyAcrylic	Deft DFT 159	Varmor CF Satin	Total DFT – 6.5 mils minimum

Wood – Oil Base Stain – Exterior Semi-Transparent

SYSTEM W2	SHERWIN WILLIAMS	PPG		REMARKS
Surface preparation	Clean and Dry	Clean and Dry	Clean and Dry	--
Prime coat	WoodScapes Exterior Polyurethane Semi-Transparent Stain A15T5	PPG Flood 812	P&L Rustic	--
Intermediate coat	--	--	--	--
Finish coat	WoodScapes Exterior Polyurethane Semi-Transparent Stain A15T5	PPG Flood 812	P&L Rustic	Total DFT – 4.2 mils minimum

Wood – Acrylic or Oil Base Stain – Exterior Solid Color

SYSTEM W3	SHERWIN WILLIAMS	PPG		REMARKS
Surface	Clean and Dry	Clean and Dry	Clean and Dry	--

SYSTEM W3	SHERWIN WILLIAMS	PPG		REMARKS
preparation				
Prime coat	WoodScapes Exterior Polyurethane Semi-Transparent Stain A15T5	PPG Flood 820	P&L Solid Hide	--
Intermediate coat	--	--	--	--
Finish coat	WoodScapes Exterior Polyurethane Semi-Transparent Stain A15T5	PPG Flood 820	P&L Solid Hide	--

Wood – Painted – Exterior

SYSTEM W4	SHERWIN WILLIAMS	PPG		REMARKS
Surface preparation	Clean and Dry	Clean and Dry	Clean and Dry	--
Prime coat	Exterior Oil-based Wood Primer Y24W8020	Seal Grip 17-941NF	Series 151-1051 Elasto-Grip PC	--
Intermediate coat	DTM Acrylic Primer/Finish B66W00001	Pitt Tech Plus 4216 1.5-4.0 mils	Series 6-Color Tneme-Cryl 2.0-3.0 mils	--
Finish coat	WoodScapes Exterior Polyurethane Semi-Transparent Stain A15T5	Pitt Tech Plus 4216 1.5-4.0 mils	Series 6-Color Tneme-Cryl 2.0-3.0 mils	Total DFT – 7.5 mils, minimum

NOTE: Table A-1 and the Equipment Finish Schedule (Table A-2) are not intended to list every structure or equipment item to be painted. All new structures, equipment, and appurtenances including all items furnished under the contract shall be painted by the Contractor, in accordance with the most applicable category from Table A-1. New concrete tanks are not to be painted unless specifically identified in the following tables or on the architectural drawings.

TABLE A-2
EQUIPMENT FINISH SCHEDULE

Building Name/Process	Item Name	Color
General equipment	Aluminum in contact with concrete	Black
	Wall sleeves (interior portion only)	Black
	Gate operators	Grey
	Strainers, backflow preventers, water meters	Match pipe color
	Hydrants – fire	Safety Yellow

Building Name/Process	Item Name	Color
	Submerged ductile iron and steel pipe, supports, valves	Black
	Non-submerged interior ductile iron and steel pipe, supports, valves	Per pipe schedule
	PVC pipe accessories	Per pipe schedule
	Miscellaneous interior non-submerged ferrous metal	(1)
	Flow elements	Light Brown
	Floor drains	Black
	Lintels	(1)
	Chemical feed system, feed pumps and supports (unless otherwise listed)	Per pipe schedule
	Sump pumps	Manufacturer's standard
	Interior motors, drives, pump, valve operators – non- submerged	Light Gray
	Interior ferrous metal – non-submerged	(1)
	Existing and new monorails, cranes, and support systems ⁽²⁾	Safety Yellow
	Existing and new trolleys, hoists and portable lifting devices ⁽²⁾	Safety Yellow
	Bollards	Safety Yellow

(1) To be selected by Owner during shop drawing review.

(2) Except components that are finished with a hot dip galvanized coating or are either all stainless steel and/or aluminum materials; are not painted.

Note: All other equipment shall be manufacturer's standard unless otherwise indicated in the equipment specification.

3.8 COLOR CODED AND MARKED PIPING

A. All exposed piping shall be painted, color coded, and marked as scheduled.

1. Piping in exposed trenches shall be considered exposed.
2. Markers shall be of an all temperature adhesive tape, suitable for any pipe finish or covering.
3. Printing on markers shall be of sufficient size and style as reviewed by Engineer.
4. A flow arrow shall be installed with each pipe marker at a minimum spacing of 10 ft.
5. Where two colors do not have sufficient contrast to easily differentiate between them, a six-inch band of contrasting color shall be on one of the pipes at 30 inch intervals.

- B. On fiberglass, plastic, stainless steel, copper pipe, or other uncoated piping, a combination of wide banding tape and narrow banding tape shall be used for the pipe color and band.
- C. Labels and markings for specific pipe services are specified in the Section entitled "Mechanical Identification".

TABLE A-3
PIPING COLOR CODE TABLE

WASTEWATER TREATMENT FACILITY STANDARDS

Legend	Pipe Color
Raw Sludge Line	Gray
Sludge Recirculation Suction Line	Brown with Yellow Bands
Sludge Draw Off Line	Brown with Orange Bands
Sludge Recirculation Discharge Line	Brown
Digested Sludge Line	Black
Sludge Gas Line	Red
Natural Gas Line	Red
Non-potable water line	Purple
Potable water line	Blue
Fire main	Red
Chlorine line	Yellow
Sulfur Dioxide	Yellow with Red Bands
Sewage (wastewater) line	Gray
Compressed air line	Dark Green
Process air line	Light Green
Water lines for heating digesters or buildings	Blue with a 6-inch Red Band spaced 30 inches apart
Fuel oil/diesel	Red
Plumbing drains and vents	Black
Ferric Chloride	Orange
Polymer	Unpainted PVC

WATER TREATMENT FACILITY STANDARDS

Legend	Pipe Color
WATER LINES	
Raw or Recycle	Olive Green

Legend	Pipe Color
Settled or Clarified	Aqua
Finished or Potable	Dark Blue
CHEMICAL LINES	
Alum or Primary Coagulant	Orange
Ammonia	White
Carbon Slurry	Black
Caustic	Yellow with Green Band
Chlorine (Gas and Solution)	Yellow
Chlorine Dioxide	Yellow with Violet Band
Fluoride	Light Blue with Red Band
Lime Slurry	Light Green
Ozone	Yellow with Orange Band
Phosphate Compounds	Light Green with Red Band
Polymers or Coagulant Aids	Orange with Green Band
Potassium Permanganate	Violet
Soda Ash	Light Green with Orange Band
Sulfuric Acid	Yellow with Red Band
Sulfur Dioxide	Light Green with Yellow Band
WASTE LINES	
Backwash Waste	Light Brown
Sludge	Dark Brown
Sewer (Sanitary or Other)	Dark Gray
OTHER	
Compressed Air	Dark Green
Gas	Red
Other Lines	Light Gray

- (1) Pipe color and labels shall be in accordance with 10 States Standards.
- (2) To be selected by Owner during shop drawing review.
- (3) Submit manufacturer's color swatch for Engineer approval.
- (4) Do not paint stainless steel, copper, HDPE, FRP or PVC pipe. Provide pipe labels only.
- (5) This table may not list every pipe to be painted or labeled. All ferrous piping and conduit shall be painted.
- (6) Where pipe is insulated, provide color bands and pipe labels on insulation.
- (7) Paint pipe bollards safety yellow.

END OF SECTION

PAINT SCHEDULE

Reviewed by Paint Mfg. Rep. _____

Interior or Exterior Surfaces to Be Painted and Major Equipment	Surface Preparation		Paint System	Prime Coat Product, No. of Coats, Dry Film Thickness, and Coverage		Intermediate Coat	Finish Coat	Painting Status	Remarks (Any Special Treatment or Application Requirements)
	Shop	Field		Color	Color	Color	Color		

DAILY EPOXY COATINGS INDUCTION RECORD

Date	Product	Location	Ambient Temperature (°F)	Mix Start Time	Induction End Time	Total Induction Time Before Use

SECTION 10 28 13 TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Product Data: Specifications or data sheets and installation instructions for each product required.
- B. Contract Closeout Submittals: Furnish the following, as applicable, for each product required:
 - 1. Operation and maintenance data.
 - 2. Parts list.
 - 3. Keys and tools.

1.2 QUALITY ASSURANCE

- A. Provide products from more than one manufacturer if necessary to meet the requirements of this Section.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's original protective packaging.
 - 1. Furnish items with protective wrappings or covers as required to protect finishes. Do not remove protective coverings until completion of other Work liable to damage accessory finish.
- B. Pack products with required trim, mounting devices, fasteners, service tools or keys, and complete installation instructions.

PART 2 - PRODUCTS

2.1 MIRRORS

- A. Types:
 - 1. Type A: Polished tempered glass mirror in stainless steel frame, 18" x 24" flat to wall.

2.2 HAND DRYER

- A. Bradley Aerix Surface mounted 120v, 1150 Watts, variable air flow, variable air time, variable temperature, sensor-operated hand dryer, white steel cover - 2902-2873.

2.3 DOUBLE ROLL TOILET TISSUE DISPENSERS - SURFACE MOUNTED

- A. Valay Fixture Model No. 1007 dispenser by SQP, of Scotia, NY 12302; (518) 374-0770. Two roll design.

2.4 SOAP DISPENSER - SURFACE MOUNTED

- A. Global Industrial Automatic Hand Sanitizer/Liquid Soap Dispenser -1000ml capacity
#T9A695801 Battery operated hands free, white plastic construction.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Unless otherwise indicated, install Work of this Section in strict accordance with the manufacturer's instructions.
 - 1. Install all attachments, anchorage devices, and fasteners as required to securely mount accessory units to types of wall or partition construction indicated.

3.2 CLEANING AND POLISHING

- A. Remove protective wrappings from installed accessories after completion of other Work liable to damage accessory finish. Remove residue, if any, and polish exposed surfaces.

END OF SECTION

**SECTION 22 05 00
COMMON WORK RESULTS FOR PLUMBING**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following basic plumbing materials and methods to complement other Division 22 Sections.
 - 1. Pipe joining materials.
 - 2. Transition fittings.
 - 3. Dielectric fittings.
 - 4. Sleeves.
 - 5. Mechanical sleeve seals.
 - 6. Escutcheons.
 - 7. Grout.
 - 8. Fabricated metal equipment supports.
 - 9. Installation requirements common to plumbing specification Sections.
 - 10. Piping joint construction.
 - 11. Cutting and patching.
 - 12. Painting and finishing
- B. Pipe and pipe fitting materials are specified in piping systems sections.

1.3 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. 2015 Building Code of New York State
 - 2. 2015 Mechanical Code of New York State
 - 3. 2015 Plumbing Code of New York State
 - 4. American Society of Mechanical Engineers (ASME)
 - 5. American National Standards Institute (ANSI)
 - 6. National Fire Protection Association (NFPA)
 - 7. Underwriters Laboratories (UL)
 - 8. American Society for Testing and Materials (ASTM)
 - 9. American Welding Society (AWS)
 - 10. Occupational Safety and Health Administration (OSHA)

B. Definitions:

1. Pipe, pipe fittings, and piping include tube, tube fittings, and tubing.
2. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below the roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
3. Exposed Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
4. Exposed Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
5. Concealed Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
6. Concealed Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
7. The following are industry abbreviations for plastic materials:
 - a. ABS: Acrylonitrile-butadiene-styrene plastic.
 - b. CPVC: Chlorinated polyvinyl chloride plastic.
 - c. PE: Polyethylene plastic.
 - d. PVC: Polyvinyl chloride plastic.
8. The following are industry abbreviations for rubber materials:
 - a. EPDM: Ethylene-propylene-diene terpolymer rubber.
 - b. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

- A. Submit the following in accordance with the General Conditions.
- B. Product Data: "Catalog cuts" and spec sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data. Submit product data for following items:
 1. Mechanical sleeve seals.
 2. Transition fittings.
 3. Dielectric fittings.
 4. Escutcheons.

1.5 WARRANTY

- A. Provide parts and labor warranty in accordance with the General Conditions.

PART 2 - PRODUCTS**2.1 PIPE JOINING MATERIALS**

- A. Materials and Construction:

1. Refer to individual piping system specification Sections in Division 22 for special joining materials not listed below.
2. Solder Filler Metal: ASTM B32.
 - a. Alloy Sn95 or Alloy Sn94: Tin (approximately 95 percent) and silver (approximately 5 percent), having 0.10 percent lead content.
 - b. Alloy Sn50: Tin (50 percent) and lead (50 percent).
3. Brazing Filler Metals: AWS A5.8.
 - a. BCuP Series: Copper-phosphorus alloys for general duty brazing.
 - b. BAg1: Silver alloy for refrigerant piping.
4. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
5. Solvent Cements: Manufacturer's standard solvents complying with the following:
 - a. Acrylonitrile-Butadiene-Styrene (ABS): ASTM D2235.
 - b. Chlorinated Poly (Vinyl Chloride) (CPVC): ASTM F493.
 - c. Poly (Vinyl Chloride) (PVC): ASTM D2564.
 - d. PVC to ABS Transition: Made to requirements of ASTM D3138, color other than orange.

2.2 TRANSITION FITTINGS

A. Materials and Construction:

1. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
 - a. Manufacturers:
 - 1) Eselon Thermoplastics.
 - 2) Or equal
2. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
 - a. Manufacturers:
 - 1) Thompson Plastics, Inc.
 - 2) Or equal.
3. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.
 - a. Manufacturers:
 - 1) NIBCO INC.
 - 2) Or equal.
4. Flexible Transition Couplings for Underground Piping Systems: ASTM C1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.
 - a. Manufacturers:

- 1) Cascade Waterworks Mfg. Co.
- 2) Fernco, Inc.
- 3) Mission Rubber Company.
- 4) Plastic Oddities, Inc.
- 5) Or equal.

2.3 DIELECTRIC FITTINGS

A. Manufacturers:

1. Capitol Manufacturing Co.
2. Central Plastics Company.
3. Eclipse, Inc.
4. Epco Sales, Inc.
5. Hart Industries
6. International, Inc.
7. Watts Industries, Inc.
8. Water Products Div.
9. Zurn Industries, Inc.
10. Wilkins Div.
11. Or equal

B. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

C. Performance/Design Criteria:

1. Insulating Material: Suitable for system fluid, pressure, and temperature.
2. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

D. Materials and Construction:

1. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

a. Manufacturers:

- 1) Capitol Manufacturing Co.
- 2) Central Plastics Company.
- 3) Epco Sales, Inc.
- 4) Watts Industries, Inc.; Water Products Div.
- 5) Or equal.

2. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

a. Manufacturers:

- 1) Advance Products & Systems, Inc.

- 2) Calpico, Inc.
- 3) Central Plastics Company.
- 4) Pipeline Seal and Insulator, Inc.
- 5) Or equal.
- b. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.
3. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
 - a. Manufacturers:
 - 1) Calpico, Inc.
 - 2) Lochinvar Corp.
 - 3) Or equal.
4. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.
 - a. Manufacturers:
 - 1) Perfection Corp.
 - 2) Precision Plumbing Products, Inc.
 - 3) Sioux Chief Manufacturing Co., Inc.
 - 4) Victaulic Co. of America.
 - 5) Or equal.

2.4 SLEEVES

- A. Materials and Construction:
 1. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
 2. Steel Pipe: ASTM A53, Type E, Grade B, Schedule 40, galvanized, plain ends.
 3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
 4. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - a. Underdeck Clamp: Clamping ring with set screws.
 5. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
 6. PVC Pipe: ASTM D1785, Schedule 40.
 7. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.5 MECHANICAL SLEEVE SEALS

- A. Manufacturers:

1. Advance Products & Systems, Inc.
 2. Calpico, Inc.
 3. Metraflex Co.
 4. Or equal
- B. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
- C. Materials and Construction:
1. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 2. Pressure Plates: Stainless steel. Include two for each sealing element.
 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.6 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. Materials and Construction:
1. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
 2. One-Piece, Cast-Brass Type: With set screw.
 - a. Finish: Polished chrome-plated.
 3. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - a. Finish: Polished chrome-plated.
 4. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.

2.7 GROUT

- A. Description: ASTM C1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
- B. Materials and Construction:
1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 2. Design Mix: 5000-psi, 28-day compressive strength.
 3. Packaging: Premixed and factory packaged.

2.8 FABRICATED METAL SUPPORTS

- A. Description: Structural Steel Shapes: ASTM A36.

2.9 GENERAL

- A. All components of like size and type shall be the product of the same manufacturer for purposes of parts interchangeability.

PART 3 - EXECUTION

3.1 PLUMBING DEMOLITION

- A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.
- C. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
- D. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
- E. Equipment to Be Removed: Disconnect and cap services and remove equipment.
- F. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
- G. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- H. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality

3.2 EXAMINATION

- A. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- B. Examine walls, floors, roofs, and concrete bases for suitable conditions for installation, for example, all overhead work of other trades is complete.
- C. Verify that ground connections are in place and that installation of grounding described in Section "Grounding" is complete.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Install plumbing fixtures and piping systems as shown on the Contract Drawings and in accordance with the manufacturer's installation instructions.
- B. Plumbing System Installations
 - 1. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:
 - a. Coordinate plumbing systems, equipment, and materials installation with other building components.
 - b. Verify all dimensions by field measurements.
 - c. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for plumbing installations.

- d. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
- e. Sequence, coordinate, and integrate installations of plumbing materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
- f. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
- g. Coordinate connection of plumbing systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
- h. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Owner's Representative.
- i. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
- j. Install plumbing equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
- k. Install access panel or doors where units are concealed behind finished surfaces.
- l. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

C. Piping Installation

- 1. General: Install piping as described below, except where system Sections specify otherwise. Individual piping system specification Sections in Division 22 specify piping installation requirements unique to the piping system.
- 2. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, except where deviations to layout are approved on coordination drawings.
- 3. Install piping at indicated slope.
- 4. Install components having pressure rating equal to or greater than system operating pressure.
- 5. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.
- 6. Install piping free of sags and bends.
- 7. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, except where indicated.

8. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.
 9. Install piping to allow application of insulation plus 3-inch clearance around insulation.
 10. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
 11. Install fittings for changes in direction and branch connections.
 12. Install couplings according to manufacturer's printed instructions.
 13. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings in finished areas.
 14. Verify final equipment locations for roughing in. Refer to equipment specifications in other Sections for roughing-in requirements.
 15. Angle (wye) type strainers shall be provided with shutoff valve and cap on blowdown connection.
 16. Where mains are reduced, provide eccentric reducing fittings installed with flat side on the bottom.
 17. Horizontal piping shall not be installed less than 6 inches above finished floor (along walls), less than 7 ft-6 inches above finished floor (other areas), or in front of windows.
 18. Piping shall be offset, relocated, or changed to clear ducts, beams, conduits and other obstacles.
 19. Piping systems shall be free of noise and vibration under normal operating conditions.
 20. Install piping to permit valve servicing.
 21. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - g. Bare Piping in Unfinished Service Spaces: No escutcheon.
 - h. Bare Piping in Equipment Rooms: No escutcheon.
 - i. Bare Piping at Floor Penetrations in Equipment Rooms: No escutcheon.
- D. Sleeves
1. Install sleeves for pipes passing through concrete and masonry walls, fire-rated partitions, concrete floor and roof slabs, and where indicated.
 - a. Cut sleeves to length for mounting flush with both surfaces.
 - 1) Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 4 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring where specified.

- b. Build sleeves into new walls and slabs as work progresses.
 - c. Install large enough sleeves to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - 1) Steel Pipe Sleeves: For pipes smaller than 6 inches.
 - 2) Steel Sheet-Metal Sleeves: For pipes 6 inches and larger that penetrate gypsum-board partitions.
 - 3) Cast Iron Sleeve Fittings: For floors having membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
 - d. Seal space outside of sleeve fittings with nonshrink, nonmetallic grout.
 - e. Except for below-grade wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants specified in Division 7 Section "Joint Sealants."
 - f. Above Grade, Exterior Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installation of mechanical seals.
 - 1) Install steel pipe for sleeves smaller than 6 inches.
 - 2) Install cast-iron wall pipes for sleeves 6 inches and larger.
 - 3) Assemble and install mechanical seals according to manufacturer's printed instructions.
 - g. Below Grade, Exterior Wall, Pipe Penetrations: Install cast-iron wall pipes for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installation of mechanical seals.
 - h. Below Grade, Exterior Wall, Pipe Penetrations: Install ductile-iron wall penetration system sleeves according to manufacturer's printed installation instructions.
 - i. Fire Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping sealant material. Firestopping materials are specified in Division 7 Section Penetration Firestop.
2. Sleeves are not required for core-drilled holes.
- E. Piping Joint Construction
- 1. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
 - 2. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 - 3. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
 - 4. Soldered Joints: Apply ASTM B813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B32.
 - 5. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
 - 6. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full inside diameter. Join pipe fittings and valves as follows:

- a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- 7. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- 8. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- 9. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - a. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
 - b. ABS Piping: Join according to ASTM D2235 and ASTM D2661 Appendices.
 - c. CPVC Piping: Join according to ASTM D2846/D2846M Appendix.
 - d. PVC Pressure Piping: Join schedule number ASTM D1785, PVC pipe and PVC socket fittings according to ASTM D2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D2855.
 - e. PVC Nonpressure Piping: Join according to ASTM D2855.
 - f. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D3138 Appendix
- 10. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D3139.
- 11. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D3212.
- 12. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D2657.
 - a. Plain-End Pipe and Fittings: Use butt fusion.
 - b. Plain-End Pipe and Socket Fittings: Use socket fusion.
- 13. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.
- F. Piping Connections
 - 1. Piping Connections: Except as otherwise indicated, make piping connections as specified below.
 - a. Install unions in piping 2 inches and smaller adjacent to each valve and at final connection to each piece of equipment having a threaded pipe connection.
 - b. Install flanges in piping 2-1/2 inches and larger adjacent to flanged valves and at final connection to each piece of equipment having flanged pipe connection.
 - c. Dry Piping Systems (Gas, Compressed Air, and Vacuum): Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 - d. Wet Piping Systems (Water and Steam): Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.
- G. Equipment Installation – Common Requirements

1. Install equipment to provide the maximum possible headroom where mounting heights are not indicated.
 2. Install equipment according to submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to the Owner's Representative.
 3. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.
 4. Install plumbing equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
 5. Install equipment giving right-of-way to piping systems installed at a required slope.
- H. Painting and finishing
1. Refer to Division 9 for field painting requirements.
 2. Damage and Touch Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.
- I. Fabrication and erection of metal equipment supports and anchorage
1. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical equipment.
 2. Field Welding: Comply with AWS D1.1 "Structural Welding Code – Steel."
- J. Cutting and patching
1. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for plumbing installations. Perform cutting by skilled mechanics of the trades involved.
 2. Repair cut surfaces to match adjacent surfaces.
- K. Grouting
1. Install non-metallic non-shrink grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's printed instructions.
 2. Clean surfaces that will come into contact with grout.
 3. Provide forms for placement of grout, as required.
 - a. Avoid air entrapment when placing grout.
 - b. Place grout to completely fill equipment bases.
 4. Place grout on concrete bases to provide a smooth bearing surface for equipment.
 5. Place grout around anchors.
 6. Cure placed grout according to manufacturer's printed instructions.

3.4 PROTECTION

- A. Protect installed equipment from damage through Substantial Completion.

END OF SECTION

SECTION 22 05 23 GENERAL DUTY VALVES FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes general duty valves for Plumbing piping as shown on the Contract Drawings.
- B. Section Includes:
 - 1. Bronze ball valves.
 - 2. Bronze swing check valves.
 - 3. Bronze gate valves.
 - 4. Manual Air Vents
 - 5. Low Point Drains

1.3 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American Society for Testing and Materials (ASTM)
 - 2. American National Standards Institute (ANSI)
 - 3. American Society of Mechanical Engineers (ASME)
 - 4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - a. ASME B31.1 for power piping valves.
 - b. ASME B31.9 for building services piping valves.

1.4 COORDINATION REQUIREMENTS

- A. Coordinate layout and installation of plumbing valves with electrical equipment, light fixtures, HVAC equipment and ductwork, piping, and roof drains.

1.5 SUBMITTALS

- A. Submit the following in accordance with the General Conditions.
- B. Product Data: "Catalog cuts" and spec sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.

1.6 QUALITY ASSURANCE

A. Qualifications

1. Manufacturer's Factory Qualifications: Manufacturing facilities shall have accreditation to ISO 9000:2000 or an equivalent quality management system acceptable to the Engineer.

1.7 DELIVERY, STORAGE AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Handle plumbing valve components according to manufacturer's written instructions. Use factory-installed lifting provisions.

1.8 WARRANTY

A. Provide parts and labor warranty in accordance with the General Conditions.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to Plumbing valve schedule for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:

1. Handwheel: For valves other than quarter-turn types.
2. Handlever: For quarter-turn valves NPS 6 (DN 150) and smaller

E. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:

1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
 2. Grooved: With grooves according to AWWA C606.
 3. Threaded: With threads according to ASME B1.20.1.
- G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BALL VALVES

- A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Valve, Inc.
 - b. Conbraco Industries, Inc.; Apollo Valves.
 - c. Crane Co.; Crane Valve Group; Crane Valves.
 - d. Hammond Valve.
 - e. Lance Valves; a division of Advanced Thermal Systems, Inc.
 - f. Legend Valve.
 - g. Milwaukee Valve Company.
 - h. NIBCO INC.
 - i. Red-White Valve Corporation.
 - j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig (1035 kPa).
 - c. CWP Rating: 600 psig (4140 kPa).
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Bronze.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.
 - k. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:
 3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Hammond Valve.

- d. Lance Valves; a division of Advanced Thermal Systems, Inc.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
4. Description:
- a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig (1035 kPa).
 - c. CWP Rating: 600 psig (4140 kPa).
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Stainless steel.
 - i. Ball: Stainless steel, vented.
 - j. Port: Full.

2.3 BRONZE SWING CHECK VALVES

- A. Class 125, Bronze Swing Check Valves with Bronze Disc:
- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Valve, Inc.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Division.
 - e. Hammond Valve.
 - f. Kitz Corporation.
 - g. Milwaukee Valve Company.
 - h. NIBCO INC.
 - i. Powell Valves.
 - j. Red-White Valve Corporation.
 - k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - l. Zy-Tech Global Industries, Inc.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.

- e. Ends: Threaded.
 - f. Disc: Bronze.
- B. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:
- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Hammond Valve.
 - e. Kitz Corporation.
 - f. Milwaukee Valve Company.
 - g. NIBCO INC.
 - h. Red-White Valve Corporation.
 - i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 4.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: PTFE or TFE.
- C. Class 150, Bronze Swing Check Valves with Bronze Disc:
- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Valve, Inc.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Division.
 - e. Kitz Corporation.
 - f. Milwaukee Valve Company.
 - g. NIBCO INC.
 - h. Red-White Valve Corporation.
 - i. Zy-Tech Global Industries, Inc.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 300 psig (2070 kPa).

- c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: Bronze.
- D. Class 150, Bronze Swing Check Valves with Nonmetallic Disc:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 4.
 - b. CWP Rating: 300 psig (2070 kPa).
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: PTFE or TFE.

2.4 BRONZE GATE VALVES

- A. Class 125, NRS Bronze Gate Valves:
- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Valve, Inc.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Division.
 - e. Hammond Valve.
 - f. Kitz Corporation.
 - g. Milwaukee Valve Company.
 - h. NIBCO INC.
 - i. Powell Valves.
 - j. Red-White Valve Corporation.
 - k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - l. Zy-Tech Global Industries, Inc.

2. Description:
 - a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded [or solder joint].
 - e. Stem: Bronze.
 - f. Disc: Solid wedge; bronze.
 - g. Packing: Asbestos free.
- B. Class 125, RS Bronze Gate Valves:
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Valve, Inc.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Division.
 - e. Hammond Valve.
 - f. Kitz Corporation.
 - g. Milwaukee Valve Company.
 - h. NIBCO INC.
 - i. Powell Valves.
 - j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - k. Zy-Tech Global Industries, Inc.
 2. Description:
 - a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 200 psig (1380 kPa).
 - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded [or solder joint].
 - e. Stem: Bronze.
 - f. Disc: Solid wedge; bronze.
 - g. Packing: Asbestos free.
- C. Class 150, NRS Bronze Gate Valves:
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Hammond Valve.
 - b. Kitz Corporation.
 - c. Milwaukee Valve Company.

- d. NIBCO INC.
 - e. Powell Valves.
 - f. Red-White Valve Corporation.
 - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
- a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 300 psig (2070 kPa).
 - c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - d. Ends: Threaded.
 - e. Stem: Bronze.
 - f. Disc: Solid wedge; bronze.
 - g. Packing: Asbestos free.
- D. Class 150, RS Bronze Gate Valves:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Stockham Division.
 - c. Hammond Valve.
 - d. Kitz Corporation.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Powell Valves.
 - h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - i. Zy-Tech Global Industries, Inc.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 300 psig (2070 kPa).
 - c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - d. Ends: Threaded.
 - e. Stem: Bronze.
 - f. Disc: Solid wedge; bronze.
 - g. Packing: Asbestos free.

2.5 MANUAL AIR VENTS

- A. Bronze body and nonferrous internal parts; 150-psig working pressure; 225 deg F operating temperature; manually operated with screwdriver or thumbscrew; with 1/8-inch discharge connection and 1/2-inch inlet connection.

2.6 AUTOMATIC AIR VENTS

- A. Designed to vent automatically with float principle; bronze body and nonferrous internal parts; 150-psig working pressure; 240 deg F operating temperature; with 1/4-inch discharge connection and 1/2-inch inlet connection.

2.7 LOW-POINT DRAIN VALVES

- A. Low-point drain valves shall be 3/4-inch hose end ball valve with chained gasketed cap rated for system working temperature and pressure.

2.8 SOURCE QUALITY CONTROL

- A. Factory Quality Certification
 - 1. Submit copy of factory quality assurance certificate.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.
- F. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- G. Examine walls, floors, roofs, and concrete bases for suitable conditions for installation, for example, all overhead work of other trades is complete.
- H. Verify that ground connections are in place and that installation of grounding described in Section "Grounding" is complete.
- I. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install plumbing valves as shown on the Contract Drawings and in accordance with the manufacturer's installation instructions.
- B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- C. Locate valves for easy access and provide separate support where necessary.
- D. Install valves in horizontal piping with stem at or above center of pipe.
- E. Install valves in position to allow full stem movement.

- F. Install check valves for proper direction of flow

3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball or Gate Valves.
 - 2. Pump-Discharge Check Valves:
 - a. NPS 2 (DN 50) and Smaller: Bronze swing check valves with bronze disc.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 3. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged ends.
 - 4. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.
 - 5. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 6. For Steel Piping, NPS 5 (DN 125) and Larger: Flanged ends.

3.5 IDENTIFICATION

- A. Identify valves in accordance with Identification for Plumbing Piping and Equipment.

3.6 CLEANING

- A. On completion of installation, inspect interior and exterior of equipment. Remove dust, dirt, paint splatters and other spots from exterior and wipe down with damp cotton cloth. Touch up exposed surfaces to match original finish. Do not use compressed air to assist in cleaning.

3.7 PROTECTION

- A. Protect installed equipment from damage through Substantial Completion.

3.8 POTABLE AND NON-POTABLE WATER AND TEMPERED WATER VALVE SCHEDULE

- A. Pipe NPS 2 (DN 50) and Smaller:
 - 1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
 - 2. Ball Valves: Two piece, full port, bronze with bronze trim.
 - 3. Bronze Swing Check Valves: Class 125 bronze disc.

4. Bronze Gate Valves: Class 125 NRS bronze.

3.9 SUMP PUMP DISCHARGE VALVE SCHEDULE

A. Pipe NPS 2 and smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Retain only valve types, in five subparagraphs below, required for Project.
3. Caution: No one-piece, reduced-port, brass ball valves with stainless-steel trim; three-piece, regular-port, brass ball valves with brass trim; or bronze ball valves with bronze trim are included in the Section Text. Retain brass or stainless-steel trim with brass ball valves, or bronze or stainless-steel trim with bronze ball valves.
4. Ball Valves: Two piece, full port, bronze with bronze trim.
5. Bronze Swing Check Valves: Class 125 bronze disc.
6. Bronze Gate Valves: Class 125 NRS bronze.

END OF SECTION

SECTION 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes hangers, supports, and restraints for Plumbing systems including piping and equipment as shown on the Contract Drawings.

1.3 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
- B. 2009 International Plumbing Code
- C. Manufacturers Standardization Society (MSS):
 - 1. MSS SP-58-2009 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application and Installation
 - 2. MSS SP-127-2001 - Bracing for Piping Systems - Seismic-Wind-Dynamic Design, Selection, Application

1.4 REQUIREMENTS

- A. Coordinate layout and installation of hangers, supports and restraints of plumbing piping systems with other mechanical systems including HVAC equipment and ductwork, electrical equipment, and light fixtures

1.5 SUBMITTALS

- A. Submit the following in accordance with the General Conditions.
- B. Product Data: "Catalog cuts" and spec sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.
- C. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, and seismic restraint by a qualified professional engineer.
 - 1. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.

1.6 QUALITY ASSURANCE

- A. Qualifications
 - 1. Manufacturer's Factory Qualifications: Manufacturing facilities shall have accreditation to ISO 9000:2000 or an equivalent quality management system acceptable to the Engineer.
 - 2. Seismic Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing seismic engineering services, including the design of seismic restraints, that are similar to those indicated for this Project.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All components of like size and type shall be the product of the same manufacturer for purposes of parts interchangeability.

2.2 MISCELLANEOUS MATERIALS

- A. Structural steel: ASTM A36.
- B. Grout: ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)]

2.3 UPPER HANGER ATTACHMENTS

- A. Standard-Duty Beam Clamps (for piping): Malleable iron jaw, steel tie-rod, nuts, and washer. Underwriters Laboratories (UL) listed, Factory Mutual approved
- B. Heavy-Duty Beam Clamps (for large pipe and equipment): Forged steel
- C. Welded Structural Attachments: Carbon steel
- D. Brace Fitting: Malleable iron bracket and pipe end, hex-head cap screw and nut
- E. Wall Brackets: Factory-fabricated carbon steel bracket with knee brace
- F. Concrete Inserts [for new upper deck construction only]:
 - 1. Malleable iron inserts, threaded for rod.
 - 2. Carbon steel inserts with lateral adjustment capability
- G. Concrete Attachments: carbon steel plate with factory-drilled and anchor holes and factory-welded rod attachments

2.4 FASTENER SYSTEMS

- A. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Anchor Fasteners: Insert wedge-type, stainless steel anchors, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 METAL PIPE HANGERS AND SUPPORT

- A. Carbon-Steel Pipe Hangers and Supports
 - 1. Description: MSS SP-58, Types 1 through 58, factory fabricated components.

2. Galvanized Metal Coatings: Pregalvanized or hot dipped.
 3. Nonmetallic coatings: Plastic coating, jacket or liner.
 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Stainless Steel Pipe Hangers and Supports:
1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
- C. Copper Pipe Hangers:
1. Description: MSS SP-58, Types 1 through 58, copper coated steel, factory-fabricated components.
 2. Hanger Rods: Continuous-thread rod, nuts and washer made of stainless steel.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Vertical Piping:
1. Support vertical risers of piping systems by means of heavy duty hangers installed close to base of pipe risers, and by riser clamps with extension arms at intermediate floors, with the distance between clamps not to exceed 25 feet, unless otherwise specified. Support pipe risers in vertical shafts equivalent to the aforementioned. Install riser clamps above floor slabs, with the extension arms resting on floor slabs or pipe sleeves. Provide adequate clearances for risers that are subject to appreciable expansion and contraction caused by operating temperature ranges.
 2. Support for extension arms of riser clamps which are secured to risers to be insulated for cold service shall be 4 inches above floor slabs, to allow room for insulation and vapor sealing around riser clamps.
- C. Use clevis hangers for horizontal runs less than 20 feet long.
- D. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes.
- E. Insulated Piping: Comply with the following:
1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits according to ASME B31.9.
 2. Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span arc of 180 degrees.

3.2 HANGER SCHEDULE

- A. Horizontal piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
- B. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
- C. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
- D. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. C-Clamps (MSS Type 23): For structural shapes.
 2. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
- E. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
- F. Comply with MSS SP-58 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- G. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.3 PIPE HANGER SPACING

- A. Space hangers or supports for horizontal piping on maximum center distances as indicated in Table 4 of MSS SP-58.
- B. CPVC pipe operating above 70 deg F shall have continuous support.
- C. For Directional Changes: Install a hanger or support close to the point of change of direction of all pipe runs in either a horizontal or vertical plane.
- D. For Concentrated Loads: Install additional hangers or supports, spaced as required and directed, at locations where concentrated loads such as in-line pumps, valves, fittings or accessories occur, to support the concentrated loads.
- E. For Branch Piping Runs and Runouts over 5 feet in Length: Install a minimum of one hanger, and additional hangers if required by the hanger spacing schedules.
- F. Parallel Piping Runs: Where several pipe lines run parallel in the same place and in close proximity to each other, trapeze hangers may be submitted for approval. Base hanger spacing for trapeze type hangers on the smallest size of pipe being supported. Design the entire hanger assembly based on a safety factor of five, for the ultimate strength of the material being used.

- G. Support floor drain traps from the overhead construction, with hangers of type and design as required. Over-head supports are not required for floor drain traps installed directly below earth supported concrete floors

3.4 ANCHORS, RESTRAINTS, RIGID SUPPORTS, STAYS AND SWAY BRACES

- A. Install pipe anchors, restraints and sway braces, at locations noted on the Drawings. Design anchors so as to permit piping to expand and contract freely in opposite directions, away from anchor points. Install anchors independent of all hangers and supports, and in a manner which will not affect the structural integrity of the building.
- B. In grooved-end piping systems, install restraints, anchors, and rigid supports as recommended by the manufacturer of the grooved end fittings to ensure proper support and alignment of the piping under operating and testing pressures (maximum hanger or support spacing shall be as previously specified).:
 - 1. Horizontal piping shall maintain a constant pitch without sags, humps, or lateral deflections.
 - 2. Branch piping shall remain perpendicular to main piping and/or risers.
 - 3. Vertical piping shall remain plumb without deflections.
 - 4. Vertical piping shall be rigidly supported, or anchored at both top and bottom and wherever necessary to prevent movement and/or shearing forces at branch connections

3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 EQUIPMENT HANGERS

- A. Provide vibration isolating hangers for equipment with motors.
- B. Support air terminal units independent of ductwork.
- C. Support slot diffusers independent of suspended ceiling grid.

3.7 RODS

- A. Pipe and duct hanger rods shall be full size to match hangers.
- B. Trapeze and equipment hanger rods shall be sized for maximum load with a safety factor of five.
- C. Provide two nuts at each end of rods for positioning rod and hanger and locking each in place.

3.8 UPPER HANGER ATTACHMENTS

- A. General
 - 1. Upper hanger attachments shall be made to structural steel wherever possible.
 - 2. Powder-driven drive pins shall not be used.
 - 3. Expansion nails shall not be used.
 - 4. Powder-driven fasteners shall not be used in precast concrete.
 - 5. Loads in excess of 250 pounds shall not be supported from a single welded or powder-driven stud.

- B. Steel Frame Construction
 - 1. Provide intermediate structural steel members where required by ductwork support spacing. Select members based on a minimum safety factor of five.
 - 2. Secure upper hanger attachments to steel bar joists within 6 inches of panel points, or provide intermediate strut to transfer load to top chord of joist.
 - 3. Holes shall not be drilled in structural steel members.
 - 4. Friction clamps shall not be used.

3.9 EXAMINATION

- A. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.10 PAINTING

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 painting sections.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes Identification for Plumbing Piping and Equipment as shown on the Contract Drawings.

1.3 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American Society for Testing and Materials (ASTM)
 - 2. American National Standards Institute (ANSI)
 - a. ANSI A13.1 - Scheme for the Identification of Piping Systems.

1.4 SUBMITTALS

- A. Submit the following in accordance with the General Conditions.
- B. Product Data: "Catalog cuts" and spec sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data. For each product specified submit manufacturer's catalog sheets and specifications showing its compliance with this specification and the referenced standards.

1.5 QUALITY ASSURANCE

- A. Qualifications
 - 1. Manufacturer's Factory Qualifications: Manufacturing facilities shall have accreditation to ISO 9000:2000 or an equivalent quality management system acceptable to the Engineer.
- B. Identifying labels and markings for piping shall conform to ANSI A13.1 for legend, color, visibility, and size of legend and letters.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The following manufacturers are named to establish a standard of quality necessary for the Project:
 - 1. Seton Identification Company, Branford, Connecticut.

2. W. H. Brady Corporation, Milwaukee, Wisconsin.
3. Or equal.

2.2 MATERIALS AND CONSTRUCTION

- A. Pipe Identification Painting
 1. Type: As identified in Section entitled "Field Painting."
 2. Color: As scheduled in Paragraph 3.2.
- B. Pipe Identification Markers:
 1. Snap-On Type: Precoiled acrylic plastic marker with clear polyester coating, incorporating flow arrows, and legend printed in alternate directions.
 - a. Piping or insulation under 6 inch O.D.: One piece wrap around type with 3/4 inch adhesive strip on inside edge and 360 degree visibility.
 - b. Piping or insulation 6 inch O.D. and larger: Strip type with factory applied grommets, secure with stainless steel spring fasteners.
 2. Stick-On Type: One piece pressure sensitive adhesive backed plastic marker with clear polyester coating, incorporating flow arrows, and legend printed in alternate directions.
 - a. Piping or insulation under 8 inch O.D.: Wrap around type with 360 degree visibility.
 - b. Piping or insulation 8 inch O.D. and larger: Strip type.
 3. Markers shall be color coded based on pipe contents. Color selection shall be according to chart in Part 3 of this Section.
- C. Pipe Banding Tape:
 1. 1-1/2 inch width (minimum), pressure sensitive adhesive backed type, of same material as pipe identification mark, and of color to match background color of pipe identification marker.
- D. Pipe Service Identification Tags:
 1. Type: Brass, 19 B&S gage, with 1/4 inch high pipe service abbreviated lettering over 1/2-inch high pipe size lettering. Lettering shall be deep stamped and black filled. Tag to have 3/16 inch diameter hole at top for fastening.
 2. Size: 2 inch square tag.
 3. Fasteners: Brass "S" hook or brass jack chain, size as required for pipe to which tag is attached.
- E. Valve Identification Tags:
 1. Type: Brass, 19 B&S gage, with 1/4 inch high valve service abbreviated lettering over 1/2-inch high lettering indicating valve service chart number. Lettering shall be deep stamped and black filled. Tag to have 3/16 inch diameter hole at top for fastening.
 2. Size:
 - a. Plumbing: 1-1/2 inch hexagon tag.
 3. Fasteners: Brass "S" hook or brass jack chain, size as required for valve stem or handle to which tag is attached.
- F. Equipment Identification Letters & Numbers:
 1. Type: Stick-on type, made of all purpose polyester, single character letters and numbers, specifically designed for outdoor use.

2. Color: Black letters on bright yellow background.
3. Size: Letters and numbers shall be 1 inch or 3 inches in height, as specified.

2.3 ACCESSORIES

- A. Valve Service Identification Chart Frames:
 1. Satin finished extruded aluminum frame of size to fit 8-1/2 x 11 inch valve chart and complete with rigid clear plastic glazing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 IDENTIFICATION

- A. Piping General:
 1. Piping shall be identified as to content and direction of flow by use of pipe identification markers or tags.
 2. Identify all piping, bare or insulated, whose contents match those listed in the Pipe Identification Schedule, with the following exceptions:
 - a. Piping in furred spaces or above plastered ceilings, except at access panels where valves and piping shall be identified as specified for exposed piping.
 - b. Piping in finished spaces such as offices, toilet rooms, locker rooms, etc.
 3. Marker legend size, field color, and length of field shall be in accordance with ANSI A13.1.
 4. Legend wording shall be developed by the Contractor and submitted for review (see Section 1.3,B). Whenever possible, standard terminology should be used. Identification by the combination of two or more standard labels (at each identification point) is acceptable.
- B. Use of Markers or Tags:
 1. Pipe or insulation with an outside diameter (O.D.) of 3/4 inch and less shall be identified by the use of Pipe Service Identification Tags.
 2. Pipe or insulation with an O.D. larger than 3/4 inch shall be identified by the use of Pipe Identification Markers.
 3. Either snap-on or stick-on type markers may be used; except that stick-on markers shall not be used in the following situations:
 - a. Areas where humid, wet, or dripping conditions are anticipated.
 - b. Areas where chemical fumes are anticipated.
 - c. Outdoor installations.
 - d. On lines subject to 50 degree F temperature variations.
- C. Location of Markers and Tags:
 1. Pipe markers and tags shall be located so as to be readily visible from any reasonable point of observation.

2. Locate identification at all valves, branch or riser take-offs, and both sides of pipe passage through walls, floors, and ceilings.
3. On continuous pipe runs locate identification at 20 foot intervals, but not less than one marker or tag on any length of 10 feet or greater.

D. Preparation:

1. Insure that any painting is complete and the paint has thoroughly dried before applying identification.
2. Prepare surface in accordance with the manufacturer's instructions for the type of identification used and the surface to which it is applied.

E. Installation:

1. Install markers and tags in accordance with the manufacturer's instructions.
2. Secure both ends of stick-on type markers with 360 degree application of pipe banding tape. Tape shall have one inch lap on pipe or insulation.

F. Pipe Identification Schedule: Identify the following types of piping with markers and/or tags.

Pipe Service	Pipe Label Abbreviation	Valve Tag Abbreviation	Background Color	Letter Color
Domestic Cold Water Supply	Dom. Cold Water Sup.	DCWS	Green	White
Domestic Hot Water Supply	Dom Hot Water Sup.	DHWS	Yellow	Black
Domestic Hot Water Return	Dom. Hot Water Ret.	DHWR	Yellow	Black
Tempered Water Supply	Tempered Water Sup.	TWS	Green	White
Non-Potable Water (Plant Water)	Non-Potable Water	NPW	Green	White
Sanitary Drainage	Sanitary Drain	SAN	Green	White
Sanitary Vent	V	SAN-V	Blue	White

G. Installation:

1. Fasten tags to valve stems or handles using brass "S" hooks or jack chain.
2. Fasten tags in a manner and location that will permit easy reading, but will not interfere with the operation of the valve.

- H. Valve Service Identification Chart:
1. Provide two framed valve charts for each piping system to have valve identification tags.
 2. Charts shall be typed, in the reviewed format, on 8-1/2 x 11 inch heavy white bond paper and framed in an aluminum frame. Hang framed charts at location(s) directed.
- I. Equipment Identification General:
1. Identify plumbing equipment, bare or insulated, in the following locations, by use of stick-on letters and numbers:
 - a. Mechanical Equipment Rooms.
 - b. Boiler rooms.
 - c. Penthouses.
 - d. Suspended ceiling plenums.
 - e. Roof mounted equipment.
- J. Location and Content of Identification:
1. Equipment shall be identified with a minimum of two sets of lettering. Center identification lettering, vertically and horizontally, on opposite vertical sides of the equipment.
 2. Vertical sides selected shall have the longest dimension (i.e., label sides of equipment and not the ends), unless view is obstructed to those sides. If view is obstructed to sides of equipment, locate identification lettering on the two most visible vertical sides and/or ends.
 3. Equipment identification numbers and letters shall match the designation found in the equipment schedules on the Contract Drawings.
- K. Size of Lettering:
1. Use the largest lettering size (3 inch or 1 inch height) that will easily fit the available surface space.
 2. Use only one lettering height on any given piece of equipment (i.e., do not mix lettering sizes).
- L. Installation:
1. Prepare surface to which lettering is applied and install lettering in accordance with the manufacturer's instructions.
 2. Apply lettering in a straight line along the axis of the equipment. Lettering edges should touch, but not over-lap.

END OF SECTION

SECTION 22 05 93.5
PIPE PRESSURE TESTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes pipe pressure tests for plumbing piping systems as scheduled in Part 3 of this section.

1.3 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. 2015 International Plumbing Code

1.4 SUBMITTALS

- A. Submit the following in accordance with the General Conditions.
- B. In addition to those submittals identified in the General Conditions, the following items shall also be submitted:
- C. Test Reports
 - 1. A separate test report shall be submitted for each pressure test performed.
 - 2. Information presented in test reports shall be typewritten, clear, concise, and accurate.
 - 3. Reports shall be signed and dated by the supervisor in charge of performing the test and designated Inspector. Signatures shall certify that all information contained in the report is true and accurate to the best of the signatory's knowledge.
 - 4. Reports shall contain, as a minimum, the following information:
 - a. Type of test performed (e.g., hydrostatic, pneumatic, refrigerant, etc.)
 - b. Description of system or portion of system to which testing was performed.
 - c. Date of test.
 - d. Time of pressure start.
 - e. Time of pressure test completion.
 - f. Test fluid used in test (e.g., tap water, dry air, refrigerant, etc).
 - g. Pressure reading at beginning of test.
 - h. Pressure reading at end of test.
 - i. Location of pressure indicating devices.
 - j. Precise location of leaks detected.
 - k. Summary of leaks detected and suggested corrective action.
 - l. Conclusions regarding overall fitness and condition of tested system.
 - m. Signatures as described above.
 - n. Appendix: Calibration history of instruments used.

1.5 QUALITY ASSURANCE

- A. Tester's Qualifications
 - 1. Workers and their supervisors performing the Work of this section shall be personally experienced in testing of pipe systems and shall have been regularly employed by a company with three years minimum experience in testing of similar pipe systems.
- B. Inspection
 - 1. Tests shall be performed by the Contractor in the presence of designated Inspector(s). Witness and signoff is required.
 - 2. Inspectors shall, at all times, have access to any place where work is in preparation or in progress and Contractor shall provide sufficient safe and proper facilities for such access and inspection.
- C. Qualifications
 - 1. Manufacturer's Factory Qualifications: Manufacturing facilities shall have accreditation to ISO 9000:2000 or an equivalent quality management system acceptable to the Engineer.

1.6 SCHEDULING AND SEQUENCING

- A. Perform test operations on complete piping system or in sections as required and/or directed to progress Work in satisfactory manner and not delay the general construction of the project.
- B. If testing is performed in sections, valve or cap-off sections of piping to be tested, utilizing valves to be installed in permanent piping systems or temporary valves or caps as required to perform tests.
- C. Transmit written notification of proposed date and time of pressure tests to the Owner's Representative at least 5 days in advance of such tests.
- D. Pressure tests shall be performed prior to the installation of piping insulation or coverings.
- E. Pressure tests on underground piping shall be performed when piping has been partially backfilled with joints exposed.
- F. Pressure tests shall be performed prior to initial operation of piping systems.

PART 2 - PRODUCTS

2.1 TEST MATERIALS

- A. Test Fluid: Where scheduled, test media shall meet the following criteria.
 - 1. Tap Water: Untreated well water or plant water.
 - 2. Drinking Water: Treated, chlorinated potable water.

2.2 TEST EQUIPMENT

- A. Gauges: Calibrated, dial-type, suitable for use with specified test fluid. Upper limit of gauge pressure range shall be 1.33 times the specified test pressure. Gauge accuracy shall be 1 percent of the indicated reading or better.
- B. Soap Solution: American Gas & Chemical, "Leak-Tec"; or equivalent.
- C. Air Compressor: Unit rated to supply compressed air at or above required test pressure. Unit shall have necessary filters and driers to deliver clean, oil-free, dry compressed air. Unit shall have shut-off valve installed on discharge connection.
- D. Pressure Relief Valve: Suitable for use with compressed air, set to relieve at 10 to 15 percent above designated test pressure.

PART 3 - EXECUTION

3.1 GENERAL

- A. Tests shall be conducted at ambient temperature, unless otherwise specified.
- B. Do not use permanent system pressure gauges for pressure testing; remove and plug or isolate such gauges from the system during pressure tests.
- C. Instrumentation in, or attached to, the piping being tested shall be protected during testing by isolation or removal. Return instrumentation to pre-test condition after completion of pressure testing.
- D. Piping connected to specialties or equipment with a lower pressure rating than the specified test pressure shall be disconnected from the equipment (after the isolation valve) and openings plugged during the pressure test. After the completion of pressure testing, the piping shall be reconnected to the equipment.
- E. Expansion joints shall be provided with temporary restraint or blocked off during testing.
- F. Pressurization of piping systems by liquids or gases shall be executed in a slow and prudent manner to maintain safety, avoid over-pressurization, and avoid excessive leakage.
- G. If the piping fails the test requirements, the Contractor shall determine the cause of leakage, make necessary repairs, and retest the piping. This procedure shall be repeated until the piping complies with test requirements. A separate test report shall be submitted for each test to a piping system or section of piping.
- H. No caulking or putty shall be used in the repair of leaks. Back welding of threaded joints shall not be permitted as a means of repairing leaks.
- I. Test reports shall be filled out and readings recorded as testing proceeds.
- J. Safety glasses and hard hats shall be worn by personnel involved in or witnessing tests conducted at pressure of 20 psig or greater.

3.2 EXAMINATION

- A. Examine equipment and construction in the area of piping to be tested. Note equipment and existing construction that may be damaged by leakage of the test fluid.
- B. Verify that piping system bracing, alignment harnesses, and thrust restraints are in place before pressure is applied. Concrete restraints shall have cured adequately to withstand test pressure.
- C. Proceed with testing only after unsatisfactory conditions have been corrected.

3.3 PREPARATION

- A. Protect equipment and construction which may be damaged by leakage of test fluid by covering with appropriate material or removing from area.
- B. Verify that piping to be tested is clean and all outlets in the system are closed.
- C. Open non-outlet valves in piping section to be tested. Check valves that can prevent system sections from being filled or pressurized shall have their discs, etc. removed for testing (restore check valves to their pre-test condition after completion of pressure testing).
- D. Evacuate test areas of personnel not involved in the pressure testing.

3.4 HYDROSTATIC PRESSURE TEST

- A. Install pressure gauge to measure system pressure at low point in system.
- B. Connect pressurization pump to system.
- C. Fill the system with test liquid, opening vents to permit complete filling. Close vents.
- D. Using the pump, raise the pressure in the system to the scheduled test pressure. Hold pressure for a minimum of 1 hour.
- E. Reduce and hold the pressure 20 percent below test pressure. Inspect the entire system for visible leaks. Note location of leaks for repair.
- F. If leaks or defects are found, release the pressure, drain the system, and make repairs. Repeat the test procedure on the repaired piping.
- G. If the piping shows no visible leakage, raise the pressure in the system to the scheduled test pressure and isolate the system, under pressure, from the pump. The system should be closed with the pressure gauge indicating test pressure within system.
- H. System shall remain pressurized for the duration indicated in the test schedule. After the specified duration, check pressure reading on system gauge. No detectable drop in pressure shall have occurred in the system.
- I. If a drop in pressure occurs, Contractor shall determine cause. Once cause is determined release the pressure, drain the system, repair pipe as necessary, and retest.

- J. Upon compliance with test requirements, drain the system, remove items added or replace those removed for testing.

3.5 PIPE TEST SCHEDULE

- A. Perform pressure tests, of type indicated, on piping system(s) indicated using scheduled test fluid and pressure.
- B. Schedule

UTILITY	TEST METHOD	TEST MEDIUM	TEST PRESSURE	TEST DURATION	LEAKAGE
Potable Cold and Hot Water & Tempered Water	Hydrostatic	Water	100 psig	1 Hour	0
Non-Potable Water	Hydrostatic	Water	100 psig	1 Hour	0
Sanitary DWV	Gravity	Water	10 ft. of water	3 hours	0

END OF SECTION

SECTION 22 07 19 PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes insulating the following plumbing piping services:
 - 1. Domestic cold-water piping.
 - 2. Domestic hot-water piping.
 - 3. Supplies and drains for handicap-accessible lavatories and sinks.
- B. Insulation Materials:
 - 1. Mineral Fiber (MF).
 - 2. Flexible Elastomeric (FE).

1.3 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. 2015 Plumbing Code of New York State
 - 2. American Society for Testing and Materials (ASTM)
 - 3. Military Specifications (MIL), as applicably noted.
 - 4. International Energy Conservation Code.

1.4 SUBMITTALS

- A. Submit the following in accordance with the General Conditions.
- B. Product Data: "Catalog cuts" and spec sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.
- C. Shop Drawings:
 - 1. Pipe
 - a. Application of protective shields, saddles, and inserts at pipe hangers for each type of insulation and hanger.
 - b. Attachment and covering of heat trace inside insulation.
 - c. Insulation application at pipe expansion joints for each type of insulation.
 - d. Removable insulation at piping specialties and equipment connections.
 - e. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - f. Application of field-applied jackets.

1.5 QUALITY ASSURANCE

- A. Qualifications
 - 1. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.
 - a. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.
 - b. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.
- B. Maintain ambient conditions required by manufacturers of tapes, adhesives, mastics, cements, and insulation materials.

PART 2 - PRODUCTS

2.1 MINERAL FIBER INSULATION

- A. Manufacturers:
 - 1. CertainTeed Saint-Gobain.
 - 2. Johns Manville
 - 3. Knauf Insulation
 - 4. Owens Corning
 - 5. Or equal.
- B. Description:
 - 1. Fibrous Glass (Mineral-fiber) Insulation: Glass fibers bonded with a thermosetting resin complying with the following:
 - a. Preformed Pipe Insulation: Comply with ASTM C 547, Type 1, with factory-applied, all-purpose, vapor-retarder jacket with or without self-sealing lap as applicable for application.
 - b. Fire-Resistant Adhesive: Comply with MIL-A-3316C in the following classes and grades:
 - 1) Class 1, Grade A for bonding glass cloth and tape to unfaced glass-fiber insulation, for sealing edges of glass-fiber insulation, and for bonding lagging cloth to unfaced glass-fiber insulation.
 - 2) Class 2, Grade A for bonding glass-fiber insulation to metal surfaces.
 - c. Vapor-Retarder Mastics: Fire- and water-resistant, vapor-retarder mastic for indoor applications. Comply with MIL-C-19565C, Type II.
 - d. Mineral-Fiber Insulating Cements: Comply with ASTM C 195.
 - e. Expanded or Exfoliated Vermiculite Insulating Cements: Comply with ASTM C 196.

- f. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

2.2 FLEXIBLE ELASTOMERIC INSULATION

- A. Manufacturers:
 - 1. Armacell
 - 2. Aeroflex USA Inc., Aerocel.
 - 3. Rubatex International
 - 4. Or equal.
- B. Description:
 - 1. Flexible Elastomeric: Closed cell, sponge or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials
 - a. Flexible Elastomeric Adhesive: Comply with MIL-A-24179a, Type II, Class I.

2.3 FIELD-APPLIED JACKETS

- A. Manufacturers:
 - 1. Johns Manville; Zeston.
 - 2. P.I.C. Plastics, Inc.; FG Series.
 - 3. Proto Corporation; LoSmoke.
 - 4. Speedline Corporation; SmokeSafe.
 - 5. Or equal.
- B. Description:
 - 1. Field-applied jackets shall comply with ASTM C921, Type I, unless otherwise indicated.
 - 2. Heavy PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 30-mil-thick, high-impact, ultraviolet-resistant PVC. Application; as noted for mechanical rooms and outdoor use.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.
 - b. Adhesive: As recommended by insulation and/or material manufacturer for temperature application.
 - 3. Standard PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 20-mil-thick, high-impact, ultraviolet-resistant PVC for indoor use only.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.
 - b. Adhesive: As recommended by insulation and/or material manufacturer for temperature application.

2.4 ACCESSORIES

- A. Description:
 - 1. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz/yd².
 - a. Tape Width: 4 inches.
 - 2. Bands: 3/4 inch wide, in one of the following materials compatible with jacket:

- a. Stainless Steel: ASTM A 666, Type 304; 0.020 inch thick.
- b. Galvanized Steel: 0.005 inch thick.
- c. Aluminum: 0.007 inch thick.
- d. Brass: 0.010 inch thick.
- e. Nickel-Copper Alloy: 0.005 inch thick.
- 3. Wire: 0.080-inch, nickel-copper alloy; 0.062-inch, soft-annealed, stainless steel; or 0.062-inch, soft-annealed, galvanized steel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 INSTALLATION GENERAL

- A. Install materials as shown on the Contract Drawings and in accordance with the manufacturer's installation instructions.
- B. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; and free of voids throughout the length of equipment, fittings and piping, including fittings, valves and specialties.
- C. Refer to schedules at the end of this Section for materials, jackets, and thicknesses required for each piping system.
- D. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- E. Apply multiple layers of insulation with longitudinal and end seams staggered.
- F. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.
- G. Keep insulation materials dry during storage, application and finishing.
- H. Apply pipe insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
- I. Apply insulation with the least number of joints practical.

- J. Apply insulation over fittings and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
- K. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.
- L. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic. Apply insulation continuously through hangers and around anchor attachments.
 - 1. Apply insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
 - 3. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.
- M. Insulation Terminations: For insulation application where vapor retarders are indicated, seal ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
- N. Apply insulation with integral jackets as follows:
 - 1. Pull jacket tight and smooth.
 - 2. Joints and Seams: Cover with tape and vapor retarder as recommended by insulation material manufacturer to maintain vapor seal.
 - 3. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to duct flanges and fittings.
 - 4. Circumferential Joints: Cover with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches o.c.
 - 5. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches. Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
 - a. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.
- O. Cut insulation according to manufacturer's written instructions to prevent compressing insulation to less than 75 percent of its nominal thickness.
- P. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.
 - 1. Seal penetrations with vapor-retarder mastic.
 - 2. Apply insulation for exterior applications tightly joined to interior insulation ends.
 - 3. Seal insulation to roof flashing with vapor-retarder mastic.
 - 4. Extend metal jacket of exterior insulation outside roof flashing at least 2 inches below top of roof flashing.

- Q. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.
- R. Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire/smoke damper sleeves for fire-rated wall and partition penetrations.
- S. Floor Penetrations: Terminate insulation at underside of floor assembly and at floor support at top of floor.
 - 1. For insulation indicated to have vapor retarders, taper termination and seal insulation ends with vapor-retarder mastic.

3.4 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Apply insulation to straight pipes and tubes as follows:
 - 1. Secure each layer of preformed pipe insulation to pipe with wire, tape, or bands without deforming insulation materials.
 - 2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic. Apply vapor retarder to ends of insulation at intervals of 15 to 20 feet to form a vapor retarder between pipe insulation segments.
 - 3. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.
 - 4. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches o.c.
- B. Apply insulation to flanges as follows:
 - 1. Apply preformed pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
 - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
- C. Apply insulation to fittings and elbows as follows:
 - 1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
 - 2. When premolded insulation elbows and fittings are not available, apply mitered sections of pipe insulation, or glass-fiber blanket insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape, or bands.
 - 3. Cover indoor fittings with standard PVC fitting covers.
 - 4. Cover mechanical room and outdoor fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
- D. Apply insulation to valves and specialties as follows:
 - 1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.

2. When premolded insulation sections are not available, apply glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to strainer basket without disturbing insulation.
3. Apply insulation to flanges as specified for flange insulation application.
4. Indoors: Use preformed standard PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
5. Outdoors: Use preformed heavy PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Apply insulation to straight pipes and tubes as follows:
 1. Follow manufacturer's written instructions for applying insulation.
 2. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.
- B. Apply insulation to flanges as follows:
 1. Apply pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of the same thickness as pipe insulation.
 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.
- C. Apply insulation to fittings and elbows as follows:
 1. Apply mitered sections of pipe insulation.
 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.
- D. Apply insulation to valves and specialties as follows:
 1. Apply preformed valve covers manufactured of the same material as pipe insulation and attached according to the manufacturer's written instructions.
 2. Apply cut segments of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, fabricate removable sections of insulation arranged to allow access to strainer basket.
 3. Apply insulation to flanges as specified for flange insulation application.
 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

3.6 INSTALLATION OF FIELD-APPLIED JACKET

- A. Apply PVC jacket where indicated, with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
- B. Apply metal jacket where indicated, with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.7 FIELD QUALITY CONTROL

- A. Inspection: Engage a qualified inspection agency to perform the following field quality-control inspections, after installing insulation materials, jackets, and finishes, to determine compliance with requirements:
- B. Insulation applications will be considered defective if sample inspection reveals noncompliance with requirements. Remove defective Work and replace with new materials according to these Specifications.
- C. Reinstall insulation and covers on piping uncovered for inspection according to these Specifications.

3.8 IDENTIFICATION

- A. Identify piping and valves as specified in Identification for Plumbing Piping and Equipment Section.

3.9 SCHEDULE

- A. Refer to insulation application Table 1 for required insulation thicknesses.

PART 4 - TABLE 1 – PIPE INSULATION THICKNESS

Pipe Service	Insulation Thickness	
	MF	FE
Domestic cold and non-potable water – All sizes	½"	½"
Domestic Hot water – up to & including 1 ½" dia.	1"	1"
Domestic Hot water – 2" dia. & larger	1 ½"	1 ½"

END OF SECTION

SECTION 22 11 16 DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes Domestic Water Piping including all potable water piping systems as shown on the Contract Drawings.

1.3 REFERENCES

- A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. 2015 Plumbing Code of New York State
 - 2. American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)
 - a. ANSI/ASME B16.3 – Malleable Iron Threaded Fittings Class 150 NS 300.
 - b. ANSI/ASME B16.22 – Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
 - c. ANSI/ASME B16.29 – Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings – DWV.
 - 3. American National Standards Institute (ANSI)/American Society for Testing and Materials (ASTM)
 - a. ANSI/ASTM B32 – Solder Metal.
 - b. ANSI/ASTM F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
 - c. AWWA C110/ANSI A21.10 - Ductile-Iron and Gray-Iron Fittings, 3" through 48" for Water.
 - d. AWWA C115/ANSI A21.15 - Flanged Ductile-Iron Pipe with Ductile Iron or Gray-Iron Threaded Flanges.
 - e. AWWA C151/ANSI A21.51 - Standard for Ductile-Iron Pipe, Centrifugally Cast.
 - 4. American Society For Testing and Materials (ASTM)
 - a. ASTM A53 – Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
 - b. ASTM B88 – Seamless Copper Water Tube.
 - c. ASTM D2846 – Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic and Cold Water Distribution Systems.
 - d. ASTM F438 – Specification for Socket-type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.

- e. ASTM F493 – Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
- f. ASTM D2855 – Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
- g. ASTM D1785 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120.
- h. m. ASTM D2466 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
- 5. National Sanitation Foundation
 - a. NSF 61 --- Drinking Water System Components: Health Effects.
- 6. 2009 International Plumbing Code

1.4 COORDINATION REQUIREMENTS

- A. Coordinate layout and installation of domestic water piping system with electrical equipment, light fixtures, HVAC equipment and ductwork, piping, and roof drains.
- B. Submit specially prepared Coordination Drawings for this Project, including floor plans and sections, drawn to scale. Include scaled equipment layouts and relationships between equipment and adjacent structural, mechanical, HVAC, and electrical elements. Show the following:
 - 1. Vertical and horizontal runs, offsets, and transitions.
 - 2. Clearances for access above and to the side.
 - 3. Show dimensions and details, including connections.
 - 4. Support locations, type of support, and weight on each support.
 - 5. Location of adjacent construction elements including light fixtures, HVAC and plumbing equipment, fire sprinklers and piping, signal and control devices, and other equipment.

1.5 SUBMITTALS

- A. Submit the following in accordance with the General Conditions.
- B. Product Data: “Catalog cuts” and spec sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.

1.6 QUALITY ASSURANCE

- A. Qualifications
 - 1. Manufacturer’s Factory Qualifications: Manufacturing facilities shall have accreditation to ISO 9000:2000 or an equivalent quality management system acceptable to the Engineer.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Coordinate delivery of domestic water piping and fittings to allow movement into designated space.

1.8 WARRANTY

- A. Provide parts and labor warranty in accordance with the General Conditions.

PART 2 - PRODUCTS

2.1 POTABLE COLD WATER PIPING, ABOVE GRADE

A. Manufacturers:

1. Cerro Flow Products Inc.
2. NIBCO INC.
3. U. S. Pipe.
4. Or equal.

B. Description:

1. 3" diameter and below: Copper Tubing: ASTM B88, Type L. Fittings: ANSI/ASME B16.22, wrought copper. Joints: ANSI/ASTM B32, solder, Grade 95TA.
2. 4" diameter and larger: /AWWA C151/ANSI A21.15 - Ductile Iron Pipe - Double Thickness Cement Lined in accordance with AWWA C104/ANSI 21.4. Fittings: AWWA C110/ANSI A21.10 or AWWA C115/ANSI A21.15.

2.2 POTABLE COLD WATER PIPING, BELOW GRADE

A. Manufacturers:

1. Cerro Flow Products Inc.
2. NIBCO INC.
3. U.S. Pipe.
4. Or equal.

B. Description:

1. 3" diameter and below: Copper Tubing: ASTM B88, Type K. Fittings: ANSI/ASME B16.22, wrought copper. Joints: ANSI/ASTM B32, solder, Grade 95TA.
2. 4" diameter and above: Ductile iron, Class 53 with Megalug joints. Refer to the Section entitled "Ductile Iron Pipe."

2.3 POTABLE HOT WATER

A. Manufacturers:

1. Cerro Flow Products Inc.
2. NIBCO INC.
3. Charlotte Pipe and Foundry Company.
4. Or equal.

B. Description:

1. 2-inch and below Copper Tubing: ASTM B88, Type L. Fittings: ANSI/ASME B16.22, wrought copper. Joints: ANSI/ASTM B32, solder, Grade 95TA.

2. 2-inch and below: CPVC plastic pipe and tubing – ASTM D2846 and NSF 61. Fittings: CPVC plastic – ASTM F438. Joints: Solvent cement – ASTM F493.

2.4 TEMPERED WATER PIPING

A. Manufacturers:

1. Cerro Flow Products Inc.
2. NIBCO INC.
3. U. S. Pipe.
4. Or equal.

B. Description:

1. 3" diameter and below: Copper Tubing: ASTM B88, Type L. Fittings: ANSI/ASME B16.22, wrought copper. Joints: ANSI/ASTM B32, solder, Grade 95TA.

2.5 GENERAL

- ### **A.**
- All components of like size and type shall be the product of the same manufacturer for purposes of parts interchangeability.

PART 3 - EXECUTION

3.1 EXAMINATION

- #### **A.**
- Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- #### **B.**
- Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- #### **A.**
- Install piping and accessories in accordance with the configuration shown on Contract Drawings.
- #### **B.**
- All areas shall be interpreted as industrial and all piping shall be installed exposed unless otherwise shown or specified.
- #### **C.**
- Areas with a finished ceiling indicated on the Contract Drawings "Room Finish Schedule" shall have all piping concealed unless otherwise shown or specified.
- #### **D.**
- Sleeves shall be provided where piping passes through floors and walls.
1. Sleeves shall be caulked watertight or gastight as required.
 2. Where water tightness or gas tightness is not required and the pipe is insulated, the sleeve shall be sized to permit full insulation thickness of pipe to be installed through the sleeve.
- #### **E.**
- Leakage tests shall be as specified.
- #### **F.**
- No fixture or equipment shall be connected directly to the potable water system in such a manner that a cross-connection exists and backflow of contaminated water into the potable water system could occur.
- #### **G.**
- All piping, except where noted, shall be kept as high as possible.

- H. All connections between ferrous and non-ferrous piping and equipment shall be made with dielectric unions.
- I. Copper piping installed in concrete shall be coated with bitumastic paint.
- J. All water piping shall be run true and plumb, free of traps, and installed with adequate clearance from mechanical work.
- K. All water piping shall pitch to drain at a slope of $\frac{1}{4}$ inch per 10 feet unless otherwise noted. Manual air vents shall be installed at all high points and drain valves shall be installed at all low points.
- L. Piping shall not be installed across or in front of doors or windows.
- M. All piping shall be routed parallel to building column lines.
- N. All hot and cold water lines above grade shall be insulated. All exposed insulated piping within five (5) feet of finished floor shall have a metal jacket.
- O. All potable water piping shall be disinfected in accordance with the International Plumbing Code, Section 610.
- P. Install water hammer arresters complete with accessible isolation valve.
- Q. Install lowpoint drain valves with threaded nipple and cap.

3.3 IDENTIFICATION

- A. Identify piping as specified in accordance with the Section entitled "Identification for Plumbing Piping and Equipment."

3.4 PROTECTION

- A. Protect installed equipment from damage through Substantial Completion.

END OF SECTION

SECTION 22 11 19 DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes Plumbing Specialties including backflow preventers, water hammer arresters, hose bibbs, hose valves, wall hydrants, trap primer valves and distribution units as shown on the Contract Drawings.

1.3 REFERENCES

- A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 1. American National Standards Institute (ANSI)/American Society of Sanitary Engineering (ASSE)
 - a. ANSI/ASSE 1011 - Hose Connection Vacuum Breakers
 - b. ANSI/ASSE 1019 - Wall Hydrants, Frost Proof Automatic Draining Anti-Backflow Types.
 2. American National Standards Institute (ANSI)
 - a. ANSI A112.21.1 - Floor Drains.
 - b. ANSI A112.2.1.2 - Roof Drains.
 - c. ANSI A112.26.1 - Water Hammer Arresters.
 3. American Society for Testing and Materials (ASTM)
 - a. ASTM A 48 – Specifications for Gray Iron Castings.
 - b. ASTM A126 – Specifications for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 4. National Sanitation Foundation (NSF)
 - a. NSF 61 – Drinking Water System Components – Health Effects.
 5. American Society of Mechanical Engineers (ASME)
 - a. ASME B120.1 – Pipe Threads, General Purpose (inch).
 6. Plumbing and Drainage Institute (PDI)
 7. 2009 International Plumbing Code
 8. AWWA Standard C700
 9. University of Southern California Foundation for Cross-Connection Control and Hydraulic Research
 - a. List of Approved Backflow Prevention Assemblies.

1.4 COORDINATION REQUIREMENTS

- A. Coordinate layout and installation of Domestic Water Piping Specialties with electrical equipment, light fixtures, HVAC equipment and ductwork, and piping.

1.5 SUBMITTALS

- A. Submit the following in accordance with the General Conditions.
- B. Product Data: "Catalog cuts" and spec sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.
 - 1. In addition to those submittals identified in the General Conditions, the following items shall also be submitted.
 - 2. Submit minimum inlet pressure requirements and pressure drop data for backflow preventers.

1.6 QUALITY ASSURANCE

- A. Qualifications
 - 1. Manufacturer's Factory Qualifications: Manufacturing facilities shall have accreditation to ISO 9000:2000 or an equivalent quality management system acceptable to the Engineer.

1.7 WARRANTY

- A. Provide parts and labor warranty in accordance with the General Conditions.

PART 2 - PRODUCTS**2.1 BACKFLOW PREVENTERS**

- A. Manufacturers / Models - 1" diameter:
 - 1. Ames – Model LF4000BM2
- B. Description:
 - 1. Reduced pressure zone backflow preventers shall have a relief valve located between two independently operating check valves. Backflow preventers shall be designed for horizontal flow installation and sized as indicated on Contract Drawings.

2.2 WATER HAMMER ARRESTER

- A. Manufacturers / Model:
 - 1. Precision Plumbing Products, Inc. - Model SC
 - 2. Watts - SG Series
 - 3. Zurn Industries, Inc - Wilkins Model 1250.
 - 4. or equal.
- B. Description:
 - 1. Water hammer arrester shall have copper body construction suitable for operating pressures up to 150 psig.

2.3 HOSE BIBB**A. Manufacturers:**

1. Acorn Engineering Company - Model 8121-CP
2. Woodford Mfg. – Model 24.
3. Mifab – Series MHY-90.
4. Or equal.

B. Description:

1. Hose bibbs shall have a 3/4-inch flanged female I.P.S. Inlet, 3/4-inch hose thread outlet with lock shield cap, vacuum breaker, and polished chrome plate finish.

2.4 HOSE REEL AND HOSE**A. Manufacturers / Models:**

1. Reelcraft
2. or equal.

B. Description:

1. Hose reel shall be constructed of heavy gauge steel with a capacity for 50 feet of 1 ½ - inch I.D. hose. Hose shall be 25 feet of 1 ½ inch Camlock heavy duty rubber hose with 1 ½" high flow washdown hose nozzle. Provide Coxreels model 1185-1124 or approved equal.

2.5 NON-FREEZE WALL HYDRANT**A. Manufacturers:**

1. Josam Manufacturing Company.
2. J.R. Smith Manufacturing Company.
3. Zurn Industries, Inc.
4. Or equal.

B. Description:

1. Wall Hydrant shall be of the non-freeze type with a bronze box and chrome plated face, bronze hydrant, bronze casing, hose connection, integral vacuum breaker, 3/4-inch inlet connection and a "T" handle key.

2.6 TRAP PRIMER VALVE**A. Manufacturers:**

1. Precision Plumbing Products, Inc.
2. J.R. Smith Manufacturing Company.
3. Or equal.

B. Description:

1. Trap Primer Valve shall be provided to supply water to floor drain trap to prevent loss of trap seal.

2.7 TRAP PRIMER DISTRIBUTION UNIT

- A. Manufacturers:
 - 1. Precision Plumbing Products, Inc.
 - 2. Or equal.
- B. Description:
 - 1. Distribution unit shall have a copper reservoir with brass fittings and clear plastic inspection cover on side of reservoir. Unit shall be provided with mounting brackets.

2.8 WATER METER

- A. Manufacturers / Models
 - 1. Neptune / T-10
 - 2. Or equal.
- B. Description:
 - 1. Cold water meter shall be a magnetic-driven, positive displacement, flat nutating disc type.
 - 2. Maincase: corrosion resistant, lead-free, high copper alloy.
 - 3. Maximum Operating Water Pressure: 150 psig (1035 kPa)
 - 4. Connection: 1" NPS
 - 5. Normal Operating Accuracy: +/- 1.5% for flows between 1 to 50 GPM.
 - 6. Register Capacity: 10,000,000 US Gallons.

2.9 WATER PRESSURE REDUCING VALVE

- A. Manufacturers / Models
 - 1. Watts / LF25AUB-Z
 - 2. Or equal.
- B. Description:
 - 1. Suitable for supply pressures up to 300 psi.
 - 2. Adjustable from 25 psi to 75 psi.
 - 3. Body: Lead free cast copper silicon alloy construction.
 - 4. Seat: Replaceable engineered polymer
 - 5. Integral Strainer: stainless-steel.
 - 6. Diaphragm: Reinforced EPDM with PTFE wetted surface.
 - 7. Valve Disc: EPDM
 - 8. Connection: 3/4" NPT

2.10 GENERAL

- A. All components of like size and type shall be the product of the same manufacturer for purposes of parts interchangeability.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- B. Examine walls, floors, roofs, and concrete bases for suitable conditions for installation, for example, all overhead work of other trades is complete.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install Domestic Water Piping Specialties as shown on the Contract Drawings and in accordance with the manufacturer's installation instructions.
- B. Install water hammer arresters complete with accessible isolation valve.

3.3 IDENTIFICATION

- A. Identify Domestic Water Piping Specialties as specified in Section "Identification for Plumbing Piping and Equipment".

3.4 CLEANING

- A. On completion of installation, inspect interior and exterior of equipment. Remove dust, dirt, paint splatters and other spots from exterior and wipe down with damp cotton cloth. Touch up exposed surfaces to match original finish.

3.5 PROTECTION

- A. Protect installed equipment from damage through Substantial Completion.

END OF SECTION

SECTION 22 11 23 DOMESTIC WATER BOOSTER PUMP

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes Domestic Water Booster Pump (BP-1), Hydro-pneumatic Tanks (HPT-1, HPT-2) and pump controls, as shown on the contract drawings.

1.3 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American Society for Testing and Materials (ASTM)
 - 2. American National Standards Institute (ANSI)
 - 3. American Society of Mechanical Engineers (ASME)
 - a. ASME B120.1 – Pipe Threads, General Purpose (inch).
 - 4. Underwriters Laboratories (UL)
 - a. UL 94 – Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.
 - b. National Sanitation Foundation (NSF) NSF 61 – Drinking Water System Components – Health Effects
 - 5. 2015 New York State Plumbing Code

1.4 COORDINATION REQUIREMENTS

- A. Coordinate layout and installation of Domestic Water Piping Specialties with electrical equipment, light fixtures, HVAC equipment and ductwork, and piping.

1.5 SUBMITTALS

- A. Submit the following in accordance with the General Conditions/General Requirements
- B. Product Data: "Catalog cuts" and spec sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data. Submit pump curves for booster pumps with operating point clearly indicated.

1.6 QUALITY ASSURANCE

- A. Qualifications
 - 1. Manufacturer's Factory Qualifications: Manufacturing facilities shall have accreditation to ISO 9000:2000 or an equivalent quality management system acceptable to the Engineer.

1.7 DELIVERY AND HANDLING

- A. Deliver booster pump in shipping splits that can be moved past obstructions in the delivery path.
- B. Coordinate delivery of booster pump to allow movement into designated space.
- C. Handle booster pump components according to manufacturer's written instructions. Use factory-installed lifting provisions.

1.8 WARRANTY

- A. Provide parts and labor warranty in accordance with the General Conditions.

PART 2 - PRODUCTS

2.1 BOOSTER PUMP (BP-1)

- A. The following manufacturers are named to establish a standard of quality necessary for the Project:
 - 1. Goulds
 - 2. Grundfos
 - 3. Or equal
- B. Water pressure booster pump shall have capacities as scheduled in the contract documents.
- C. Provide one variable speed pumping station designed to provide constant pressure, at required flow rates.
- D. The pump station shall utilize one vertical multistage stainless-steel pump, in conjunction with variable speed pump controller. Appropriate check and shutoff valves, pressure transducers, suction/discharge piping.
- E. Pumps shall be constructed of 304 or 316 stainless steel and be of vertical multi-stage design. Pump case, impellers, diffusers, seal spring, inner bowls, seal spring, shaft sleeve and retainer clip shall be manufactured from stainless steel. Mechanical seal assembly shall be constructed of carbon/silicon or carbon/viton as standard. Shaft sleeves shall be from stainless steel. Pump curve shall rise continuously to shut off head. Best efficiency point of pump shall lie between 70% and 80% of maximum flow capacity of the pump.
- F. The pump base shall be designed and fabricated to provide proper structural support for all attached equipment, and provide anchor bolt support. Provide inline mounting and support as required for the pump.
- G. Motor for the pump shall be C-face frame type, TEFC enclosures, 1.15 service factor, min. insulation class F.

2.2 HYDRO-PNEUMATIC TANK (HPT-1, HPT-2)

- A. Provide ASME rated pressurized hydro-pneumatic tanks as shown on the contract drawings. Tanks to be designed and constructed per ASME Section VIII, Division 1.

2.3 CONTROLS (FOR BP-1)

- A. The pump controls and electrical protection shall be integrated into a single pump controller package. Features shall include input line reactors, lightning protection, low suction pressure switch, and flexible suction/discharge flanged connection.
- B. Pressure transducer shall be provided with the pump controller. The pump controller shall receive a 4-20 mA signal from the transducer. The pressure transducer will monitor system discharge pressure and provide an analog (4-20mA) to the pump control software, and allow the variable pump controller, to provide variable volts/Hz output to the motor. Once the pressure drops below the set system pressure, the pump will start and provide system pressure. All program settings shall be based on centrifugal pump language and centrifugal pumps. Program settings must be field adjustable to provide on-site adjustments. When the system experiences low demand, the variable speed pump controller will reduce the speed of the pump until the demand has stopped. Pump controllers will stop the pump at zero demand, without the use of external switches or controls.
- C. Pumping controller to include an electrical enclosure, complete with main fusible disconnect, variable speed pump controller, pressure sensor and transducer, NEMA motors, instrumentation and controls to automatically start, stop and modulate pump speed to smoothly, efficiently and reliably provide pump variable flow rates at a constant discharge pressure. Pumping station shall provide full pump, motor and drive safety features needed to protect the equipment and the piping system.
- D. Disconnect shall have a through door operator. Motor fusible disconnect panel shall be housed in a NEMA 4 enclosure with integral latches.
- E. The control panel with controls shall be built in accordance with NEC, and shall comply with U.L. standard UL508A. Panel face switches and lights to include:
 - 1. Reset – Acknowledges pump station alarms
 - 2. Run and alarm lights
 - 3. Low suction pressure reset.
- F. All electrical equipment shall be protected by a UL approved Category C and Category B surge arrester, which shall suppress excessive voltage surges on incoming power. The device shall withstand an impulse of 10Kv/10Ka under IEEE C62.41 Category C and shall withstand a ringwave of 6Kv/500a and an impulse of 6Kv/3Ka under Category B.
- G. The pump controller shall provide an adjustable carrier frequency with IGBT power switching, and utilize PWM technology. The drive shall provide noiseless operation of the driving motor, short circuit and grounding protection, and work with controlled sinusoidal current synthesis and dynamic over current limitations.

2.4 ACCESSORIES (FOR BP-1, HPT-1, HPT-2)

- A. Provide the following accessories for the pump, hydropneumatic tank:
 - 1. Provide isolation valves -- full port ball valves.
 - 2. Provide pump discharge (BP-1 only) with a spring-loaded silent non-slam check valve, appropriately sized to allow no greater than 5 psi of head loss at full station rated capacity. Check valve 2" and below shall have brass body and PTFE Teflon seat. Check valves 2" and below shall be pressure rated to 400 psi WOG.
 - 3. Dielectric fittings at connections between piping and equipment.
 - 4. Provide pressure gauges before and after pump. Pressure gauges shall be liquid filled, bourdon tube type. Gauges shall be supplied for both suction and discharge manifolds.
- B. Testing: The entire package shall be hydrostatically and electrically tested prior to shipment.
- C. The manufacturer shall warranty the water pumping system to be free from defects in material and workmanship for one year (12 months) from date of authorized start-up, not to exceed 18 months from the date of the manufacturers invoice.
- D. Water pressure booster system shall have capacities as scheduled on the Contract Drawings.

2.5 PERFORMANCE REQUIREMENTS

	Minimum	Maximum
System Flow Rate (2 pump system)	3.0 Gpm.	20.0 Gpm.
Pump Flow Rate	3.0 Gpm.	20.0 Gpm.
Inlet Pressure	24 psig	48 psig
Outlet Pressure	76 psig	86 psig
Total system lift	0 ft.	162 Ft.
Motor Horsepower		2 HP / 480V 3 Ph.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- B. Examine roughing-in of booster pump systems to verify the following:
 - 1. Each utility pipe and conduit is in the correct location.
- C. Examine walls, floors, roofs, and concrete bases for suitable conditions for installation, for example, all overhead work of other trades is complete.

- D. Verify that ground connections are in place and that installation of grounding described in Section "Grounding" is complete.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install booster pump as shown on the Contract Drawings and in accordance with the manufacturer's installation instructions.

3.3 IDENTIFICATION

- A. Identify in accordance with Specification Section 22 05 53.

3.4 PROTECTION

- A. Protect installed equipment from damage through Substantial Completion.

END OF SECTION

SECTION 22 11 30 NON-POTABLE WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes Non-Potable Water Piping as shown on the Contract Drawings.

1.3 REFERENCES

- A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 1. American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)
 - a. ANSI/ASME B16.3 – Malleable Iron Threaded Fittings Class 150 NS 300.
 - b. ANSI/ASME B16.22 – Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
 - c. ANSI/ASME B16.29 – Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings – DWV.
 2. American National Standards Institute (ANSI)/American Society for Testing and Materials (ASTM)
 - a. ANSI/ASTM B32 – Solder Metal.
 - b. ANSI/ASTM F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
 - c. AWWA C110/ANSI A21.10 - Ductile-Iron and Gray-Iron Fittings, 3" through 48" for Water.
 - d. AWWA C115/ANSI A21.15 - Flanged Ductile-Iron Pipe with Ductile Iron or Gray-Iron Threaded Flanges.
 - e. AWWA C151/ANSI A21.51 - Standard for Ductile-Iron Pipe, Centrifugally Cast.
 3. American Society For Testing and Materials (ASTM)
 - a. ASTM A53 – Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
 - b. ASTM B88 – Seamless Copper Water Tube.
 - c. ASTM D2846 – Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic and Cold Water Distribution Systems.
 - d. ASTM F438 – Specification for Socket-type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
 - e. ASTM F493 – Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
 - f. ASTM D2855 – Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
 - g. ASTM D1785 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120.

- h. m. ASTM D2466 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
- 4. 2015 Plumbing Code of New York State

1.4 COORDINATION REQUIREMENTS

- A. Coordinate layout and installation of domestic water piping system with electrical equipment, light fixtures, HVAC equipment and ductwork, piping, and roof drains.
- B. Submit specially prepared Coordination Drawings for this Project, including floor plans and sections, drawn to scale. Include scaled equipment layouts and relationships between equipment and adjacent structural, mechanical, HVAC, and electrical elements. Show the following:
 - 1. Vertical and horizontal runs, offsets, and transitions.
 - 2. Clearances for access above and to the side.
 - 3. Show dimensions and details, including connections.
 - 4. Support locations, type of support, and weight on each support.
 - 5. Location of adjacent construction elements including light fixtures, HVAC and plumbing equipment, fire sprinklers and piping, signal and control devices, and other equipment.

1.5 SUBMITTALS

- A. Submit the following in accordance with the General Conditions.
- B. Product Data: “Catalog cuts” and spec sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.

1.6 QUALITY ASSURANCE

- A. Qualifications
 - 1. Manufacturer’s Factory Qualifications: Manufacturing facilities shall have accreditation to ISO 9000:2000 or an equivalent quality management system acceptable to the Engineer.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Coordinate delivery of domestic water piping and fittings to allow movement into designated space.

1.8 WARRANTY

- A. Provide parts and labor warranty in accordance with the General Conditions.

PART 2 - PRODUCTS

2.1 NON-POTABLE COLD WATER PIPING, ABOVE GRADE

- A. Manufacturers:
 - 1. Cerro Flow Products Inc.

2. NIBCO INC.
3. U.S. Pipe
4. Or equal.

B. Description: [ADDENDUM 4]

1. 3" diameter and below: Copper Tubing: ASTM B88, Type L. Fittings: ANSI/ASME B16.22, wrought copper. Joints: ANSI/ASTM B32, solder, Grade 95TA.
2. 4" diameter and larger: /AWWA C151/ANSI A21.15 - Ductile Iron Pipe - Double Thickness Cement Lined in accordance with AWWA C104/ANSI 21.4. Fittings: AWWA C110/ANSI A21.10 or AWWA C115/ANSI A21.15.

2.2 NON-POTABLE COLD WATER PIPING, BELOW GRADE

A. Manufacturers:

1. Cerro Flow Products Inc.
2. NIBCO INC.
3. U.S. Pipe
4. Or equal.

B. Description:

1. 3" diameter and below: Copper Tubing: ASTM B88, Type K. Fittings: ANSI/ASME B16.22, wrought copper. Joints: ANSI/ASTM B32, solder, Grade 95TA.
2. 4" diameter and above: Ductile iron, Class 53 with Megalug joints. Refer to the Section entitled "Ductile Iron Pipe."

2.3 GENERAL

- A. All components of like size and type shall be the product of the same manufacturer for purposes of parts interchangeability.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install piping and accessories in accordance with the configuration shown on Contract Drawings.
- B. All areas shall be interpreted as industrial and all piping shall be installed exposed unless otherwise shown or specified.
- C. Areas with a finished ceiling indicated on the Contract Drawings "Room Finish Schedule" shall have all piping concealed unless otherwise shown or specified.
- D. Sleeves shall be provided where piping passes through floors and walls.

1. Sleeves shall be caulked watertight or gastight as required.
 2. Where water tightness or gas tightness is not required and the pipe is insulated, the sleeve shall be sized to permit full insulation thickness of pipe to be installed through the sleeve.
- E. Leakage tests shall be as specified.
- F. All piping, except where noted, shall be kept as high as possible.
- G. All connections between ferrous and non-ferrous piping and equipment shall be made with dielectric unions.
- H. Copper piping installed in concrete shall be coated with bitumastic paint.
- I. All water piping shall be run true and plumb, free of traps, and installed with adequate clearance from mechanical work.
- J. All water piping shall pitch to drain at a slope of $\frac{1}{4}$ inch per 10 feet unless otherwise noted. Manual air vents shall be installed at all high points and drain valves shall be installed at all low points.
- K. Piping shall not be installed across or in front of doors or windows.
- L. All piping shall be routed parallel to building column lines.
- M. All hot and cold water lines above grade shall be insulated. All exposed insulated piping within five (5) feet of finished floor shall have a metal jacket.
- N. Install water hammer arresters complete with accessible isolation valve.
- O. Install low point drain valves with threaded nipple and cap.

3.3 IDENTIFICATION

- A. Identify piping in accordance with the Section entitled "Identification of Plumbing Piping and Equipment".

3.4 PROTECTION

- A. Protect installed equipment from damage through Substantial Completion.

END OF SECTION

SECTION 22 13 16 SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes Sanitary Waste and Vent Piping Systems including all sanitary drainage piping systems and sump pump discharge systems as shown on the Contract Drawings.

1.3 REFERENCES

- A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 1. American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)
 - a. ANSI/ASME B16.3 – Malleable Iron Threaded Fittings Class 150 NS 300.
 - b. ANSI/ASME B16.22 – Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
 - c. ANSI/ASME B16.29 – Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings – DWV.
 2. American National Standards Institute (ANSI)/American Society for Testing and Materials (ASTM)
 - a. ANSI/ASTM B32 – Solder Metal.
 - b. ANSI/ASTM F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
 3. American National Standards Institute (ANSI)/American Water Works Association (AWWA)
 - a. ANSI/AWWA C110 – Ductile-Iron and Gray-Iron Fittings 3 in. through 48 in., for Water and Other Liquids.
 - b. ANSI/AWWA C111– Rubber-Gasket Joints for Ductile Iron and Gray-Iron Pressure Pipe and Fittings.
 - c. ANSI/AWWA C151 – Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
 4. American Society For Testing and Materials
 - a. ASTM A53 – Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
 - b. ASTM A74 – Cast Iron Soil Pipe and Fittings.
 - c. ASTM B306 – Copper Drainage Tube (DWV).
 - d. ASTM C564 – Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
 - e. ASTM F438 – Specification for Socket-type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
 - f. ASTM F493 – Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.

- g. ASTM D2665 – Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
- h. ASTM D3311 – Specification for Drain, Water and Vent (DWV) Plastic Fittings Patterns.
- i. ASTM D2855 – Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
- j. ASTM D1785 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120.
- k. ASTM D2466 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
- l. ASTM D3034 – Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- 5. Cast Iron Soil Pipe Institute (CISPI)
 - a. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems.
- 6. 2015 Plumbing Code of New York State

1.4 COORDINATION REQUIREMENTS

- A. Coordinate layout and installation of Sanitary Waste and Vent Piping with electrical equipment, light fixtures, HVAC equipment and ductwork, and piping.
- B. Submit specially prepared Coordination Drawings for this Project, including floor plans and sections, drawn to scale. Include scaled equipment layouts and relationships between equipment and adjacent structural, mechanical, HVAC. Show the following:
 - 1. Vertical and horizontal runs, offsets, and transitions.
 - 2. Clearances for access above and to the side.
 - 3. Show dimensions and details, including connections.
 - 4. Support locations, type of support, and weight on each support.
 - 5. Location of adjacent construction elements including light fixtures, HVAC and plumbing equipment, fire sprinklers and piping, signal and control devices, and other equipment.

1.5 SUBMITTALS

- A. Submit scaled layout drawings of the piping system. Coordinate layout drawings with architectural, structural, electrical, plumbing and mechanical work. Drawings shall specify pipe and joint type, size, elevation and slope.
- B. Product Data: “Catalog cuts” and spec sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.

1.6 QUALITY ASSURANCE

- A. Qualifications
 - 1. Manufacturer’s Factory Qualifications: Manufacturing facilities shall have accreditation to ISO 9000:2000 or an equivalent quality management system acceptable to the Engineer.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Handle Sanitary Waste and Vent Piping components according to manufacturer's written instructions.

1.8 WARRANTY

- A. Provide parts and labor warranty in accordance with the General Conditions.

PART 2 - PRODUCTS**2.1 SANITARY DRAINAGE PIPING, BELOW GRADE**

- A. Description:
 1. Cast Iron Soil Pipe: ASTM A74 service weight. Fittings: Cast iron. Joints: hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets.
 2. Polyvinyl Chloride (PVC) Plastic Pipe (Type DWV): ASTM D2665. Fittings: PVC, Type DWV – ASTM D3311. Joints: Solvent cement in accordance with ASTM D2855.

2.2 SANITARY VENT PIPING, BELOW GRADE

- A. Description:
 1. Cast Iron Soil Pipe: ASTM A74 service weight. Fittings: Cast iron. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets.
 2. Polyvinyl Chloride (PVC) Plastic Pipe (Type DWV): ASTM D2665. Fittings: PVC, Type DWV – ASTM D3311. Joints: Solvent cement in accordance with ASTM D2855.

2.3 SANITARY DRAINAGE PIPING, ABOVE GRADE

- A. Description:
 1. Cast Iron Soil Pipe: CISPI 301, hubless, service weight. Fittings: Cast iron. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.
 2. Copper Pipe: ASTM B306, DWV. Fittings: ANSI/ASME B16.3, cast bronze, or ANSI/ASME B16.29, wrought copper. Joints: ANSI/ASTM B32, solder, Grade 50B.
 3. Polyvinyl Chloride (PVC) Plastic Pipe (Type DWV): ASTM D2665. Fittings: PVC, Type DWV – ASTM D3311. Joints: Solvent cement in accordance with ASTM D2855.

2.4 SANITARY VENT PIPING, ABOVE GRADE

- A. Description:
 1. Cast Iron Soil Pipe: CISPI 301, hubless, service weight. Fittings: Cast iron. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.
 2. Copper Pipe: ASTM B306, DWV. Fittings: ANSI/ASME B16.3, cast bronze, or ANSI/ASME B16.29, wrought copper. Joints: ANSI/ASTM B32, solder, Grade 50B.
 3. Polyvinyl Chloride (PVC) Plastic Pipe (Type DWV): ASTM D2665. Fittings: PVC, Type DWV – ASTM D3311. Joints: Solvent cement in accordance with ASTM D2855.

2.5 PUMP DISCHARGE

- A. Description:
 - 1. Galvanized Steel Pipe - Schedule 40: ASTM A53. Fittings: Cast Iron. Joints: Threaded.

2.6 MANUFACTURERS

- A. The following manufacturers are named to establish a standard of quality necessary for the Project:
 - 1. Cast Iron Soil Pipe Institute.
 - 2. Charlotte Pipe and Foundry Co.
 - 3. Harvel Plastics Inc.
 - 4. Nibco.
 - 5. Or equal.

2.7 GENERAL

- A. All components of like size and type shall be the product of the same manufacturer for purposes of parts interchangeability.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- B. Examine walls, floors, roofs, and concrete bases for suitable conditions for installation, for example, all overhead work of other trades is complete.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install piping as shown on the Contract Drawings and in accordance with the manufacturer's installation instructions.
- B. Install piping and accessories in accordance with the configuration shown on Contract Drawings.
- C. All areas shall be interpreted as industrial and all piping shall be installed exposed unless otherwise shown or specified.
- D. Areas with a finished ceiling indicated on the Contract Drawings "Room Finish Schedule" shall have all piping concealed unless otherwise shown or specified.
- E. Sleeves shall be provided where piping passes through floors and walls.
 - 1. Sleeves shall be caulked watertight or gastight as required.

2. Where watertightness or gastightness is not required and the pipe is insulated, the sleeve shall be sized to permit full insulation thickness of pipe to be installed through the sleeve.
- F. Leakage tests shall be as specified.
 - G. No fixture or equipment shall be connected directly to the potable water system in such a manner that a cross-connection exists and backflow of contaminated water into the potable water system could occur.
 - H. All piping, except where noted, shall be kept as high as possible.
 - I. All connections between ferrous and non-ferrous piping and equipment shall be made with dielectric unions.
 - J. Copper piping installed in concrete shall be coated with bitumastic paint.
 - K. Piping shall not be installed across or in front of doors or windows.
 - L. All piping shall be routed parallel to building column lines.
 - M. Cleanouts shall be installed at the base of all risers and below floors and where shown.
 1. Cleanouts shall be the full size of the pipe up to and including four (4) inches in diameter. Cleanouts on pipe larger than four (4) inches in diameter shall remain 4 inches in diameter.
 2. Cleanouts installed buried below the floor shall have deckplate cleanouts (DPCO). Cleanouts concealed in walls or partitions shall have wallplate cleanouts.
 - N. Label plumbing pipes in accordance with the Section entitled "Identification for Plumbing Piping and Equipment"

3.3 IDENTIFICATION

- A. Identify Sanitary Waste and Vent Piping as specified in Section "Identification for Plumbing Piping and Equipment".

3.4 CLEANING

- A. On completion of installation, inspect interior and exterior of equipment. Remove dust, dirt, paint splatters and other spots from exterior and wipe down with damp cotton cloth. Touch up exposed surfaces to match original finish.

3.5 PROTECTION

- A. Protect installed piping from damage through Substantial Completion.

END OF SECTION

SECTION 22 13 19 SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes Sanitary Waste Piping Specialties including floor drains and cleanouts as shown on the Contract Drawings.

1.2 REFERENCES

- A. Comply with the latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American National Standards Institute (ANSI)/American Society of Sanitary Engineering (ASSE)
 - 2. American National Standards Institute (ANSI)
 - a. ANSI A112.21.1 - Floor Drains.
 - 3. American Society for Testing and Materials (ASTM)
 - 4. 2015 Plumbing Code of New York State

1.3 COORDINATION REQUIREMENTS

- A. Coordinate layout and installation of Sanitary Waste Piping Specialties with electrical equipment, light fixtures, HVAC equipment and ductwork, and piping.

1.4 SUBMITTALS

- A. Submit the following in accordance with the General Conditions.
- B. Product Data: "Catalog cuts" and spec sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.

1.5 QUALITY ASSURANCE

- A. Qualifications
 - 1. Manufacturer's Factory Qualifications: Manufacturing facilities shall have accreditation to ISO 9000:2000 or an equivalent quality management system acceptable to the Engineer.
- B. Source Limitations: Obtain Sanitary Waste Piping Specialties and accessories through one source from a single manufacturer.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Handle Sanitary Waste Piping Specialties components according to manufacturer's written instructions. Use factory-installed lifting provisions.

1.7 WARRANTY

- A. Provide parts and labor warranty in accordance with the General Conditions.

PART 2 - PRODUCTS

2.1 FLOOR DRAINS (F.D.)

A. Manufacturers:

1. J.R. Smith Manufacturing Company.
2. Zurn Industries, Inc.
3. Josam Manufacturing Company.
4. Or equal.

B. Description:

1. Type "A" floor drain to be used in finished areas. The drain shall have a cast iron body with a flashing collar, an adjustable nickel bronze strainer head with a 6-inch diameter round top a 1/2-inch trap primer connection and a bottom outlet connection.
2. Type "B" floor drain to be used for indirect waste. The drain shall have a cast iron body and flashing collar, seepage openings, 8-inch diameter nickel-bronze adjustable strainer head with 4-inch nickel-bronze funnel attached, 1/2-inch trap primer connection, and a bottom outlet connection.
3. Type "C" floor drain to be used in unfinished areas. The drain shall have a cast iron body and flashing collar, 12" diameter adjustable top and bar grate with sediment bucket, and a bottom outlet connection.
4. Type "D" floor drain to be used in unfinished areas. The drain shall have a cast iron body and flashing collar, 15" diameter adjustable top and bar grate with sediment bucket, and a bottom outlet connection.

2.2 DECKPLATE CLEANOUT (D.P.C.O.)

A. Manufacturers:

1. J.R. Smith Manufacturing Company.
2. Zurn Industries, Inc.
3. Manufacturing Company.
4. Or equal.

B. Description:

1. Cleanout for finished floor areas shall have a cast iron body with round nickel-bronze adjustable top.
2. Cleanout for unfinished floor areas shall have a cast iron body with round extra heavy duty cast iron adjustable top.

2.3 WALL CLEANOUT FRAME AND COVER (W.C.O.)

A. Manufacturers:

1. J.R. Smith Manufacturing Company.
2. Zurn Industries Inc.
3. Josam Manufacturing Company.

4. Or equal.

B. Description:

1. A. Wall cleanout frame and cover shall be square with a secured bronze cover. Opening shall be 8 inches square.

2.4 GENERAL

A. All components of like size and type shall be the product of the same manufacturer for purposes of parts interchangeability.

2.5 FLAP VALVE

A. Provide 4" Kennedy Flap valve or approved equal for backflow preventer drain applications.

2.6 DUPLEX PUMPING SYSTEMS

A. Manufacturers:

1. Bell & Gossett Domestic Pump; ITT Corporation.
2. Goulds Pumps; ITT Corporation.
3. Grundfos Pumps Corp.
4. Little Giant Pump Co.
5. Weil Pump Company, Inc.
6. Zoeller Company.

B. Description:

1. Factory-assembled and -tested sump-pump unit.
2. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller,
3. centrifugal sump pump.
4. Pump Casing: Cast iron, with strainer inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
5. Impeller: Statically and dynamically balanced, designed for clear wastewater handling, and keyed and secured to shaft.
6. Pump and Motor Shaft: Steel, with double factory-seal, grease-lubricated ball bearings.
7. Seal: double mechanical.
8. Motor: Hermetically sealed, with built-in overload protection; lifting eye or lug; and three conductor, waterproof power cable of length required and with grounding plug and cable sealing assembly for connection at pump.
 - a. Motor Housing Fluid: Oil
 - b. Moisture sensor for primary seal failure.

C. Duplex Sump Pump Control Panel

1. Provide a factory-assembled UL listed and labeled Duplex Sump Pump Control Panel for the following sump pumps:
2. Control Panel shall have the following components:
 - a. NEMA 1 enclosure with main disconnect.
 - b. Control power transformer with primary and secondary fuses, line voltage primary and 120V grounded secondary.

- c. For each pump: Combination motor circuit protector and starter with NEMA Class 10 overload relay, with a door-mounted RESET pushbutton.
 - d. Pump motor moisture and winding temperature protection relay for each pump.
 - e. Door-mounted HAND-OFF-AUTO selector switch, and red RUNNING and green
 - f. OFF pilot lights for each pump. Provide label at HAND-OFF-AUTO selector switch
 - g. "DO NOT LEAVE H-O-A SWITCH IN HAND UNATTENDED."
 - h. Selector switches, pilot lights, relays and control wiring configured for the specified functionality.
 - i. Provide compression type cord connectors for the submersible pump and float switch cords.
3. Sump float switches shall be mounted as shown on the Drawings, with the following functionality:
- a. a. First level float switch: turn off Primary Pump and Standby Pump
 - b. b. Second level float switch: turn on Primary Pump
 - c. c. Third level float switch: sound and send alarm to SCADA (direct connection).
 - d. d. Fourth level float switch: turn on Standby Pump
4. Pump AUTO sequence of operation shall be as follows:
- a. HAND-OFF-AUTO selector switch is normally left in AUTO position, disconnect switch in ON position.
 - b. RUNNING lights off.
 - c. OFF lights illuminated.
 - d. Sump level below respective first level float switch actuation level for pump: pump off.
 - e. Sump level rises to second switch: Primary pump on.
 - f. Sump level rises to third switch: sound and send alarm to SCADA (direct connection).
 - g. Sump level rises to fourth switch: Standby pump on.
5. Pump HAND sequence of operation shall be as follows:
- a. In HAND and OFF, pump motor shall start and stop respectively (no low level cutoff).
6. Sump Pump Control Panel power supply wiring and alarm wiring shall be per Specification 26 00 00. Other field wiring required for pump operation shall be provided under this section of the Specification.

D. Performance/Design Criteria

- 1. As scheduled on the Contract Drawings

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- B. Examine walls, floors, roofs, and concrete bases for suitable conditions for installation, for example, all overhead work of other trades is complete.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install Sanitary Waste Piping Specialties as shown on the Contract Drawings and in accordance with the manufacturer's installation instructions.
- B. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

3.3 IDENTIFICATION

- A. Identify Sanitary Waste Piping Specialties as specified in Section "Identification for Plumbing Piping and Equipment."

3.4 CLEANING

- A. On completion of installation, inspect interior and exterior of equipment. Remove dust, dirt, paint splatters and other spots from exterior and wipe down with damp cotton cloth. Touch up exposed surfaces to match original finish.

3.5 PROTECTION

- A. Protect installed equipment from damage through Substantial Completion.

END OF SECTION

SECTION 22 33 00
ELECTRIC DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes electric water heaters as shown on the Contract Drawings.

1.3 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
1. 2015 International Plumbing Code
 2. American Society for Testing and Materials (ASTM)
 3. American National Standards Institute (ANSI)
 - a. ANSI/UL 1453 – Electric Booster and Commercial Storage Tank Water Heaters.
 4. ASME B120.1 – Pipe Threads, General Purpose (inch).
 5. Underwriters Laboratories (UL)
 - a. UL 94 – Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.
 - b. UL 499 – Standard for Electrical Heating Appliances.
 - c. ETL/UL 508 – Standard for Industrial Control Equipment.
 6. National Sanitation Foundation (NSF)
 - a. NSF 61 – Drinking Water System Components – Health Effects.

1.4 COORDINATION REQUIREMENTS

- A. Coordinate layout and installation of Electric Domestic Water Heaters with electrical equipment, light fixtures, HVAC equipment and ductwork, and piping.

1.5 SUBMITTALS

- A. Submit the following in accordance with the General Conditions.
- B. Product Data: “Catalog cuts” and spec sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.

1.6 QUALITY ASSURANCE

- A. Qualifications
 - 1. Manufacturer's Factory Qualifications: Manufacturing facilities shall have accreditation to ISO 9000:2000 or an equivalent quality management system acceptable to the Engineer.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Handle Domestic Electric Water Heaters according to manufacturer's written instructions.

1.8 WARRANTY

- A. Provide parts and labor warranty in accordance with the General Conditions.

PART 2 - PRODUCTS

2.1 ELECTRIC WATER HEATERS

- A. Manufacturers:
 - 1. A.O. Smith Company
 - 2. State Water Heaters
 - 3. Or equal
- B. Description:
 - 1. Electric water heaters shall be commercial style water heaters with storage capacities and heater element requirements as scheduled on the Contract Drawings.
- C. Performance/Design Criteria:
 - 1. Water heaters shall be provided with ASME rated temperature and pressure relief valves.

2.2 GENERAL

- A. All components of like size and type shall be the product of the same manufacturer for purposes of parts interchangeability.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- B. Examine walls, floors, roofs, and concrete bases for suitable conditions for installation, for example, all overhead work of other trades is complete.

- C. Verify that ground connections are in place and that installation of grounding described in Section "Grounding" is complete.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install Domestic Electric Water Heater as shown on the Contract Drawings and in accordance with the manufacturer's installation instructions.

3.3 IDENTIFICATION

- A. Identify Domestic Electric Water Heater as specified in Section "Identification of Plumbing Piping and Equipment".

3.4 CLEANING

- A. On completion of installation, inspect interior and exterior of equipment. Remove dust, dirt, paint splatters and other spots from exterior and wipe down with damp cotton cloth. Touch up exposed surfaces to match original finish.

3.5 PROTECTION

- A. Protect installed equipment from damage through Substantial Completion.

END OF SECTION

SECTION 22 40 00 PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes Plumbing Fixtures including water closets, urinals, lavatories, sinks, mop basins, water coolers, showers, shower trim, rough-in and final connections of fixtures as shown on the Contract Drawings.

1.3 REFERENCES

- A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American Society of Mechanical Engineers – ASME
 - a. ASME A112.18.1 – Plumbing Fixture Fittings.
 - b. ASME A112.19.1 – Enameled Cast Iron Plumbing Fixtures.
 - c. ASME A112.19.2 – Vitreous China Plumbing Fixtures.
 - d. ASME A112.19.3 – Stainless Steel Plumbing Fixtures.
 - e. ASME A112.19.6 – Hydraulic Performance for Water Closets and Urinals.
 - f. American Society of Sanitary Engineering – ASSE
 - g. ASSE 1037 – Performance Requirements for Pressurized Flushing Devices for Plumbing Fixtures.
 - 2. American Society for Testing and Materials (ASTM)
 - 3. American National Standards Institute (ANSI)
 - 4. 2015 Plumbing Code of New York State

1.4 COORDINATION REQUIREMENTS

- A. Coordinate layout and installation of Plumbing Fixtures with electrical equipment, light fixtures, HVAC equipment and ductwork, and piping.

1.5 SUBMITTALS

- A. Submit the following in accordance with the General Conditions.
- B. Product Data: “Catalog cuts” and spec sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.

1.6 QUALITY ASSURANCE

- A. Qualifications
 - 1. Manufacturer's Factory Qualifications: Manufacturing facilities shall have accreditation to ISO 9000:2000 or an equivalent quality management system acceptable to the Engineer.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Handle Plumbing Fixtures according to manufacturer's written instructions.

1.8 WARRANTY

- A. Provide parts and labor warranty in accordance with the General Conditions.

PART 2 - PRODUCTS

2.1 GRAVITY TANK TYPE WATER CLOSETS (WC-1)

- A. Manufacturers:
 - 1. American Standard Companies, Inc. – Model Exposed Trapway Cadet Touchless
 - 2. Crane Plumbing L.L.C.
 - 3. Kohler Co.
 - 4. Or equal.
- B. Description:
 - 1. Gravity tank type water closet shall be a white vitreous china toilet suitable for flushing 1.6 gal./flush (6-L/flush).
 - 2. Bowl Type: Floor mounting, floor outlet elongated with siphon-jet design. Bolts and caps matching fixture.
 - 3. Tank: gravity type with trim. Unit shall meet requirements of ASME A112.19.2.
 - 4. Trip Mechanism: Touchless tank with sensor, activated by a simple hand wave. Sensor and control module shall be battery powered.
 - 5. Supply: NPS ½ chrome plated with handle type stop.

2.2 WATER CLOSET SEATS

- A. Manufacturers:
 - 1. Beneke – Model 525 SS.
 - 2. Church – Model 9500SSCT.
 - 3. Or equal.
- B. Description:
 - 1. Seat for Water Closet shall be white solid plastic with extended back, open front, check hinge and of the elongated design.

2.3 WALL-MOUNTED LAVATORY FOR HANDICAPPED (LAV-1)

- A. Manufacturers:
 - 1. American Standard - Model 9141.011.

2. Kohler – Morningside Model K-12636.
 3. Or equal.
- B. Description:
1. Wall-mounted lavatory for the handicapped shall be a vitreous china wheelchair lavatory with a front over-flow, and single centered faucet hole suitable for electronic proximity lavatory faucet. Unit shall meet requirements of ASME A112.19.2.
 2. Lavatory faucet shall be electronic proximity lavatory faucet, American Standard – Model Selectronic, or approved equal. Faucet shall be single inlet, battery powered, and provided with thermostatic mixing valve. Unit shall meet requirements of ASME A112.18.1.

2.4 GENERAL

- A. All components of like size and type shall be the product of the same manufacturer for purposes of parts interchangeability.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install materials and equipment as shown on the Contract Drawings and in accordance with the manufacturer's installation instructions.

3.3 CLEANING

- A. On completion of installation, inspect interior and exterior of equipment. Remove dust, dirt, paint splatters and other spots from exterior and wipe down with damp cotton cloth.

3.4 PROTECTION

- A. Protect installed equipment from damage through Substantial Completion.

END OF SECTION

SECTION 23 05 00
COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following basic mechanical materials and methods to complement other Division 23 Sections.
1. Pipe joint materials.
 2. Transition fittings.
 3. Dielectric fittings.
 4. Sleeves.
 5. Mechanical sleeve seals.
 6. Escutcheons.
 7. Grout.
 8. Fabricated metal equipment supports.
 9. Installation requirements common to mechanical specification Sections.
 10. Piping joint construction.
 11. Cutting and patching.
- B. Pipe and Pipe fitting materials are specified in piping system sections.

1.3 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
1. 2015 International Building Code
 2. 2015 International Mechanical
 3. 2015 International Plumbing Code
 4. 2015 International Fire Protection Code
 5. American Society of Mechanical Engineers (ASME)
 6. American National Standards Institute (ANSI)
 7. National Fire Protection Association (NFPA)
 8. Underwriters Laboratories (UL)
 9. American Society for Testing and Materials (ASTM)
 10. American Welding Society (AWS)
 11. Occupational Safety and Health Administration (OSHA)
- B. DEFINITIONS:
1. Pipe, pipe fittings, and piping include tube, tube fittings, and tubing.
 2. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below the roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

3. Exposed Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
4. Exposed Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
5. Concealed Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
6. Concealed Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
7. The following are industry abbreviations for plastic materials:
 - a. ABS: Acrylonitrile-butadiene-styrene plastic.
 - b. CPVC: Chlorinated polyvinyl chloride plastic.
 - c. PE: Polyethylene plastic.
 - d. PVC: Polyvinyl chloride plastic.
8. The following are industry abbreviations for rubber materials:
 - a. EPDM: Ethylene-propylene-diene terpolymer rubber.
 - b. NBR: Acrylonitrile-butadiene rubber.

1.4 COORDINATION REQUIREMENTS

- A. Coordinate layout and installation of <insert room or area descriptions> with electrical equipment, light fixtures, HVAC equipment and ductwork, piping, and roof drains.
- B. Submit specially prepared Coordination Drawings for this Project, including floor plans and sections, drawn to scale. Include scaled equipment layouts and relationships between equipment and adjacent structural, mechanical, HVAC, and electrical elements. Show the following:
 1. Vertical and horizontal runs, offsets, and transitions.
 2. Clearances for access above and to the side.
 3. Show dimensions and details, including connections.
 4. Support locations, type of support, and weight on each support.
 5. Location of adjacent construction elements including light fixtures, HVAC and plumbing equipment, fire sprinklers and piping, signal and control devices, and other equipment.
- C. Sequencing:
 1. Coordinate mechanical equipment installation with other building components.
 2. Arrange for chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.
 3. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
 4. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning prior to closing in the building.
 5. Coordinate connection of electrical services.
 6. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

7. Coordinate requirements for access panels and doors where mechanical items requiring access are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors."
8. Coordinate installation of identifying devices after completing covering and painting where devices are applied to surfaces. Install identifying devices prior to installing acoustical ceilings and similar concealment.

1.5 SUBMITTALS

- A. Submit the following in accordance with the General Conditions.
- B. Product Data: "Catalog cuts" and spec sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data. Submit product data for following items:
 1. Mechanical sleeve seals.
 2. Transition fittings.
 3. Dielectric fittings.
 4. Escutcheons.
- C. Shop Drawings: detailing fabrication and installation for supports and anchorage for mechanical materials and equipment.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver in shipping splits that can be moved past obstructions in the delivery path.
- B. Coordinate delivery to allow movement into designated space.
- C. Handle components according to manufacturer's written instructions. Use factory-installed lifting provisions.

PART 2 - PRODUCTS

2.1 PIPE JOINING MATERIALS

- A. Refer to individual piping system specification Sections in Division 23 for special joining materials not listed below.
- B. Solder Filler Metal: ASTM B32.
 1. Alloy Sn95 or Alloy Sn94: Tin (approximately 95 percent) and silver (approximately 5 percent), having 0.10 percent lead content.
 2. Alloy Sn50: Tin (50 percent) and lead (50 percent).
 3. Alloy E: Tin (approximately 95 percent) and copper (approximately 5 percent), having 0.10 percent maximum lead content.
 4. Alloy HA: Tin-antimony-silver-copper-zinc, having 0.10 percent maximum lead content.
 5. Alloy HB: Tin-antimony-silver-copper-nickel, having 0.10 percent maximum lead content.
 6. Alloy Sb5: Tin (95 percent) and antimony (5 percent), having 0.20 percent maximum lead content.

- C. Brazing Filler Metals: AWS A5.8.
 - 1. BcuP Series: Copper-phosphorus alloys.
 - 2. Bag1: Silver alloy.
- D. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- E. Solvent Cements: Manufacturer's standard solvents complying with the following:
 - 1. Acrylonitrile-Butadiene-Styrene (ABS): ASTM D2235.
 - 2. Chlorinated Poly (Vinyl Chloride) (CPVC): ASTM F493.
 - 3. Poly (Vinyl Chloride) (PVC): ASTM D2564.
 - 4. PVC to ABS Transition: Made to requirements of ASTM D3138, color other than orange.

2.2 TRANSITION FITTINGS

- A. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
 - 1. Manufacturers:
 - a. Eslon Thermoplastics.
 - b. Or equal
- B. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
 - 1. Manufacturers:
 - a. Thompson Plastics, Inc.
 - b. Or equal.
- C. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.
 - 1. Manufacturers:
 - a. NIBCO INC.
 - b. Or equal.
- D. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.
 - 1. Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Fernco, Inc.
 - c. Mission Rubber Company.
 - d. Plastic Oddities, Inc.
 - e. Or equal.

2.3 DIELECTRIC FITTINGS

- A. Manufacturers:

1. Capitol Manufacturing Co.
 2. Central Plastics Company.
 3. Eclipse, Inc.
 4. Epco Sales, Inc.
 5. Hart Industries
 6. International, Inc.
 7. Watts Industries, Inc.
 8. Water Products Div.
 9. Zurn Industries, Inc.
 10. Wilkins Div.
 11. Or equal
- B. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- C. Performance/Design Criteria:
1. Insulating Material: Suitable for system fluid, pressure, and temperature.
 2. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).
- D. Materials and Construction:
1. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.
 - a. Manufacturers:
 - 1) Capitol Manufacturing Co.
 - 2) Central Plastics Company.
 - 3) Epco Sales, Inc.
 - 4) Watts Industries, Inc.; Water Products Div.
 - 5) Or equal.
 2. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 - a. Manufacturers:
 - 1) Advance Products & Systems, Inc.
 - 2) Calpico, Inc.
 - 3) Central Plastics Company.
 - 4) Pipeline Seal and Insulator, Inc.
 - 5) Or equal.
 - b. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.
 3. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
 - a. Manufacturers:
 - 1) Calpico, Inc.
 - 2) Lochinvar Corp.
 - 3) Or equal.

4. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.
 - a. Manufacturers:
 - 1) Perfection Corp.
 - 2) Precision Plumbing Products, Inc.
 - 3) Sioux Chief Manufacturing Co., Inc.
 - 4) Victaulic Co. of America.
 - 5) Or equal.

2.4 SLEEVES

- A. Materials and Construction:
 1. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
 2. Steel Pipe: ASTM A53, Type E, Grade B, Schedule 40, galvanized, plain ends.
 3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
 4. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - a. Underdeck Clamp: Clamping ring with set screws.
 5. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
 6. PVC Pipe: ASTM D1785, Schedule 40.
 7. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.5 MECHANICAL SLEEVE SEALS

- A. Manufacturers:
 1. Advance Products & Systems, Inc.
 2. Calpico, Inc.
 3. Metraflex Co.
 4. Or equal
- B. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
- C. Materials and Construction:
 1. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 2. Pressure Plates: Stainless steel. Include two for each sealing element.
 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.6 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. Materials and Construction:
 - 1. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
 - 2. One-Piece, Cast-Brass Type: With set screw.
 - a. Finish: Polished chrome-plated.
 - 3. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - a. Finish: Polished chrome-plated.
 - 4. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.
 - 5. Split-Plate, Stamped-Steel Type: With exposed-rivet hinge, set screw or spring clips, and chrome-plated finish.
 - 6. One-Piece, Floor-Plate Type: Cast-iron floor plate.
 - 7. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.7 GROUT

- A. Description: ASTM C1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
- B. Materials and Construction:
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

2.8 FABRICATED METAL SUPPORTS

- A. Structural Steel Shapes: ASTM A36.

2.9 SHOP FINISHES

- A. Finish: ANSI 61 light gray paint.
- B. With the exception of those parts and components customarily furnished unpainted, prepare and coat all metal surfaces with rust inhibitive shop paint. Shop paint shall be fully compatible with the field paint specified.
- C. Protect machined surfaces against damage and corrosion by other means.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.

- B. Examine roughing-in of systems to verify the following:
 - 1. Systems are within the limitations established by the manufacturer.
 - 2. Each utility pipe and conduit is in the correct location.
- C. Examine walls, floors, roofs, and concrete bases for suitable conditions for installation, for example, all overhead work of other trades is complete.
- D. Verify that ground connections are in place and that installation of grounding described in Section "Grounding" is complete.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install as shown on the Contract Drawings and in accordance with the manufacturer's installation instructions.
- B. Mechanical installations
 - 1. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:
 - a. Coordinate mechanical systems, equipment, and materials installation with other building components.
 - b. Verify all dimensions by field measurements.
 - c. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.
 - d. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
 - e. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
 - f. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
 - g. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
 - h. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Owner's Representative.
 - i. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
 - j. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
 - k. Install access panel or doors where units are concealed behind finished surfaces.

- I. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

C. Piping installation

1. General: Install piping as described below, except where system Sections specify otherwise. Individual piping system specification Sections in Division 23 specify piping installation requirements unique to the piping system.
2. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, except where deviations to layout are approved on coordination drawings.
3. Install piping at indicated slope.
4. Install components having pressure rating equal to or greater than system operating pressure.
5. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.
6. Install piping free of sags and bends.
7. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, except where indicated.
8. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.
9. Install piping to allow application of insulation plus 3-inch clearance around insulation.
10. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
11. Install fittings for changes in direction and branch connections.
12. Install couplings according to manufacturer's printed instructions.
13. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings in finished areas.
14. Verify final equipment locations for roughing in. Refer to equipment specifications in other Sections for roughing-in requirements.
15. Angle (wye) type strainers shall be provided with shutoff valve and cap on blowdown connection.
16. Where mains are reduced, provide eccentric reducing fittings installed with flat side on the bottom.
17. Horizontal piping shall not be installed less than 6 inches above finished floor (along walls), less than 7 ft-6 inches above finished floor (other areas), or in front of windows.
18. Piping shall be offset, relocated, or changed to clear ducts, beams, conduits and other obstacles.
19. Piping systems shall be free of noise and vibration under normal operating conditions.
20. Install piping to permit valve servicing.
21. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type with spring clips.

- d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
- e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
- f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
- g. Bare Piping in Unfinished Service Spaces: Non escutcheon.
- h. Bare Piping in Equipment Rooms: No escutcheon.
- i. Bare Piping at Floor Penetrations in Equipment Rooms: No escutcheon.

D. Sleeves

1. Install sleeves for pipes passing through concrete and masonry walls, fire-rated partitions, concrete floor and roof slabs, and where indicated.
 - a. Cut sleeves to length for mounting flush with both surfaces.
 - 1) Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 4 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring where specified.
 - b. Build sleeves into new walls and slabs as work progresses.
 - c. Install large enough sleeves to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - 1) Steel Pipe Sleeves: For pipes smaller than 6 inches.
 - 2) Steel Sheet-Metal Sleeves: For pipes 6 inches and larger that penetrate gypsum-board partitions.
 - 3) Cast Iron Sleeve Fittings: For floors having membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
 - d. Seal space outside of sleeve fittings with nonshrink, nonmetallic grout.
 - e. Except for below-grade wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants specified in Division 7 Section "Joint Sealants."
 - f. Above Grade, Exterior Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installation of mechanical seals.
 - 1) Install steel pipe for sleeves smaller than 6 inches.
 - 2) Install cast-iron wall pipes for sleeves 6 inches and larger.
 - 3) Assemble and install mechanical seals according to manufacturer's printed instructions.
 - g. Below Grade, Exterior Wall, Pipe Penetrations: Install cast-iron wall pipes for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installation of mechanical seals.
 - h. Below Grade, Exterior Wall, Pipe Penetrations: Install ductile-iron wall penetration system sleeves according to manufacturer's printed installation instructions.
 - i. Fire Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping sealant material. Firestopping materials are specified in Division 7 Section Penetration Firestopping.
2. Sleeves are not required for core-drilled holes.

E. Piping joint construction

1. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
2. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
3. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
4. Soldered Joints: Apply ASTM B813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B32.
5. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
6. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full inside diameter. Join pipe fittings and valves as follows:
 - a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
7. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
8. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
9. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - a. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
 - b. ABS Piping: Join according to ASTM D2235 and ASTM D2661 Appendices.
 - c. CPVC Piping: Join according to ASTM D2846/D2846M Appendix.
 - d. PVC Pressure Piping: Join schedule number ASTM D1785, PVC pipe and PVC socket fittings according to ASTM D2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D2855.
 - e. PVC Nonpressure Piping: Join according to ASTM D2855.
 - f. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D3138 Appendix
10. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D3139.
11. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D3212.
12. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D2657.
 - a. Plain-End Pipe and Fittings: Use butt fusion.
 - b. Plain-End Pipe and Socket Fittings: Use socket fusion.
13. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

F. Piping connections

1. Piping Connections: Except as otherwise indicated, make piping connections as specified below.

- a. Install unions in piping 2 inches and smaller adjacent to each valve and at final connection to each piece of equipment having a threaded pipe connection.
 - b. Install flanges in piping 2-1/2 inches and larger adjacent to flanged valves and at final connection to each piece of equipment having flanged pipe connection.
 - c. Dry Piping Systems (Gas, Compressed Air, and Vacuum): Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 - d. Wet Piping Systems (Water and Steam): Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.
 - 1) Where copper tube is joined to steel pipe, a section of brass pipe or a brass valve may be substituted for a dielectric fitting.
- G. Equipment installation – common requirements
 - 1. Install equipment to provide the maximum possible headroom where mounting heights are not indicated.
 - 2. Install equipment according to submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to the Owner's Representative.
 - 3. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.
 - 4. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
 - 5. Install equipment giving right-of-way to piping systems installed at a required slope.
- H. Painting and finishing
 - 1. Refer to The Section Painting for field painting requirements.
 - 2. Damage and Touch Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.
- I. Fabrication and erection of metal equipment supports and anchorage
 - 1. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical equipment.
 - 2. Field Welding: Comply with AWS D1.1 "Structural Welding Code – Steel."
- J. Cutting and patching
 - 1. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of the trades involved.
 - 2. Repair cut surfaces to match adjacent surfaces.
- K. Grouting
 - 1. Install nonmetallic nonshrink grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's printed instructions.
 - 2. Clean surfaces that will come into contact with grout.
 - 3. Provide forms for placement of grout, as required.
 - a. Avoid air entrapment when placing grout.

- b. Place grout to completely fill equipment bases.
- 4. Place grout on concrete bases to provide a smooth bearing surface for equipment.
- 5. Place grout around anchors.
- 6. Cure placed grout according to manufacturer's printed instructions.

3.3 PAINTING

- A. Perform field painting in accordance with the Section "Painting."

3.4 IDENTIFICATION

- A. Identify piping, valves, equipment as specified in Section "Identification of HVAC Piping and Equipment."

3.5 CLEANING

- A. On completion of installation, inspect interior and exterior of equipment. Remove dust, dirt, paint splatters and other spots from exterior and wipe down with damp cotton cloth. Touch up exposed surfaces to match original finish. Vacuum interior "white glove clean", removing all dirt and debris while taking care to protect static-sensitive and fragile parts from damage. Do not use compressed air to assist in cleaning.

3.6 PROTECTION

- A. Protect installed equipment from damage through Substantial Completion.

END OF SECTION

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes hangers, supports, and restraints for HVAC systems including piping, ductwork, and equipment as shown on the Contract Drawings.

1.3 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
- B. American Society of Mechanical Engineers (ASME):
 - 1. ASME B31.1 – Power Piping Code
 - 2. ASME B31.9 – Building Services Piping
 - 3. ASME Boiler and Pressure Vessel Code
- C. Manufacturers Standardization Society (MSS):
 - 1. MSS SP-58 Materials and Design of Pipe Supports
 - 2. MSS SP-69 Selection and Application of Pipe Supports
 - 3. MSS SP-89 Fabrication and Installation of Pipe Supports
- D. American Society for Testing and Materials (ASTM):
 - 1. ASTM A36 – Specification for Carbon Structural Steel
 - 2. ASTM A167 – Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - 3. ASTM A480 – Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
 - 4. ASTM A653 – Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process.
 - 5. ASTM A924 – Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot Dip Process.
 - 6. ASTM B209 – Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - 7. ASTM C1107 – Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
- E. Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA):
 - 1. SMACNA "HVAC Duct Construction Standards."

1.4 COORDINATION REQUIREMENTS

- A. Coordinate layout and installation with electrical equipment, light fixtures, HVAC equipment and ductwork, piping, and roof drains.

- B. Submit specially prepared Coordination Drawings for this Project, including floor plans and sections, drawn to scale. Include scaled equipment layouts and relationships between equipment and adjacent structural, mechanical, HVAC, and electrical. Show the following:
 - 1. Vertical and horizontal runs, offsets, and transitions.
 - 2. Clearances for access above and to the side.
 - 3. Show dimensions and details, including connections.
 - 4. Support locations, type of support, and weight on each support.
 - 5. Location of adjacent construction elements including light fixtures, HVAC and plumbing equipment, fire sprinklers and piping, signal and control devices, and other equipment.

1.5 SUBMITTALS

- A. Submit the following in accordance with the General Conditions.
- B. Product Data: "Catalog cuts" and spec sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.
- C. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- D. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, and seismic restraint by a qualified professional engineer.
 - 1. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.

1.6 QUALITY ASSURANCE

- A. Qualifications
 - 1. Manufacturer's Factory Qualifications: Manufacturing facilities shall have accreditation to ISO 9000:2000 or an equivalent quality management system acceptable to the Engineer.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All components of like size and type shall be the product of the same manufacturer for purposes of parts interchangeability.

2.2 CROSS MEMBERS

- A. Structural steel shapes, ASTM A36.

2.3 UPPER HANGER ATTACHMENTS

- A. Standard-Duty Beam Clamps (for piping): Malleable iron jaw, steel tie-rod, nuts, and washer. Underwriters Laboratories (UL) listed, Factory Mutual approved
- B. Heavy-Duty Beam Clamps (for large pipe and equipment): Forged steel
- C. Welded Structural Attachments: Carbon steel
- D. Brace Fitting: Malleable iron bracket and pipe end, hex-head cap screw and nut
- E. Wall Brackets: Factory-fabricated carbon steel bracket with knee brace
- F. Concrete Inserts [or new upper deck construction only]:
 - 1. Malleable iron inserts, threaded for rod.
 - 2. Carbon steel inserts with lateral adjustment capability
- G. Concrete Attachments [for existing concrete upper decks]: carbon steel plate with factory-drilled and anchor holes and factory-welded rod attachments

2.4 FASTENERS

- A. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

2.5 RODS

- A. Rods: Carbon steel, ASTM A36, continuous thread or end thread.

2.6 DUCTWORK HANGERS

- A. Sheet metal Straps:
 - 1. Galvanized steel: ASTM A 527, lock-forming quality; and ASTM A525, coating designation G-90.
 - 2. Aluminum: ASTM B209, alloy MLA with H-14 temper.
 - 3. Stainless steel: ASTM A167, Type 302, 304, or 316; and ASTM A480, finish no. 1 or no. 4.
 - 4. Material shall match ductwork.
 - 5. Fasteners and supports for FRP ductwork shall be Stainless Steel.
- B. Fasteners:
 - 1. Sheet metal screws: same material as duct.
 - 2. Bolts and nuts: steel or galvanized steel, hex-head.
- C. Fabricate ductwork hangers in accordance with SMACNA "HVAC Duct Construction Standards."

PART 3 - EXECUTION

3.1 GENERAL

- A. Hang, support, and restrain mechanical work from structural work. Do not hang, support, or restrain mechanical work from electrical work or from other mechanical work. Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

3.2 EQUIPMENT HANGERS

- A. Provide vibration isolating hangers for equipment with motors.
- B. Support air terminal units independent of ductwork.
- C. Support slot diffusers independent of suspended ceiling grid.

3.3 RODS

- A. Pipe and duct hanger rods shall be full size to match hangers.
- B. Trapeze and equipment hanger rods shall be sized for maximum load with a safety factor of five.
- C. Provide two nuts at each end of rods for positioning rod and hanger and locking each in place.

3.4 UPPER HANGER ATTACHMENTS

- A. General
 - 1. Upper hanger attachments shall be made to structural steel wherever possible.
 - 2. Powder-driven drive pins shall not be used.
 - 3. Expansion nails shall not be used.
 - 4. Powder-driven fasteners shall not be used in precast concrete.
 - 5. Loads in excess of 250 pounds shall not be supported from a single welded or powder-driven stud.
- B. Steel Frame Construction
 - 1. Provide intermediate structural steel members where required by ductwork support spacing. Select members based on a minimum safety factor of five.
 - 2. Secure upper hanger attachments to steel bar joists within 6 inches of panel points, or provide intermediate strut to transfer load to top chord of joist.
 - 3. Holes shall not be drilled in structural steel members.
 - 4. Friction clamps shall not be used.

3.5 EXAMINATION

- A. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- B. Examine roughing-in of systems to verify the following:
 - 1. Systems are within the limitations established by the manufacturer.
 - 2. Each utility pipe and conduit is in the correct location.
- C. Examine walls, floors, roofs, and concrete bases for suitable conditions for installation, for example, all overhead work of other trades is complete.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.6 PROTECTION

- A. Protect installed equipment from damage through Substantial Completion.

END OF SECTION

SECTION 23 05 53 IDENTIFICATION FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following as shown on the Contract Drawings.
 - 1. Duct Identification.
 - 2. Equipment Identification.

1.3 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
- B. American National Standards Institute (ANSI)
 - 1. ANSI A13.1 - Scheme for the Identification of Piping Systems.

1.4 COORDINATION REQUIREMENTS

- A. Coordinate layout and installation with electrical equipment, light fixtures, HVAC equipment and ductwork, piping, and roof drains.

1.5 SUBMITTALS

- A. Submit the following in accordance with the General Conditions.
- B. Product Data: Catalog cuts and spec sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.
- C. Submit, for review, samples of symbols and abbreviations, letter size, color for coding, and a complete list of legend wording proposed for mechanical identification. Do not order or purchase identification materials until samples have been reviewed.
Quality Control Submittals
 - 1. Submit manufacturer's installation instructions.
- D. Contract Closeout Submittals
 - 1. Submit final valve service identification chart(s), framed as specified below.

1.6 QUALITY ASSURANCE

- A. Identifying labels and markings for piping shall conform to ANSI A13.1 for legend, color, visibility, and size of legend and letters.

B. Qualifications

1. Manufacturer's Factory Qualifications: Manufacturing facilities shall have accreditation to ISO 9000:2000 or an equivalent quality management system acceptable to the Engineer.

1.7 SEQUENCING AND SCHEDULING

- A. Complete all testing, insulation, and finish painting prior to executing the Work of this Section.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials and Construction:

1. Duct and Equipment Identification Letters & Numbers:
 - a. Type: Stick-on type, made of all purpose polyester, single character letters and numbers, specifically designed for outdoor use.
 - b. Color: Black letters on bright yellow background.
 - c. Size: Letters and numbers shall be 1 inch or 3 inches in height, as specified.

2.2 MANUFACTURERS

- A. The following manufacturers are named to establish a standard of quality necessary for the Project:
1. Seton Identification Company, Branford, Connecticut.
 2. Brady Corporation, Milwaukee, Wisconsin.
 3. Or equal

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- B. Examine roughing-in of systems to verify the following:
1. Systems are within the limitations established by the manufacturer.
 2. Each utility pipe and conduit is in the correct location.
- C. Verify that ground connections are in place and that installation of grounding described in Section "Grounding" is complete.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 DUCT IDENTIFICATION

- A. General:

1. Ductwork shall be identified as to type of air being conveyed and, where specified, the air handling unit to which it is connected by use of stick-on letters and numbers.
 2. Identify bare or insulated interior ductwork (outdoor ductwork does not require labeling) in the following locations:
 - a. Mechanical Equipment Rooms.
 - b. Penthouses.
 - c. Ductwork penetrating the roof (below the roof).
- B. Location and Content of Identification:
1. Locate identification at ductwork connections to equipment and at ductwork roof penetrations.
 2. Assemble letters to identify air within the duct as one of the following:
 - a. "SUPPLY AIR"
 - b. "RETURN AIR"
 - c. "EXHAUST AIR"
 - d. "OUTSIDE AIR"
 - e. "FUME EXHAUST"
 3. In addition, at roof penetrations, include the equipment identification number to which or from which the penetrating duct is connected. For example:
 4. "EXHAUST AIR" or "SUPPLY AIR"
 5. "TO EF-12A" "FROM ACU-301"
 6. Horizontal ductwork shall have lettering on opposite sides, along centerline of the duct at each point of identification. Where view of vertical sides is obstructed, apply lettering to be visible from bottom and/or top of duct.
 7. Vertical ductwork shall have lettering applied on the two most visible sides, oriented to read from the bottom upward, along the centerline of the duct.
- C. Size of Lettering:
1. 12 inch or less duct or insulation dimension (or diameter) to which the lettering is applied: 1 inch high lettering.
 2. Greater than 12 inch duct or insulation dimension (or diameter) to which the lettering is applied: 3 inch high lettering.
- D. Installation:
1. Prepare surface to which lettering is applied and install lettering in accordance with the manufacturer's instructions.
 2. Apply lettering in a straight line along the axis of the duct. Lettering edges should touch, but not overlap.

3.3 EQUIPMENT IDENTIFICATION

- A. General:
1. Identify mechanical equipment, bare or insulated, in the following locations, by use of stick-on letters and numbers:
 - a. Mechanical Equipment Rooms.
 - b. Suspended ceiling plenums.
 - c. Roof mounted equipment.
- B. Location and Content of Identification:

1. Equipment shall be identified with a minimum of two sets of lettering. Center identification lettering, vertically and horizontally, on opposite vertical sides of the equipment.
 2. Vertical sides selected shall have the longest dimension (i.e., label sides of equipment and not the ends), unless view is obstructed to those sides. If view is obstructed to sides of equipment, locate identification lettering on the two most visible vertical sides and/or ends.
 3. Equipment identification numbers and letters shall match the designation found in the equipment schedules on the Contract Drawings.
- C. Size of Lettering:
1. Use the largest lettering size (3 inch or 1 inch height) that will easily fit the available surface space.
 2. Use only one lettering height on any given piece of equipment (i.e., do not mix lettering sizes).
- D. Installation:
1. Prepare surface to which lettering is applied and install lettering in accordance with the manufacturer's instructions.
 2. Apply lettering in a straight line along the axis of the equipment. Lettering edges should touch, but not over-lap.

3.4 CLEANING

- A. On completion of installation, inspect interior and exterior of equipment. Remove dust, dirt, paint splatters and other spots from exterior and wipe down with damp cotton cloth. Touch up exposed surfaces to match original finish. Vacuum interior "white glove clean", removing all dirt and debris while taking care to protect static-sensitive and fragile parts from damage. Do not use compressed air to assist in cleaning.

3.5 PROTECTION

- A. Protect installed equipment from damage through Substantial Completion.

END OF SECTION

SECTION 23 05 93
TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes testing, adjusting, and balancing HVAC systems to produce design objectives, including the following:
 - 1. Balancing airflow and water flow within distribution systems, including submains, branches, and terminals, to indicated quantities according to specified tolerances.
 - 2. Adjusting total HVAC systems to provide indicated quantities.
 - 3. Measuring electrical performance of HVAC equipment.
 - 4. Setting quantitative performance of HVAC equipment.
 - 5. Verifying that automatic control devices are functioning properly.
 - 6. Reporting results of the activities and procedures specified in this Section.

1.3 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. Associated Air Balance Council (AABC).
 - 2. Air Movement and Control Association (AMCA).
 - 3. Cooling Tower Institute (CTI).
 - 4. National Environmental Balancing Bureau (NEBB).
 - 5. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

1.4 PROJECT CONDITIONS

- A. Full Owner Occupancy: The Owner will occupy the site and existing building during the entire testing, adjusting, and balancing period. Cooperate with the Owner during testing, adjusting, and balancing operations to minimize conflicts with the Owner's operations.
- B. Partial Owner Occupancy: The Owner may occupy completed areas of the building before Substantial Completion. Cooperate with the Owner during testing, adjusting, and balancing operations to minimize conflicts with the Owner's operations.

1.5 COORDINATION REQUIREMENTS

- A. Coordinate with electrical equipment, light fixtures, HVAC equipment and ductwork, piping, and roof drains.
- B. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist testing, adjusting, and balancing activities.

- C. Notice: Provide 7 days advance notice to Owner's Representative for each test. Include scheduled test dates and times.
- D. Witness and signoff by Owner's Representative is required.
- E. Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.6 SUBMITTALS

- A. Submit the following in accordance with the General Conditions.
- B. Quality-Assurance Submittals: Within 30 days from the Contractor's Notice to Proceed, submit 2 copies of evidence that the testing, adjusting, and balancing Agent and this Project's testing, adjusting, and balancing team members meet the qualifications specified in the "Quality Assurance" Article below.
- C. Contract Documents Examination Report: Within 45 days from the Contractor's Notice to Proceed, submit 2 copies of the Contract Documents review report as specified in Part 3 of this Section.
- D. Strategies and Procedures Plan: Within 60 days from the Contractor's Notice to Proceed, submit 2 copies of the testing, adjusting, and balancing strategies and step-by-step procedures as specified in Part 3 "Preparation" Article below. Include a complete set of report forms intended for use on this Project.
- E. Certified Testing, Adjusting, and Balancing Reports: Submit 2 copies of reports prepared, as specified in this Section, on approved forms certified by the testing, adjusting, and balancing Agent.
- F. Sample Report Forms: Submit 2 sets of sample testing, adjusting, and balancing report forms.
- G. Warranty: Submit 2 copies of special warranty specified in the "Warranty" Article below.
- H. Product Data: "Catalog cuts" and spec sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.

1.7 QUALITY ASSURANCE

- A. Agent Qualifications: Engage a testing, adjusting, and balancing agent certified by either AABC or NEBB.
- B. Testing, Adjusting, and Balancing Conference: Meet with the Owner's and the Architect's representatives on approval of the testing, adjusting, and balancing strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of testing, adjusting, and balancing team members, equipment manufacturers' authorized service representatives, HVAC controls Installer, and other support personnel. Provide 7 days' advance notice of scheduled meeting time and location.
 - 1. Agenda Items: Include at least the following:
 - a. Submittal distribution requirements.
 - b. Contract Documents examination report.

- c. Testing, adjusting, and balancing plan.
 - d. Work schedule and Project site access requirements.
 - e. Coordination and cooperation of trades and subcontractors.
 - f. Coordination of documentation and communication flow.
- C. Certification of Testing, Adjusting, and Balancing Reports: Certify the testing, adjusting, and balancing field data reports. This certification includes the following:
- 1. Review field data reports to validate accuracy of data and to prepare certified testing, adjusting, and balancing reports.
 - 2. Certify that the testing, adjusting, and balancing team complied with the approved testing, adjusting, and balancing plan and the procedures specified and referenced in this Specification.
- D. Testing, Adjusting, and Balancing Reports: Use standard forms from AABC's "National Standards for Testing, Adjusting, and Balancing" or use standard forms from NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems
- E. Instrumentation Type, Quantity, and Accuracy: As described in AABC national standards or as described in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."

1.8 WARRANTY

- A. General Warranty: The national project performance guarantee specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. National Project Performance Guarantee: Provide a guarantee on AABC'S "National Standards" forms stating that AABC will assist in completing the requirements of the Contract Documents if the testing, adjusting, and balancing Agent fails to comply with the Contract Documents.
- C. Special Guarantee: Provide a guarantee on NEBB forms stating that NEBB will assist in completing the requirements of the Contract Documents if the testing, adjusting, and balancing Agent fails to comply with the Contract Documents. Guarantee includes the following provisions:
- 1. The certified Agent has tested and balanced systems according to the Contract Documents.
 - 2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 DEFINITIONS

- A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

- B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to design quantities.
- C. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.
- D. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
- E. Report Forms: Test data sheets for recording test data in logical order.
- F. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.
- G. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.
- H. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- I. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.
- J. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
- K. Test: A procedure to determine quantitative performance of a system or equipment.
- L. Testing, Adjusting, and Balancing Agent: The entity responsible for performing and reporting the testing, adjusting, and balancing procedures.

3.2 EXAMINATION

- A. Examine Contract Documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper testing, adjusting, and balancing of systems and equipment.
 - 1. Contract Documents are defined in the General and Supplementary Conditions of the Contract.
 - 2. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- B. Examine approved submittal data of HVAC systems and equipment.
- C. Examine project record documents described in Division 1 Section "Project Record Documents."
- D. Examine Engineer's design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

- E. Examine equipment performance data, including fan and pump curves. Relate performance data to project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce the performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.
- F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.
- G. Examine system and equipment test reports.
- H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- J. Examine strainers for clean screens and proper perforations.
- K. Examine open-piping-system pumps to ensure absence of entrained air in the suction piping.
- L. Examine equipment for installation and for properly operating safety interlocks and controls.
- M. Examine automatic temperature system components to verify the following:
 - 1. Dampers, valves, and other controlled devices operate by the intended controller.
 - 2. Dampers and valves are in the position indicated by the controller.
 - 3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
 - 4. Automatic modulating and shutoff valves, including 2-way valves and 3-way mixing and diverting valves, are properly connected.
 - 5. Sensors are located to sense only the intended conditions.
 - 6. Sequence of operation for control modes is according to the Contract Documents.
 - 7. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
 - 8. Interlocked systems are operating.
- N. Report deficiencies discovered before and during performance of testing, adjusting, and balancing procedures. Report the status of each component listed in the examination in paragraph M above.
- O. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.

- P. Examine roughing-in systems to verify the following:
 - 1. Systems are within the limitations established by the manufacturer.
 - 2. Each utility pipe and conduit is in the correct location.
- Q. Verify that ground connections are in place and that installation of grounding described in Section “Grounding” is complete.
- R. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PREPARATION

- A. Prepare a testing, adjusting, and balancing plan that includes strategies and step-by-step procedures.
- B. Complete system readiness checks and prepare system readiness reports. Verify the following:
 - 1. Permanent electrical power wiring is complete.
 - 2. Hydronic systems are filled, clean, and free of air.
 - 3. Automatic temperature-control systems are operational.
 - 4. Isolating and balancing valves are open and control valves are operational.

3.4 GENERAL TESTING AND BALANCING PROCEDURES

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC national standards and this Section or perform testing and balancing procedures on each system according to the procedures contained in NEBB’s “Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems” and this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.
- C. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

3.5 CONSTANT-VOLUME AIR SYSTEMS – BALANCING PROCEDURES

- A. The procedures in this Article apply to constant-volume supply-, return-, and exhaust-air systems. Additional procedures are required for process exhaust-air systems. These additional procedures are specified in other articles in this Section.
- B. Adjust fans to deliver total design airflows within the maximum allowable rpm listed by the fan manufacturer.
 - 1. Measure fan static pressures to determine actual static pressure as follows:
 - a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.

- c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 - 2. Measure static pressure across each air-handling unit component.
 - a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.
 - 3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers under final balanced conditions.
 - 4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
 - 5. Adjust fan speed higher or lower than design with the approval of the Engineer. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
 - 6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure no overload will occur. Measure amperage in full cooling, full heating, and economizer modes to determine the maximum required brake horsepower.
- C. Adjust volume dampers for main duct, submain ducts, and major branch ducts to design airflows within specified tolerances.
 - 1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
 - a. Where sufficient space in submains and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 - 2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submains and branch ducts to design airflows within specified tolerances.
- D. Measure terminal outlets and inlets without making adjustments.
 - 1. Measure terminal outlets using a direct-reading hood or the outlet manufacturer's written instructions and calculating factors.
- E. Adjust terminal outlets and inlets for each space to design airflows within specified tolerances of design values. Make adjustments using volume dampers rather than extractors and the dampers at the air terminals.
 - 1. Adjust each outlet in the same room or space to within specified tolerances of design quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 - 2. Adjust patterns of adjustable outlets for proper distribution without drafts or as indicated on the Contract Documents.

3.6 AIR HANDLING UNITS

- A. Record drawing, design and field test static pressure, in order of physical arrangement, for each applicable system component; i.e., louver, filter, preheat coil, cooling coil, etc., and the most remote terminal unit. With controls functioning properly and proper water

flow rates, test and record air dry bulb and wet bulb temperature of entering outside air, return air, mixed air, supply air, and air entering and leaving each coil for each air handling unit. Where feasible, measure air dry bulb and wet bulb temperatures with the mechanically aspirated psychrometer. All filters shall be clean and in place before starting fans. All air filters shall be artificially loaded, by partial blanking or other means, to produce air pressure drop midway between clean and dirty. Controls and dampers shall be set for normal full air flow testing and balancing.

3.7 MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 - 1. Manufacturer, model, and serial numbers.
 - 2. Motor horsepower rating.
 - 3. Motor rpm.
 - 4. Efficiency rating if high-efficiency motor.
 - 5. Nameplate and measured voltage, each phase.
 - 6. Nameplate and measured amperage, each phase.
 - 7. Starter thermal-protection-element rating.

3.8 TEMPERATURE TESTING

- A. During testing, adjusting, and balancing, report need for adjustment in temperature regulation within the automatic temperature-control system.
- B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of 2 successive 8-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.
- C. Measure outside-air, wet- and dry-bulb temperatures.

3.9 TEMPERATURE-CONTROL VERIFICATION

- A. Verify that controllers are calibrated and commissioned.
- B. Check transmitter and controller locations and note conditions that would adversely affect control functions.
- C. Record controller settings and note variances between set points and actual measurements.
- D. Verify operation of limiting controllers (i.e., high- and low-temperature controllers).
- E. Verify free travel and proper operation of control devices such as damper and valve operators.
- F. Verify sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water-flow measurements. Note the speed of response to input changes.
- G. Confirm interaction of electrically operated switch transducers.
- H. Confirm interaction of interlock and lockout systems.

- I. Record voltages of power supply and controller output. Determine if the system operates on a grounded or nongrounded power supply.
- J. Note operation of electric actuators using spring return for proper fail-safe operations.

3.10 TOLERANCES

- A. Set HVAC system airflow and water flow rates within the following tolerances:
 - 1. Supply, Return, and Exhaust Fans: Plus 5 to plus 10 percent.
 - 2. Air Outlets and Inlets: 0 to minus 10 percent.
 - 3. Heating-Water Flow Rate: 0 to minus 10 percent.
 - 4. Cooling-Water Flow Rate: 0 to minus 5 percent.

3.11 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article above, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.12 FINAL REPORT

- A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in 3-ring binder, tabulated and divided into sections by tested and balanced systems.
- B. Include a certification sheet in front of binder signed by the certified testing and balancing agent.
 - 1. Include a list of the instruments used for procedures, along with proof of calibration.
- C. Final Report Contents: In addition to the certified field report data, include the following:
 - 1. Pump curves.
 - 2. Fan curves.
 - 3. Manufacturers' test data.
 - 4. Field test reports prepared by system and equipment installers.
 - 5. Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data.
- D. General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:
 - 1. Title page.
 - 2. Name and address of testing, adjusting, and balancing Agent.
 - 3. Project name.
 - 4. Project location.

5. Engineer's name and address.
 6. Contractor's name and address.
 7. Report date.
 8. Signature of testing, adjusting, and balancing Agent who certifies the report.
 9. Summary of contents, including the following:
 - a. Design versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 10. Nomenclature sheets for each item of equipment.
 11. Data for terminal units, including manufacturer, type size, and fittings.
 12. Notes to explain why certain final data in the body of reports vary from design values.
 13. Test conditions for fans and pump performance forms, including the following:
 - a. Settings for outside-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings, including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.
- E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present with single-line diagrams and include the following:
1. Quantities of outside, supply, return, and exhaust airflows.
 2. Water and steam flow rates.
 3. Duct, outlet, and inlet sizes.
 4. Pipe and valve sizes and locations.
 5. Terminal units.
 6. Balancing stations.
- F. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data: Include the following:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Sheave make, size in inches (mm), and bore.
 - i. Sheave dimensions, center-to-center and amount of adjustments in inches (mm).
 - j. Number of belts, make, and size.
 - k. Number of filters, type, and size.
 2. Motor Data: Include the following:
 - a. Make and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.

- e. Sheave make, size in inches (mm), and bore.
 - f. Sheave dimensions, center-to-center and amount of adjustments in inches (mm).
- 3. Test Data: Include design and actual values for the following:
 - a. Total airflow rate in cfm (L/s).
 - b. Total system static pressure in inches wg (Pa).
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg (Pa).
 - e. Filter static-pressure differential in inches wg (Pa).
 - f. Preheat coil static-pressure differential in inches wg (Pa).
 - g. Cooling coil static-pressure differential in inches wg (Pa).
 - h. Heating coil static-pressure differential in inches wg (Pa).
 - i. Outside airflow in cfm (L/s).
 - j. Return airflow in cfm (L/s).
 - k. Outside-air damper position.
 - l. Return-air damper position.
- G. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
 - 1. Report Data: Include the following:
 - a. System and air-handling unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg F (deg C).
 - d. Duct static pressure in inches wg (Pa).
 - e. Duct size in inches (mm).
 - f. Duct area in sq. ft. (sq. m).
 - g. Design airflow rate in cfm (L/s).
 - h. Design velocity in fpm (m/s).
 - i. Actual airflow rate in cfm (L/s).
 - j. Actual average velocity in fpm (m/s).
 - k. Barometric pressure in psig (Pa).
- H. Instrument Calibration Reports: For instrument calibration, include the following:
 - 1. Report Data: Include the following:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

3.13 ADDITIONAL TESTS

- A. Within 90 days of completing testing, adjusting, and balancing, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial testing, adjusting, and balancing procedures were not performed during near-peak summer and winter conditions, perform additional inspections, testing, and adjusting during near-peak summer and winter conditions.

3.14 PAINTING

- A. Perform field painting in accordance with the Section "Painting".

3.15 CLEANING

- A. On completion of installation, inspect interior and exterior of equipment. Remove dust, dirt, paint splatters and other spots from exterior and wipe down with damp cotton cloth. Touch up exposed surfaces to match original finish. Vacuum interior "white glove clean", removing all dirt and debris while taking care to protect static-sensitive and fragile parts from damage. Do not use compressed air to assist in cleaning.

3.16 PROTECTION

- A. Protect installed equipment from damage through Substantial Completion.

END OF SECTION

SECTION 23 07 00 HVAC INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes mechanical insulation as shown on the Contract Drawings.
 - 1. Semi-rigid and flexible duct and plenum; insulating cements; factory- or field-applied jackets; accessories and attachments; and sealing compounds.
 - 2. Blanket and board; insulating cements; factory- or field-applied jackets; accessories and attachments; and sealing compounds.

1.3 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American Society for Testing and Materials (ASTM)
 - 2. Military Specifications (MIL), as applicably noted.
 - 3. International Energy Conservation Code.

1.4 COORDINATION REQUIREMENTS

- A. Coordinate layout and installation with electrical equipment, light fixtures, HVAC equipment and ductwork, piping, and roof drains.
- B. Coordinate clearance requirements with duct, equipment and piping Installer(s) for insulation applications.
- C. Coordinate size and location of supports, hangers, and insulation shields specified in the Section "Hangers and Supports for HVAC Piping and Equipment."
- D. Coordinate installation and testing of electric heat tracing.

1.5 SUBMITTALS

- A. Submit the following in accordance with the General Conditions.
- B. Product Data: "Catalog cuts" and spec sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.
- C. Shop Drawings:
 - 1. Show fabrication and installation details for the following:
 - a. Duct
 - 1) Removable insulation sections at access panels.
 - 2) Application of field-applied jackets.
 - 3) Applications at linkages for control devices.
 - 4) Duct lining.

- D. Certificates:
 - 1. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

1.6 QUALITY ASSURANCE

- A. Qualifications
 - 1. Manufacturer's Factory Qualifications: Manufacturing facilities shall have accreditation to ISO 9000:2000 or an equivalent quality management system acceptable to the Engineer.
- B. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.
 - 1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

1.7 SCHEDULING

- A. Schedule insulation application after testing duct systems and piping systems. Insulation application may begin on segments of piping and ducts that have satisfactory test results.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Mineral-Fiber Insulation:
 - a. CertainTeed Manson.
 - b. Knauf FiberGlass GmbH.
 - c. Owens-Corning Fiberglas Corp.
 - d. Johns Manville Corp.
 - 2. Flexible Elastomeric Thermal Insulation:
 - a. Armstrong World Industries, Inc.
 - b. Rubatex Corp.
 - c. Aerocel.
 - 3. Closed-Cell Phenolic-Foam Insulation:
 - a. Kooltherm Insulation Products, Ltd.
 - b. Kingspan Corp.

2.2 INSULATION MATERIALS

- A. Duct / Equipment

1. Mineral-Fiber Board Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IB, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film. Jacket to have self-sealing lap as applicable for application.
 2. Mineral-Fiber Blanket Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.
 - a. Adhesive: As recommended by insulation material manufacturer.
 - b. Ultraviolet-Protective Coating: As recommended by insulation manufacturer.
 3. Flexible Elastomeric Thermal Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type II for sheet materials.
 - a. Adhesive: As recommended by insulation material manufacturer.
 - b. Ultraviolet-Protective Coating: As recommended by insulation manufacturer.
- B. Piping/Equipment
1. Closed-Cell Phenolic-Foam Insulation: Block insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type II, Grade 1 reformed pipe insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type III, Grade 1.
 2. Install piping insulation in accordance with manufacturer's instructions.
 3. Install field-applied jacket for above grade.

2.3 FIELD-APPLIED JACKETS

- A. Duct / Equipment
1. General: ASTM C 921, Type 1, unless otherwise indicated.
 2. Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.
 3. PVC Jacket: High-impact, ultraviolet-resistant PVC; 20 mils thick; roll stock ready for shop or field cutting and forming.
 - a. Adhesive: As recommended by insulation material manufacturer.
 - b. PVC Jacket Color: White [or gray].

2.4 ACCESSORIES AND ATTACHMENTS

- A. General
1. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz/yd².
 - a. Tape Width: 4 inches.
 2. Bands: 3/4 inch wide, in one of the following materials compatible with jacket:
 - a. Stainless Steel: ASTM A 666, Type 304; 0.020 inch thick.
 - b. Galvanized Steel: 0.005 inch thick.
 - c. Aluminum: 0.007 inch thick.
 - d. Brass: 0.010 inch thick.
 - e. Nickel-Copper Alloy: 0.005 inch thick.
 3. Wire: 0.080-inch, nickel-copper alloy; 0.062-inch, soft-annealed, stainless steel; or 0.062-inch, soft-annealed, galvanized steel.

- B. Duct / Equipment
 - 1. Weld-Attached Anchor Pins and Washers: Copper-coated steel pin for capacitor-discharge welding and galvanized speed washer. Pin length sufficient for insulation thickness indicated.
 - a. Welded Pin Holding Capacity: 100 lb for direct pull perpendicular to the attached surface.
 - 2. Adhesive-Attached Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.
 - a. Adhesive: Recommended by the anchor pin manufacturer as appropriate for surface temperatures of ducts, plenums, and breechings; and to achieve a holding capacity of 100 lb for direct pull perpendicular to the adhered surface.
 - 3. Self-Adhesive Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.

2.5 VAPOR RETARDERS

- A. Mastics: Materials recommended by insulation material manufacturer that are compatible with temperature range, insulation materials, jackets, and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- D. Examine roughing-in of systems to verify the following:
 - 1. Systems are within the limitations established by the manufacturer.
 - 2. Each utility pipe and conduit is in the correct location.
- E. Examine walls, floors, roofs, and concrete bases for suitable conditions for installation, for example, all overhead work of other trades is complete.
- F. Verify that ground connections are in place and that installation of grounding described in Section "Grounding" is complete.
- G. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL APPLICATION REQUIREMENTS

- A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; and free of voids throughout the length of equipment, ducts/fittings and piping, including fittings, valves and specialties.
- B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each duct, equipment and piping system.
- C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Apply multiple layers of insulation with longitudinal and end seams staggered.
- E. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.
- F. Keep insulation materials dry during storage, application and finishing.
- G. Apply duct, equipment and pipe insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
- H. Apply insulation with the least number of joints practical.
- I. Apply insulation over fittings and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
 - 1. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.
- J. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic. Apply insulation continuously through hangers and around anchor attachments.
 - 1. Apply insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
 - 3. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.
- K. Insulation Terminations: For insulation application where vapor retarders are indicated, seal ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

- L. Apply insulation with integral jackets as follows:
 - 1. Pull jacket tight and smooth.
 - 2. Joints and Seams: Cover with tape and vapor retarder as recommended by insulation material manufacturer to maintain vapor seal.
 - 3. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to duct flanges and fittings.
 - 4. Circumferential Joints: Cover with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches o.c.
 - 5. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches. Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
 - a. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.
- M. Cut insulation according to manufacturer's written instructions to prevent compressing insulation to less than 75 percent of its nominal thickness.
- N. Install vapor-retarder mastic on equipment, ducts and plenums scheduled to receive vapor retarders.
 - 1. Ducts with Vapor Retarders: Overlap insulation facing at seams and seal with vapor-retarder mastic and pressure-sensitive tape having same facing as insulation. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-retarder seal.
 - 2. Ducts without Vapor Retarders: Overlap insulation facing at seams and secure with outward clinching staples and pressure-sensitive tape having same facing as insulation.
 - 3. Equipment with Vapor Retarders: Overlap insulation facing at seams and seal with vapor-retarder mastic and pressure-sensitive tape having same facing as insulation. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-retarder seal.
- O. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.
 - 1. Seal penetrations with vapor-retarder mastic.
 - 2. Apply insulation for exterior applications tightly joined to interior insulation ends.
 - 3. Seal insulation to roof flashing with vapor-retarder mastic.
 - 4. Extend metal jacket of exterior insulation outside roof flashing at least 2 inches below top of roof flashing.
- P. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.
- Q. Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire/smoke damper sleeves for fire-rated wall and partition penetrations.
- R. Floor Penetrations: Terminate insulation at underside of floor assembly and at floor support at top of floor.
 - 1. For insulation indicated to have vapor retarders, taper termination and seal insulation ends with vapor-retarder mastic.

- S. Insulate the following indoor equipment:
 - 1. Heating hot-water air separators.
- T. Omit equipment insulation from the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Manholes.
 - 5. Handholes.
 - 6. Cleanouts.

3.4 MINERAL-FIBER INSULATION APPLICATION: DUCTWORK

- A. Blanket Applications for Ducts and Plenums: Secure blanket insulation with adhesive and anchor pins and speed washers.
 - 1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of duct and plenum surfaces.
 - 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 - 3. Install anchor pins and speed washers on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches. Space 16 inches o.c. each way, and 3 inches maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
 - c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - 4. Impale insulation over anchors and attach speed washers.
 - 5. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 - 6. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch staples, 1 inch o.c., and cover with pressure-sensitive tape having same facing as insulation.
 - 7. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. Secure with steel band at end joints and spaced a maximum of 18 inches o.c.
 - 8. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 - 9. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch-wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches o.c.
 - 10. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

- B. Board Applications for Ducts and Plenums: Secure board insulation with adhesive and anchor pins and speed washers.
1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of duct and plenum surfaces.
 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 3. Space anchor pins as follows:
 - a. On duct sides with dimensions 18 inches and smaller, along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches. Space 16 inches o.c. each way, and 3 inches maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
 - c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 4. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 5. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch staples, 1 inch o.c., and cover with pressure-sensitive tape having same facing as insulation.
 6. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 7. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch-wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches o.c.
 8. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

3.5 FLEXIBLE ELASTOMERIC THERMAL INSULATION APPLICATION: DUCTWORK

- A. Apply insulation to ducts and plenums as follows:
1. Follow the manufacturer's written instructions for applying insulation.
 2. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the duct and plenum surface.

3.6 FIELD-APPLIED JACKET APPLICATION: DUCTWORK

- A. Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.
1. Apply jacket smooth and tight to surface with 2-inch overlap at seams and joints.
 2. Embed glass cloth between two 0.062-inch-thick coats of jacket manufacturer's recommended adhesive.
 3. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.

3.7 FINISHES: DUCTWORK – EXPOSED

- A. Glass-Cloth Jacketed Insulation: Paint insulation finished with glass-cloth jacket as specified in Section “Painting.”
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer’s recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

3.8 DUCT SYSTEM APPLICATIONS

- A. Insulation materials and thicknesses are specified in Table 1 at the end of this Section.
- B. Materials and thicknesses for systems listed below are specified in Table 1 at the end of this Section.
- C. Insulate the following plenums and duct systems:
 - 1. Gas unit heater combustion air ductwork.
 - 2. Gas unit heater gas-vent pipes within 8 ft above finished floor.
- D. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:
 - 1. Fibrous-glass ducts.
 - 2. Metal ducts with duct liner.
 - 3. Flexible connectors.
 - 4. Vibration-control devices.
 - 5. Testing agency labels and stamps.
 - 6. Nameplates and data plates.
 - 7. Access panels and doors in air-distribution systems.

3.9 FINISHES: EQUIPMENT

- A. Glass-Cloth Jacketed Insulation: Paint insulation finished with glass-cloth jacket as specified in Division 9 Section “Painting.”
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer’s recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

3.10 EQUIPMENT APPLICATIONS

- A. Insulation materials and thicknesses are specified in Table 2 at the end of this Section.

3.11 INSTALLATION

- A. Install as shown on the Contract Drawings and in accordance with the manufacturer’s installation instructions.

TABLE 1 – DUCT INSULATION MATERIALS

Notes indicated in () are at end of Table 1

SERVICE	INSULATION MATERIAL	THICKNESS	NOTES
Outdoor air ducts and plenums, connections, and mixing boxes installed indoors	Rigid mineral fiber	2 inches	Provide neat fit at intake plenum Maintain vapor retarder.
Ducts located outdoors and weatherproofed	Flexible Elastomeric foam	2 inches	(2)

Note 1: Return air ducts within air conditioned spaces, or above lay-in ceilings of air conditioned spaces, or in return air plenums are not to be insulated.

Note 2: Fasten mechanically and with recommended adhesive. Make watertight and airtight, cover seams and joints and 100% of duct. Finish weatherproof with aluminum jacket or two 1/8-inch coats of "Miracle" CO-130 mastic, as made by Miracle Adhesive Corp., troweled smooth with a layer of "Duramesh" glass fabric between coatings.

3.12 PAINTING

- A. Perform field painting in accordance with the Section "Painting".

3.13 IDENTIFICATION

- A. Identify as specified in Section "Identification of HVAC Piping and Equipment".

3.14 CLEANING

- A. On completion of installation, inspect interior and exterior of equipment. Remove dust, dirt, paint splatters and other spots from exterior and wipe down with damp cotton cloth. Touch up exposed surfaces to match original finish. Vacuum interior "white glove clean", removing all dirt and debris while taking care to protect static-sensitive and fragile parts from damage. Do not use compressed air to assist in cleaning.

3.15 PROTECTION

- A. Protect installed equipment from damage through Substantial Completion.

END OF SECTION

SECTION 23 09 13
INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes:
 - 1. Instrumentation devices for HVACs
 - 2. Control devices for HVACs
- B. Coordinate Work of this Section with Electrical Work.

1.3 COORDINATION REQUIREMENTS

- A. Coordinate location of thermostats and other exposed control sensors with plans and room details before installation.
- B. Coordinate equipment from other divisions including "Intrusion Detection," "Lighting Controls," "Motor-Control Centers," "Panelboards," and "Fire Alarm" to achieve compatibility with equipment that interfaces with those systems.
- C. Coordinate supply of conditioned electrical circuits for control units and operator workstation.
- D. Coordinate layout and installation with electrical equipment, light fixtures, HVAC equipment and ductwork, piping, and roof drains.

1.4 SUBMITTALS

- A. Submit the following in accordance with the General Conditions.
- B. In addition to those submittals identified in the General Conditions, the following items shall also be submitted:
 - 1. Manufacturer's certification that all materials furnished are in compliance with the applicable requirements of the referenced Standards and this specification.
- C. Product Data: "Catalog cuts" and spec sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.
 - 1. Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
 - a. Each control device labeled with setting or adjustable range of control.

- D. Shop Drawings:
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - a. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
 - b. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
 - c. Written description of sequence of operation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Provide a complete and functional system to operate in accordance with the sequence of operations and control schemes shown on the drawings and described in the specifications.

2.2 ELECTRIC CONTROL DEVICES

- A. Line-Voltage, On-Off Temperature controller: Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch type, or equivalent solid-state type, with adjustable differential and sensing bulb holder. Set point range shall be 0-100°F. Differential range shall be 3-10°F. Switching shall be SPDT and motor rates for the connected load. Controller shall be model T675A1508 as manufactured by Honeywell, or equal.
- B. Line-Voltage, On-Off Thermostats: Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch type, or equivalent solid-state type, with heat anticipator, integral manual on-off-auto selector switch.
 - 1. Equip thermostats, which control electric heating loads directly, with off position on dial wired to break ungrounded conductors.
 - 2. Dead Band: Maximum 2 deg F.
- C. Room thermostat accessories include the following:
 - 1. Insulating Bases: For thermostats located on exterior walls.
- D. Cooling Tower system control panel shall be packaged programmable system consisting of a temperature sensor, programmable unit with LCD screen and button inputs and both analog and digital outputs to suit the sequence of operation. Model T775 as manufactured by Honeywell, or equal.
- E. Electric Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- or automatic-reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below set point.
 - 1. Bulb Length: Minimum 20 feet.
 - 2. Quantity: One thermostat for every 20 sq ft of coil surface.
- F. Electronic Damper and Valve Actuators: Direct-coupled type designed for minimum 100,000 full-stroke cycles at rated torque. Belimo or equal.
 - 1. Valves: Size for torque required for valve close-off at maximum pump differential pressure (regardless of water loop system pressures).

2. Dampers: Size for running torque calculated as follows:
 - a. Parallel-Blade Damper with Edge Seals: 7 inch-lbs/sq ft of damper.
 - b. Opposed-Blade Damper with Edge Seals: 5 inch-lbs/sq ft of damper.
 - c. Parallel-Blade Damper without Edge Seals: 4 inch-lbs/sq ft damper.
 - d. Opposed-Blade Damper without Edge Seals: 3 inch-lbs/sq ft of damper.
 - e. Dampers with 2 to 3 inches wg of Pressure Drop or Face Velocities of 1000 to 2500 FPM: Multiply the minimum full-stroke cycles above by 1.5.
 3. Coupling: V-bolt and V-shaped, toothed cradle.
 4. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
 5. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on non-spring-return actuators.
 6. Power Requirements (Two-Position Spring Return): 120V ac.
 7. Power Requirements (Modulating): Maximum 15 VA at 24-V ac.
 8. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
 9. Temperature Rating: 22 deg F to 122°F.
 10. Run Time: 200 seconds open, 40 seconds closed.
- G. Smoke Detector
1. Ionization type air duct detectors shall be furnished as specified elsewhere in Division 26 for installation under Division 23. All wiring for air duct detectors shall be provided under the Section Fire Alarm Systems.
- H. Air flow switch
1. Service: Air and non-combustible gas flow.
 2. Vane: Stainless Steel.
 3. Temperature Limit: 180°F (82°C).
 4. Switch Type: SPDT.
 5. Electrical Rating: 125 VAC: 9.8 amp full load 58.8 amp locked rotor. 250 VAC: 4.9 amp full load 29.4 amp locked rotor. Pilot Rating: 470 VA at 125, 250 VAC. Resistive: 15 amp at 125, 250, or 480 VAC.
 6. Electrical Connections: Screw type terminal.
 7. Conduit Connection: 7/8" conduit hole.
 8. Mounting Orientation: Horizontal duct flow.
 9. Set Point Adjustment: Screw type.
 10. Unit shall be Model 530 as manufactured by Dwyer Instruments, or equal.
- I. Explosion Proof Room Thermostat
1. Room Thermostat shall control the on and off of the hot water heating system based on room air temperature. Unit shall be suitable for Class I, Division I, Group D locations. Provide a 3 degree differential, single stage SPST line voltage snap-action switch, external, coiled sensing element and adjustable setpoint knob. Unit shall be model WR80-EP as manufactured by Chromalox, or equal.
- J. Firestat
1. Ruskin TS150 or approved equal.
 2. Provide equipment rated for the classification in areas served.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that conditioned power supply is available to control units and operator workstation.
- B. Verify that duct-, pipe-, and equipment-mounted devices and wiring are installed before proceeding with installation.
- C. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- D. Examine roughing-in of Instrumentation and Control Devices for HVAC systems to verify the following:
 - 1. Instrumentation and Control Devices for HVAC systems are within the limitations established by the manufacturer.
 - 2. Each utility pipe and conduit is in the correct location.
- E. Examine walls, floors, roofs, and concrete bases for suitable conditions for installation, for example, all overhead work of other trades is complete.
- F. Verify that ground connections are in place and that installation of grounding described in Section "Grounding" is complete.
- G. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install equipment level and plumb.
- B. Verify location of thermostats and other exposed control sensors with plans and room details before installation. Locate all 60 inches above the floor.
 - 1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.
- C. Install damper actuators on outside of duct in warm areas, not in locations exposed to outdoor temperatures.
- D. Install labels and nameplates to identify control components according to the Section "Identification for HVAC Piping and Equipment."
- E. Install as shown on the Contract Drawings and in accordance with the manufacturer's installation instructions.

3.3 PAINTING

- A. Perform field painting in accordance with the Section "Painting".

3.4 IDENTIFICATION

- A. Identify as specified in the Section "Identification of HVAC piping and Equipment."

3.5 CLEANING

- A. On completion of installation, inspect interior and exterior of equipment. Remove dust, dirt, paint splatters and other spots from exterior and wipe down with damp cotton cloth. Touch up exposed surfaces to match original finish. Vacuum interior "white glove clean", removing all dirt and debris while taking care to protect static-sensitive and fragile parts from damage. Do not use compressed air to assist in cleaning.

3.6 PROTECTION

- A. Protect installed equipment from damage through Substantial Completion.

END OF SECTION

SECTION 23 31 00
HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes ductwork systems as shown on the Contract Drawings.

1.3 REFERENCES

- A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American Society for Testing and Materials (ASTM)
 - 2. Underwriters Laboratories (UL)
 - 3. National Fire Protection Association (NFPA)
 - 4. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).

1.4 COORDINATION REQUIREMENTS

- A. Coordinate layout and installation with electrical equipment, light fixtures, HVAC equipment and ductwork, piping, and roof drains.
- B. Submit specially prepared Coordination Drawings for this Project, including floor plans and sections, drawn to scale. Include scaled equipment layouts and relationships between equipment and adjacent structural, mechanical, HVAC, and electrical elements. Show the following:
 - 1. Vertical and horizontal runs, offsets, and transitions.
 - 2. Clearances for access above and to the side.
 - 3. Show dimensions and details, including connections.
 - 4. Support locations, type of support, and weight on each support.
 - 5. Location of adjacent construction elements including light fixtures, HVAC and plumbing equipment, fire sprinklers and piping, signal and control devices, and other equipment.

1.5 SUBMITTALS

- A. Submit the following in accordance with the General Conditions.
- B. In addition to those submittals identified in the General Conditions, the following shall be submitted:
 - 1. Layout drawings of the equipment, ductwork, hangers, supports and accessories. Coordinate layout drawings with architectural, structural, electrical, plumbing,

and mechanical work. Drawings shall list ductwork material, thickness (gauge), seam types, seam dimensions, and seal class for each size or size range of duct.

2. Method of attachment of duct hangers to building construction.

C. Product Data: "Catalog cuts" and spec sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.

1.6 QUALITY ASSURANCE

A. Qualifications

1. Manufacturer's Factory Qualifications: Manufacturing facilities shall have accreditation to ISO 9000:2000 or an equivalent quality management system acceptable to the Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Ductwork

1. Galvanized Steel: ASTM A527 lock forming quality - galvanizing: ASTM A525 coating designation G-90.
2. Aluminum: ASTM B-209, Alloy 3003, Temper H-14.

B. Duct Hangers

1. Strap Hangers: Same material as ducts.
2. Rod Type Hangers: Mild low carbon steel, unless otherwise specified; fully threaded or threaded each end, with 2 removable nuts each end for positioning and locking rod in place. Unless stainless steel, galvanized or cadmium plated; shop coat with metal primer.

C. Miscellaneous Fasteners and Upper Hanger Attachments

1. Sheet Metal Screws, Machine Bolts and Nuts: Same material as duct, unless otherwise specified.
2. Concrete Inserts: Steel or malleable iron, galvanized; continuously slotted or individual inserts.
3. Welding Studs: Erico Fastening Systems, capacitor discharge, low carbon steel, copper flashed.
4. Structural (carbon) Steel Shapes and Steel Plates: ASTM A36, shop primed.
5. Machine Bolt Expansion Anchors:
a. Non-caulking single unit type: FS FF-S-325, Group II, Type 2, Class 2, Style 1.
b. Non-caulking double unit type: FS FF-S-325, Group II, Type 2, Class 2, Style 2.
c. Self-drilling type: FS FF-S-325, Group III, Types 1 and 2.

2.2 RECTANGULAR DUCTWORK

A. Low Pressure Ductwork

1. Low pressure ductwork shall be defined as all duct with velocities less than 2500 FPM and static pressures of 0 to 2 inches (positive or negative). Low pressure ductwork shall conform to the 2-inch duct pressure class as classified by

SMACNA. Low pressure ductwork shall include all transitions, plenums and, for variable air volume systems, the portion of supply ductwork between the VAV boxes and the diffusers.

- B. Elbows
 - 1. All square corner elbows and all short radius elbows where the center line radius is less than 1-1/2 times duct width shall be fitted with directional flow air-turning vanes on supply, return, intake and exhaust systems.

2.3 DUCT SEALANT

- A. Low and medium pressure supply, exhaust and outdoor air duct systems shall be provided with Class A seals as defined in the SMACNA duct construction standards and as noted herein. All joints and connections shall be sealed with Duro-Dyne S-2 Hi-Pressure Sealer (an oil resistant polymer solution) or equal. Apply sealer to clean duct surface. For medium pressure classes 2 inches through 10 inches w.g., apply a 2-inch wide strip of polyvinyl-treated open weave fiberglass membrane over the wet sealer, then apply another coat of sealer over the membrane, as per manufacturer's recommendation. In addition, Contractor shall apply a coat of sealant to all male connectors of round ducts with medium pressure classification.
- B. Low pressure return systems only need to meet Class C sealing requirements.
- C. Ductmate' connections do not have to be sealed if installed per manufacturer's recommendations (see Part 3 – Execution).

2.4 FLEXIBLE DUCT

- A. Insulated flexible duct shall be a factory-fabricated assembly consisting of an inner sleeve, insulation and an outer moisture barrier. The inner sleeve shall be constructed of a continuous vinyl-coated spring steel wire helix bonded to a continuous layer of vinyl-coated fiberglass mesh. A thick insulating blanket of fiberglass, providing a thermal conductance (C Factor) of 0.23 BTU/hr/ft²/deg F at 75 deg F, shall encase the inner sleeve and be sheathed with an outer moisture barrier of a reinforced metalized Mylar/neoprene laminate of low permeability with integral attaching devices (grommets) for a suspension system as listed by Underwriters' Laboratories, Inc. The flexible duct shall be rated for a maximum working velocity of 2500 FPM and a maximum working pressure of 6 inches w.g. positive and 2 inches w.g. negative, and shall be listed by Underwriters' Laboratories, Inc. under its UL-181 Standard as a Class 1 air duct and shall comply with NFPA Standard No. 90A. The flexible duct shall be Thermaflex MK-E as manufactured by Flexible Tubing Division, or similar by Automation Industries, Inc., United McGill, Flexaust Co., or approved substitution.

PART 3 - EXECUTION

3.1 GENERAL

- A. Duct sizes shown on drawings are in terms of width by depth. Duct sizes are inside clear dimensions.
- B. Provide flexible connectors at connections to fans, air handling equipment, and fume hoods.

- C. Exhaust duct branch connections shall be made at 45 degrees.
- D. Maintain duct cross-sectional area at offsets.
- E. Ductwork shall not be penetrated by obstructions such as pipe or conduit.

3.2 INSTALLATION

- A. Install interior ductwork as high as possible and parallel to walls.
- B. Ductwork shall not be installed in front of doors or windows. Ductwork shall not block access to equipment
- C. Install products in accordance with the manufacturer's instructions.
- D. Check locations of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and light arrangement.
- E. Install duct mounted diffusers and registers with air-tight connection.
- F. Provide volume dampers on duct take-off to diffusers, registers, and grilles.
- G. Paint ductwork visible behind air outlets and inlets with matte black.

3.3 EXTERIOR FINISH

- A. Attach sponge rubber padding to exterior corners of horizontal ductwork less than 7 feet 0 inches above finished floor.

3.4 CLEANING

- A. Clean dust, dirt, debris, and scrap metal from inside ductwork prior to start-up.

3.5 EXAMINATION

- A. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- B. Examine roughing-in of systems to verify the following:
 - 1. Systems are within the limitations established by the manufacturer.
 - 2. Each utility pipe and conduit is in the correct location.
- C. Examine walls, floors, roofs, and concrete bases for suitable conditions for installation, for example, all overhead work of other trades is complete.
- D. Verify that ground connections are in place and that installation of grounding described in Electrical Sections is complete.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.6 INSTALLATION

- A. Install as shown on the Contract Drawings and in accordance with the manufacturer's installation instructions.

3.7 IDENTIFICATION

- A. Identify as specified in Section "Identification for HVAC Piping and Equipment".

3.8 CLEANING

- A. On completion of installation, inspect interior and exterior of equipment. Remove dust, dirt, paint splatters and other spots from exterior and wipe down with damp cotton cloth. Touch up exposed surfaces to match original finish. Vacuum interior "white glove clean", removing all dirt and debris while taking care to protect static-sensitive and fragile parts from damage. Do not use compressed air to assist in cleaning.

3.9 PROTECTION

- A. Protect installed equipment from damage through Substantial Completion.

END OF SECTION

SECTION 23 33 00
AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes Ductwork Accessories as shown on the Contract Drawings.

1.3 REFERENCES

- A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein: Examples:
 - 1. Underwriters Laboratories (UL).
 - 2. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).
 - 3. International Energy Conservation Code.
 - 4. International Mechanical Code.

1.4 COORDINATION REQUIREMENTS

- A. Coordinate layout and installation with electrical equipment, light fixtures, HVAC equipment and ductwork, piping, and roof drains.
- B. Submit specially prepared Coordination Drawings for this Project, including floor plans and sections, drawn to scale. Include scaled equipment layouts and relationships between equipment and adjacent structural, mechanical, HVAC, and electrical elements. Show the following:
 - 1. Vertical and horizontal runs, offsets, and transitions.
 - 2. Clearances for access above and to the side.
 - 3. Show dimensions and details, including connections.
 - 4. Support locations, type of support, and weight on each support.
 - 5. Location of adjacent construction elements including light fixtures, HVAC and plumbing equipment, fire sprinklers and piping, signal and control devices, and other equipment.

1.5 SUBMITTALS

- A. In addition to those submittals identified in the General Conditions, the following shall be submitted:
 - 1. Layout drawings of the equipment, duct work, hangers, supports and accessories. Coordinate layout drawings with architectural, structural, electrical, plumbing, and mechanical work. Drawings shall specify duct work material, pressure

- classifications, thickness (gauge), seam types, seam dimensions, and seal class for each size or size range of duct.
 - 2. Details of intermediate structural steel members required to span main structural steel for the support of duct work.
 - 3. Method of attachment of duct hangers to building construction.
 - 4. Installation details for each type of fire damper used.
- B. Submit the following in accordance with the General Conditions.
- C. Product Data: "Catalog cuts" and spec sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.

1.6 QUALITY ASSURANCE

- A. Qualifications
 - 1. Manufacturer's Factory Qualifications: Manufacturing facilities shall have accreditation to ISO 9000:2000 or an equivalent quality management system acceptable to the Engineer.

PART 2 - PRODUCTS

2.1 FILTERS AND HOUSINGS

- A. Air filters shall MERV 8, Camfill Farr 30/30, or equal.
- B. Housing shall provide for slide in access to filter with gasketed hinged access door. Material of construction shall match the ductwork system.

2.2 FIRE DAMPERS

- A. Fire dampers shall be interlocking-blade, curtain-type, and 165 deg F fusible link. Dampers shall be suitable for mounting in either a vertical or horizontal position as shown on the Contract Drawings.
- B. Fire dampers shall be rated for 1-1/2 hours as shown on the Contract Drawings. Rating shall be in accordance with UL 555, and each damper shall be UL-listed.
- C. Style B fire dampers shall be used on ducts smaller than or equal to 12-inch x 12-inch or 12-inch diameter. Style B fire dampers shall be rated for 1-1/2 hours.
- D. Style A fire dampers shall be used on ducts greater than 12-inch x 12-inch or 12-inch diameter. Style A fire dampers shall be rated for 1-1/2 hours.
- E. Interior Fire Dampers
 - 1. Style WC fire dampers shall be rated for 1-1/2 hours.
- F. Manufacturers:
 - 1. Ruskin
 - 2. NCA Manufacturing
 - 3. Equal

2.3 VOLUME DAMPER

- A. Rectangular volume dampers shall be galvanized steel or aluminum to match duct, manual operator, locking quadrant, opposed action blades.
- B. Round volume dampers shall be galvanized steel or aluminum to match duct, manual operator, locking quadrant, single blade.
- C. Manufacturers:
 - 1. Ruskin
 - 2. NCA Manufacturing
 - 3. Equal

2.4 CONTROL DAMPERS

- A. Material shall match duct.
- B. Galvanized Steel
 - 1. Rectangular control dampers shall be 14-gauge galvanized steel, air foil section, opposed action blades and suitable for use with an electric actuator. Damper shall be provided with head, sill, blade, and jamb seals. AMCA Standard 500 tested leakage rate of 48-inch x 48-inch damper shall be less than 5.6 cfm per sq ft at 4 inches w.g. Static pressure drop shall be less than 0.03-inch water-column at free area velocity of 1000 fpm. .
 - 2. Round control dampers shall be galvanized steel, single blade, pressure-sensitive blade seal and suitable for use with an electric actuator. Maximum leakage rate shall be 4 cfm per sq ft at 4 inches w.g
 - 3. Electric actuator shall be provided by damper manufacturer. Actuator operating cycle and voltage shall be 60hertz, 120 volts.
- C. Aluminum
 - 1. Rectangular control dampers shall be aluminum air foil section, opposed action blades and suitable for use with an electric actuator. Damper shall be provided with head, sill, blade, and jamb seals. AMCA Standard 500 tested leakage rate of 48-inch x 48-inch damper shall be less than 5.6 cfm per sq ft at 4 inches w.g. Static pressure drop shall be less than 0.03-inch water-column at free area velocity of 1000 fpm. Ruskin CD50, NCA Manufacturing Model ACD-56, or equal.
 - 2. Electric actuator shall be provided by damper manufacturer. Actuator operating cycle and voltage shall be 60hertz, 120 volts.

2.5 BACKDRAFT DAMPERS

- A. Gravity-operated dampers shall be galvanized steel or aluminum to match duct with blade seals and adjustable weighted operator. Operator shall open with system pressure.

2.6 FLEXIBLE CONNECTORS

- A. Flexible duct connector shall be fiberglass fabric coated with neoprene. Weight: 30 oz/sq yd. Thickness: 0.024 inches.

2.7 ACCESS DOORS

- A. Access doors shall be galvanized steel or aluminum to match duct with insulated, double wall construction.
- B. Provide butt or piano type hinges and SMACNA Lock Type 1 sash locks.

PART 3 - EXECUTION

3.1 GENERAL

- A. Provide flexible connectors at connections to fans, air handling equipment, and fume hoods.
- B. Provide access doors at inlet side of coils, intake plenums, and fire dampers.

3.2 EXAMINATION

- A. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- B. Examine roughing-in of systems to verify the following:
 - 1. Systems are within the limitations established by the manufacturer.
 - 2. Each utility pipe and conduit is in the correct location.
- C. Examine walls, floors, roofs, and concrete bases for suitable conditions for installation, for example, all overhead work of other trades is complete.
- D. Verify that ground connections are in place and that installation of grounding described in Section "Grounding" is complete.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Install as shown on the Contract Drawings and in accordance with the manufacturer's installation instructions.

3.4 IDENTIFICATION

- A. Identify as specified in Section "Identification for HVAC Piping and Equipment."

3.5 CLEANING

- A. On completion of installation, inspect interior and exterior of equipment. Remove dust, dirt, paint splatters and other spots from exterior and wipe down with damp cotton cloth. Touch up exposed surfaces to match original finish. Vacuum interior "white glove clean", removing all dirt and debris while taking care to protect static-sensitive and fragile parts from damage. Do not use compressed air to assist in cleaning.

3.6 PROTECTION

- A. Protect installed equipment from damage through Substantial Completion.

END OF SECTION

SECTION 23 34 00

HVAC FANS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes Fans and associated equipment as shown on the Contract Drawings.

1.3 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. Air Moving and Conditioning Association (AMCA).
 - 2. American Society of Testing Materials (ASTM).
 - 3. National Electrical manufacturers Association (NEMA).

1.4 COORDINATION REQUIREMENTS

- A. Coordinate layout and installation with electrical equipment, light fixtures, HVAC equipment and ductwork, piping, and roof drains.
- B. Submit specially prepared Coordination Drawings for this Project, including floor plans and sections, drawn to scale. Include scaled equipment layouts and relationships between equipment and adjacent structural, mechanical, HVAC, and electrical elements. Show the following:
 - 1. Vertical and horizontal runs, offsets, and transitions.
 - 2. Clearances for access above and to the side.
 - 3. Show dimensions and details, including connections.
 - 4. Support locations, type of support, and weight on each support.
 - 5. Location of adjacent construction elements including light fixtures, HVAC and plumbing equipment, fire sprinklers and piping, signal and control devices, and other equipment.

1.5 SUBMITTALS

- A. Submit the following in accordance with the General Conditions.
- B. Product Data: "Catalog cuts" and spec sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.
- C. Shop Drawings:
 - 1. Fan curves with operating point clearly marked.
 - 2. Sound data.

- 3. Motor orientation.
- D. Closeout Submittals
 - 1. Operation and Maintenance Data.

1.6 QUALITY ASSURANCE

- A. Qualifications
 - 1. Manufacturer's Factory Qualifications: Manufacturing facilities shall have accreditation to ISO 9000:2000 or an equivalent quality management system acceptable to the Engineer.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Coordinate delivery to allow movement into designated space.

PART 2 - PRODUCTS

2.1 SQUARE IN-LINE CENTRIFUGAL FAN

- A. Manufacturers:
 - 1. Loren Cook
 - 2. Greenheck
 - 3. Or equal
- B. Description: In-line centrifugal fans shall be the sizes and capacities as shown on the drawings. Fans shall be belt or direct driven as scheduled.
- C. Materials and Construction:
 - 1. Fan Housing
 - a. Fan housing shall be of a square design, constructed of minimum 18 galvanized steel with inlet and discharge collars. Provide one access door and mounting feet.
 - 2. Fan Wheels
 - a. Fan wheels shall be backward inclined, centrifugal type of aluminum construction. Wheel and shaft shall be statically and dynamically balanced at the factory, in accordance with AMCA standard 204-96.
 - 3. Shafts
 - a. Fan shafts shall be ground and polished steel sized so that the first critical speed is at least 25% over the maximum operating speed. Pillow block bearings shall be factory-tested and designed for air handling applications with a minimum (L50) life in excess of 200,000 hours.
 - 4. Motors
 - a. Motors for belt drive shall be premium efficiency type and shall be matched to the fan load hp as indicated. Provide a UL-listed disconnect switch, factory-mounted and -wired to the motor.
 - b. Motors for direct drive non-hazardous (non-explosion proof) shall be electrically commutated motors with integral speed adjusters accessible by screw driver.
 - c. Motors for hazardous explosion proof areas shall be XP rated for Class I, Division 1, group D.

5. Drives
 - a. Drives shall be sized for 150% of driven horse power. Machined cast iron pulleys shall be factory-set to the required RPM and shall be field adjustable for final system balancing.
6. Disconnect Switch
 - a. Provide factory-mounted and -wired, NEMA 1 disconnect switch.
 - b. Provide factory-mounted and -wired, NEMA 7 disconnect switch for hazardous explosion proof areas.
7. Inlet/Discharge Guard
 - a. Provide 1/2-inch by 1/2-inch galvanized welded wire on a galvanized frame. Frame shall be removable for service and inspection.
8. Motor Cover/Belt Guard
 - a. Provide galvanized steel constructed, combination motor cover and belt guard.
9. Motor Cover/Belt Guard
 - a. Protective Coating
 - b. All steel fan components shall be coated with an electrostatically applied, baked polyester powder coating.
10. Insulated Fan Housing
 - a. Provide fan housing with internal insulation lining as scheduled.
11. Hanging Vibration Isolators
 - a. Provide hanging vibration isolators when fan is supported from structure above. Vibration isolators shall be neoprene hanging isolators.
12. Backdraft Damper
 - a. Provide gravity backdraft damper as scheduled.

2.2 ROOF EXHAUST FAN

- A. Manufacturers:
 1. Loren Cook
 2. Greenheck
 3. Or equal
- B. Materials and Construction:
 1. Construction
 - a. Spun aluminum centrifugal aluminum wheel with non-overloading characteristics. Units shall have the motor mounted in a weather-tight compartment separate from the exhaust stream.
 2. Motor
 - a. Motors as scheduled.
 3. Disconnect
 - a. Provide factory-mounted and wired as scheduled.
 4. Dampers
 - a. Provide as scheduled.
 5. Roof Curb Cap Adapter
 - a. Provide roof curb cap adapter prefabricated aluminum with insulation to match the dimension of the existing roof curb. Field verify existing roof curb dimensions.

2.3 WALL EXHAUST FAN

- A. Manufacturers:
 - 1. Loren Cook
 - 2. Greenheck model SP-L80
 - 3. Or equal
- B. Materials and Construction:
 - 1. Construction
 - a. Corrosion resistant galvanized steel scroll and housing, white designer non-yellowing grille, oval metal outlet duct collar with integral plastic backdraft damper, single inlet forward curved wheel.
 - 2. Motor
 - a. Motors as scheduled.
 - 3. Disconnect
 - a. Provide factory-mounted and wired as scheduled.
 - 4. Dampers
 - a. Provide damper as scheduled.

2.4 FRP CENTRIFUGAL BLOWER

- A. Manufacturers:
 - 1. New York Blower
 - 2. Or equal.
- B. Description: FRP centrifugal blowers shall be of the size and capacities as shown on the Contract Drawings. The fan assembly shall be dynamically balanced and completely assembled at the factory prior to shipping.
 - 1. Unit shall be model FRP Radial Fume Exhauster, Size 200 arrangement 10 as manufactured by New York Blower, or equal.
- C. Materials and Construction:
 - 1. Fan Wheel shall be cast in a one-piece mold with a resin-glass mixture featuring premium-quality, corrosion-resistant vinyl ester resin. Solid FRP wheels are oven-cured to provide optimum strength and corrosion resistance. Radial-blade design provides stable, pulsation-free performance over the entire pressure range from wideopen to closed-off.
 - 2. Standard shaft shall be ASTM A-108 steel, grade C-1040/1045. Inside the fan housing the shaft is covered with an FRP sleeve that is bonded to the wheel backplate and extends through the housing side, protecting the shaft from corrosive attack.
 - 3. Housing is made of premium-quality, corrosion resistant polyester resin. The interior is extremely smooth, due to fabrication on male molds.
 - 4. Flanged inlet and outlet for easy in-duct connection; supplied without holes as standard.
 - 5. Fans shall be rotatable to any of six discharge positions.
 - 6. Welded-steel base shall be constructed of heavy-gauge components for structural strength and durability.
 - 7. Arrangement 10 base with self-contained motor platform.
 - 8. Close-fitting, Teflon® shaft-hole closure.

9. Neoprene gasketing at all bolted FRP joints.
10. Fan exterior shall be coated with gray epoxy enamel.
11. Dynamically balanced before and after final assembly at the specified running speed.
12. Meet ASTM D 4167 Standard Specification for Fiber-Reinforced Plastic Fans and Blowers when fan is purchased with surface veil.
13. Motor
 - a. Motors shall be explosion proof matched to the fan load, and shall be mounted out of the air stream. Provide adjustable drives.
14. Weather Cover
 - a. The weather cover shall be epoxy-coated steel and cover the shaft and drive assemblies.
15. Vibration Isolation
 - a. Provide vibration isolation pads for horizontal floor mounting.
16. Drain Connection
 - a. Connection shall be threaded FRP drain with 1-inch female PVC pipe plug, at the lowest point in the housing.
17. Electrical Grounding
 - a. Air stream surfaces shall be coated with a carbon coating with grounding straps to the motor frame.
18. Inspection Port
 - a. Opening for visual inspection of fan wheel. Gasketed and held in place with stainless steel bolts.
19. Corrosion Protection of Steel/Finish Coating
 - a. All steel fan surfaces are to be thoroughly cleaned prior to painting using a combination of washing and hand/power tool cleaning per SSPC-SP1, SSPC-SP2 and SSPC-SP3 standards.
 - b. All steel fan surfaces are to receive, as a minimum, cleaning per SSPC-SP6 standards). After cleaning, all fan exterior surfaces are to receive a coat of manufacturer's standard primer followed by one coat of epoxy enamel finish to a thickness of 2-3 mils d.f.t. Surfaces of bolted components shall be coated and allowed to dry prior to final assembly. All fasteners external to the gas stream shall be plated for extra corrosion protection.
20. Flanged Inlet
 - a. Shall be pre-drilled solid fiberglass flange.
21. Flanged Outlet
 - a. Shall be pre-drilled solid fiberglass flange.
22. Inlet Box
 - a. Provide FRP inlet box for rain protection.
23. Belt Guard
 - a. Totally enclosed belt guard shall be provided for each fan.
24. Surface Veil
 - a. Fan shall be provided with surface veil provided.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- B. Examine roughing-in of systems to verify the following:

1. Systems are within the limitations established by the manufacturer.
 2. Each utility pipe and conduit is in the correct location.
- C. Examine walls, floors, roofs, and concrete bases for suitable conditions for installation, for example, all overhead work of other trades is complete.
- D. Verify that ground connections are in place and that installation of grounding described in Section "Grounding" is complete.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install as shown on the Contract Drawings and in accordance with the manufacturer's installation instructions.
- B. Roof fans and intake hoods shall be installed with a rubber gasket between the unit's base and the roof curb. The curb cap shall be securely mounted to the roof curb.
- C. Vibration Isolators for fans shall be internally isolated by the manufacturer.
- D. Roof Curbs: Top of curb shall set level. Provide sloping roof curb or shims as required.

3.3 MANUFACTURER'S FIELD SERVICES

- A. Engage a factory-authorized service representative to perform the following inspections, checks, and supervision of testing:
1. Inspect field-assembled components, equipment installation, and electrical connections for compliance with the manufacturer's installation recommendations and requirements.
 2. Set field-adjustable settings to the values recommended by the equipment manufacturer.
 3. Confirm vibration is within allowable limits.

3.4 PAINTING

- A. Perform field painting in accordance with the Section "Painting."

3.5 IDENTIFICATION

- A. Identify as specified in the Section "Identification for HVAC Piping and Equipment".

3.6 CLEANING

- A. On completion of installation, inspect interior and exterior of equipment. Remove dust, dirt, paint splatters and other spots from exterior and wipe down with damp cotton cloth. Touch up exposed surfaces to match original finish. Vacuum interior "white glove clean", removing all dirt and debris while taking care to protect static-sensitive and fragile parts from damage. Do not use compressed air to assist in cleaning.

3.7 PROTECTION

- A. Protect installed equipment from damage through Substantial Completion.

END OF SECTION

SECTION 23 37 00 AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes air outlets and inlets and louvers as shown on the Contract Drawings.

1.3 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. National Fire Protection Association (NFPA)
 - 2. Underwriters Laboratories (UL)
 - a. Fire Resistance Directory

1.4 COORDINATION REQUIREMENTS

- A. Coordinate layout and installation of Air Outlets and Inlets with electrical equipment, light fixtures, HVAC equipment and ductwork, piping, and roof drains.

1.5 SUBMITTALS

- A. Submit the following in accordance with the General Conditions.
- B. Product Data: "Catalog cuts" and spec sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.
- C. Shop Drawings: Shop drawings shall indicate assembly, noise criteria, flow criteria, pressure drop, unit dimensions, required clearances, construction details, and field connection details.
- D. Manufacturer Instructions: Submit manufacturer's installation instructions.

1.6 QUALITY ASSURANCE

- A. Qualifications
 - 1. Manufacturer's Factory Qualifications: Manufacturing facilities shall have accreditation to ISO 9000:2000 or an equivalent quality management system acceptable to the Engineer.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Store Air inlets and Outlets in clean dry indoor rooms with electric heating to maintain the storeroom between 5 and 40 deg. C. Comply with manufacturer's additional written instructions for storing and periodic inspection and testing.
- B. Handle Air Outlets and Inlets components according to manufacturer's written instructions. Use factory-installed lifting provisions.

1.8 WARRANTY

- A. Provide parts and labor warranty in accordance with the General Conditions.

PART 2 - PRODUCTS

2.1 TRANSFER GRILLE (TG-1)

- A. Manufacturers: Titus Model 300FL, or equal by Anemostat or Krueger.
- B. Description:
 - 1. Double Deflection. Front blades shall be horizontal with individually adjustable tapered blades spaced 3/4 inch apart. Rear blades shall be individually adjustable tapered blades spaced 3/4 inch apart.
 - 2. All necessary appurtenances shall be provided to allow for mounting.
 - 3. Register blades shall have a 1-3/8 inch margin frame with countersunk screw mounting.
 - 4. Unless otherwise indicated, register blades and frame shall have factory-applied white finish.
 - 5. All supply registers shall be constructed with radius end caps and foam gaskets for a tight seal to the duct diameter.

2.2 SUPPLY REGISTER (SR-1)

- A. Manufacturers: Titus Model 300FL/300RL, or equal by Anemostat or Krueger.
- B. Supply register shall be aluminum or steel to match the ductwork of the respective system.
- C. Description:
 - 1. Double Deflection. Front blades shall be horizontal with individually adjustable tapered blades spaced 3/4 inch apart. Rear blades shall be individually adjustable tapered blades spaced 3/4 inch apart.
 - 2. Register shall have integral; face adjustable, opposed blade damper constructed of heavy duty extruded aluminum.
 - 3. All necessary appurtenances shall be provided to allow for mounting.
 - 4. Register blades shall have a 1-3/8 inch margin frame with countersunk screw mounting.
 - 5. Unless otherwise indicated, register blades and frame shall have factory-applied white finish.
 - 6. All supply registers shall be constructed with radius end caps and foam gaskets for a tight seal to the duct diameter.

2.3 RETURN REGISTER (RR-1)

- A. Heavy extruded aluminum frame shall have countersunk screw mounting. Unless otherwise indicated, register blades and frame shall have factory-applied white finish.
- B. Register shall be suitable for 24"x24" ceiling mounting as shown on the Contract Drawings. All necessary appurtenances shall be provided to allow for mounting.
- C. Actual sizes and airflows from individual registers shall be as indicated on plans.
- D. Register shall have integral, face adjustable, opposed blade damper constructed of 20-gauge galvanized steel.
- E. Manufacturers: Titus Model 50F, or equal by Anemostat or Krueger.

2.4 EXHAUST REGISTER (ER-1)

- A. Return register shall be aluminum or steel to match the ductwork of the respective system.
- B. ½ inch spacing of angled blades.
- C. Heavy extruded frame shall have countersunk screw mounting. Unless otherwise indicated, register blades and frame shall have factory-applied white finish.
- D. All necessary appurtenances shall be provided to allow for mounting.
- E. Actual sizes and airflows from individual registers shall be as indicated on plans.
- F. Register shall have integral, face adjustable, opposed blade damper constructed of 20-gauge galvanized steel.
- G. Manufacturers: Titus Model 355FL/355RL, or equal by Anemostat or Krueger.

2.5 EXHAUST GRILLE (EG-1)

- A. Return grille shall be aluminum or steel to match the ductwork of the respective system.
- B. ½ inch spacing of angled blades.
- C. Heavy extruded frame shall have countersunk screw mounting. Unless otherwise indicated, register blades and frame shall have factory-applied white finish.
- D. All necessary appurtenances shall be provided to allow for mounting.
- E. Actual sizes and airflows from individual registers shall be as indicated on plans.
- F. Register shall have integral, face adjustable, opposed blade damper constructed of 20-gauge galvanized steel.

G. Manufacturers: Titus Model 355FL/355RL, or equal by Anemostat or Krueger.

2.6 LOUVERS

A. Extruded aluminum stationary louvers with drainable blades.

B. Performance Ratings: AMCA licensed.

1. Frame:

- a. Material: Extruded aluminum, Alloy 6063-T5.
- b. Wall Thickness: 0.081 inch (2.1 mm), nominal.
- c. Depth: 6 inches (152 mm).
- d. Downspouts and caulking surfaces.

2. Blades:

- a. Style: Drainable.
- b. Material: Extruded aluminum, Alloy 6063-T5.
- c. Wall Thickness: 0.081 inch (2.1 mm), nominal.
- d. Angle: 37.5 degrees.
- e. Centers: 5-29/32 inches (150 mm), nominal.

3. Bird Screen:

- a. Material: Aluminum, 1/2 inch mesh x 0.063 inch, intercrimp.
- b. Frame: Removable, rewireable.

4. Gutters: Drain gutter in head frame and each blade.

5. Downspouts: Downspouts in jambs to drain water from louver for minimum water cascade from blade to blade.

6. Vertical Supports: Hidden vertical supports to allow continuous line appearance up to 120 inches (3,048 mm).

7. Sill: Steeply angled integral sill eliminating areas of standing or trapped moisture where mold or mildew may thrive and effect indoor air quality.

8. Assembly: Factory assembled louver components. All welded construction.

C. Design Load: Incorporate structural supports required to withstand wind load of 20 pounds per square foot.

D. Extended Sills: Extruded aluminum, Alloy 6063-T5. Minimum nominal wall thickness 0.060 inch (1.5 mm).

E. Non Visible Mullions: Manufacturer's standard horizontal or vertical mullions for architectural accent as indicated on drawings.

F. Kynar 500 Fluoropolymer Coating:

G. Conform to AAMA 605.2.

H. Apply coating following cleaning and pretreatment.

I. Cleaning: AA-C12C42R1X.

J. Dry louvers before final finish application.

- K. Total Dry Film Thickness: Approximately 1.2 mils, when baked at 450 degrees F for 10 minutes.
- L. Submit full color range for Architect's color selection
- M. Louver shall be AMCA rated model ELF6375DX as manufactured by Ruskin, or equal by Construction Specialties or Greenheck.

PART 3 - EXECUTION

3.1 GENERAL

- A. Provide supply and return air registers with 45° entries that are 4 inches long. Install registers with duct extensions such that no part of the register protrudes into the 45° entry.

3.2 EXAMINATION

- A. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- B. Examine walls, floors, roofs, and concrete bases for suitable conditions for installation, for example, all overhead work of other trades is complete.
- C. Verify that ground connections are in place and that installation of grounding described in Section "Grounding" is complete.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Install products in accordance with the manufacturer's instructions.
- B. Check locations of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and light arrangement.
- C. Install duct mounted diffusers and registers with air-tight connection.
- D. Provide volume dampers on duct take-off to diffusers, registers, and grilles.
- E. Paint ductwork visible behind air outlets and inlets with matte black.
- F. Install Air Inlets and Outlets as shown on the Contract Drawings and in accordance with the manufacturer's installation instructions.
- G. Provide testing adjusting and balancing in accordance with the Section "Testing, Adjusting and Balancing for HVAC."

3.4 CLEANING

- A. On completion of installation, inspect interior and exterior of equipment. Remove dust, dirt, paint splatters and other spots from exterior and wipe down with damp cotton cloth. Touch up exposed surfaces to match original finish.

3.5 PROTECTION

- A. Protect installed equipment from damage through Substantial Completion.

END OF SECTION

SECTION 23 73 13 HEAT RECOVERY UNIT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes Central Station Air Handling Units as shown on the Contract Drawings for heat recovery unit HRU-101.

1.3 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American Society for Testing and Materials (ASTM)
 - 2. American National Standards Institute (ANSI)
 - 3. National Fire Protection Association (NFPA).
 - 4. International Energy Conservation Construction Code.
 - 5. International Mechanical Code.
 - 6. Underwriters Laboratories (UL).

1.4 COORDINATION REQUIREMENTS

- A. Coordinate layout and installation with electrical equipment, light fixtures, HVAC equipment and ductwork, piping, and roof drains.
- B. Submit specially prepared Coordination Drawings for this Project, including floor plans and sections, drawn to scale. Include scaled equipment layouts and relationships between equipment and adjacent structural, mechanical, HVAC, and electrical elements. Show the following:
 - 1. Vertical and horizontal runs, offsets, and transitions.
 - 2. Clearances for access above and to the side.
 - 3. Show dimensions and details, including connections.
 - 4. Support locations, type of support, and weight on each support.
 - 5. Location of adjacent construction elements including light fixtures, HVAC and plumbing equipment, fire sprinklers and piping, signal and control devices, and other equipment.

1.5 SUBMITTALS

- A. In addition to those submittals identified in the General Conditions, the following shall also be submitted:
 - 1. Provide fan curves with specified operating point clearly plotted.

2. Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.
- B. Product Data: "Catalog cuts" and spec sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.
 1. Product data shall indicate dimensions, weights, capacities, ratings, fan performance, motor electrical characteristics, and gauges and finishes of materials.
 2. Submit product data of filter media, filter performance data, filter assembly, and filter frames.
- C. Shop Drawings:
 1. Shop drawings shall indicate assembly, unit dimensions, weight loading, required clearances, construction details, and field connection details.
- D. Manufacturer Instructions:
 1. Submit manufacturer's installation instructions.
 2. Submit control panel installation and operating instructions.
- E. Closeout Submittals
 1. Operation and Maintenance Data.
 2. Warranty Documentation.

1.6 QUALITY ASSURANCE

- A. Qualifications
 1. Manufacturer's Factory Qualifications: Manufacturing facilities shall have accreditation to ISO 9000:2000 or an equivalent quality management system acceptable to the Engineer.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver in shipping splits that can be moved past obstructions in the delivery path.
- B. Coordinate delivery to allow movement into designated space.
- C. Handle components according to manufacturer's written instructions. Use factory-installed lifting provisions.

1.8 WARRANTY

- A. Provide parts and labor warranty in accordance with the General Conditions.

PART 2 - PRODUCTS

2.1 HRU-101 HEAT RECOVERY UNIT

- A. MANUFACTURERS

1. The following manufacturers are named to establish a standard of quality necessary for the Project: Innovent, Concepts and Designs Incorporated, Isolation Air Systems, Inc.
 2. The design basis for the unit is Innovent Model ERU-OU-PL-10000-EH-460, or approved equal by listed manufacturer.
- B. General: Construct unit as specified herein. Single wall construction is unacceptable and will be rejected. Frame and panel construction must be used with no individual panel exceeding 36" width. All panels on the unit must be fully removable without the use of cutting tools. All internal components must be removable without dismantling the structural framing of the unit. Unit shall be suitable for outdoor installation as detailed on the plan drawings.
 - C. Base: Construct base of minimum 10 ga. welded structural steel with cross supports and integral lifting lugs. Bolted bases are unacceptable. Coat base exterior with 2 part epoxy primer and urethane modified enamel top coat. Welded lifting lugs are provided.
 - D. Framing: Frame is constructed of structural tube members designed to support flush-mounted double-wall panels. Vertical framing members must be easily removable, without the use of specialty tools or torches, for replacement of large internal components. Welded framing is not acceptable unless all internal components can be easily removed without cutting any welds. A closed-cell polyvinyl foam gasket with a thickness of 3/16" or greater must be applied between all framing members and panels.
 - E. Flooring: Floor shall be 2" thick double-wall, foam injected panel construction, with a minimum of 18 gauge galvanized steel walk on surface, and 22 gauge galvanized steel underside of paneled floor. Floor panels shall be foam injected for optimal support strength. Maximum deflection of the floor shall be $L/500$ (L =span in inches), and the maximum point load on the floor shall be 800 lbs (over 1 square foot). Floor shall be of a fastener free design, bonded to the unit base with an industrial adhesive, with all seams finished with an adhesive sealant providing a water tight floor system. Use of tack welding, caulk or screws penetrating the entire floor panel anywhere in the floor is unacceptable. The floor shall have a smooth and flat walk-on surface. A minimum 1" lip must be provided around all floor penetrations. Walk-on grating must be provided over all accessible floor mounted duct connections.
 - F. Panels: Unit shall have non-load bearing, fully-removable, heavy gauge 2" double-wall panels.
 - G. Exterior Materials: Exterior skin shall be galvanized G60 steel or galvanealed steel for painted equipment. Unpainted galvanized exterior unacceptable if unit casing or framework is welded.
 - H. A textured polyester paint (gray color) shall be provided. Coating shall be salt spray tested per ASTM B117 for a minimum of 2,500 hours and have no blistering or red rust on the face when the testing is completed.
 - I. Interior Materials: Interior skin shall be galvanized G90 steel
 - J. Thermal break construction: The entire casing, excluding doors, must be built such that no member on the exterior of the unit, excluding fasteners, has through metal contact with any member on the interior of the unit, excluding fasteners.
 - K. Casing Ratings: Maximum casing panel deflection shall not exceed $L/250$ at the design total static pressure (where L is the longest panel span on the unit). Casing shall meet a SMACNA duct leakage class (DLC) rating of 5.0 or better. The panel insertion loss, per octave band, shall not be less than the following:

L. Frequency (Hz): 100 125 250 500 1000 2000 4000
8000

M. Insertion loss (dB): 24 16 30 32 33 34 63
60

N. Insulation: All interior walls, floor, and ceiling shall be double wall and insulated with polyurethane injected foam insulation having a minimum R-13 thermal value. No insulation shall be exposed to the air stream. Fiberglass or non-injected foam insulation is not acceptable and will be rejected.

O. Access Doors: Provide double wall doors with the same insulation and inner/outer wall material as the rest of the air handler. Doors shall be full height (up to 72") with industrial stainless-steel hinges. Bi-directional compression latches with integral roller cam and hex-screw locking assembly must be provided. An EPDM type gasket must be provided in accordance with ASTM D 2000. Supply and exhaust air streams shall not be covered by a single door. Access panels in lieu of access door are unacceptable. Rain gutters are provided over all access doors that are not the full height of the unit casing. All doors that open with pressure shall be provided with a pressure relief safety latch. Provide doors for access to any area requiring routine maintenance.

P. Weather hoods (for outdoor units): Provide weather hoods with expanded aluminum bird screens over all exposed inlets and outlets. Hoods may ship loose for installation in the field.

Q. Roof (for outdoor units): Provide roof with standing seam construction which allows removal of individual sections for inspection purposes without removal of the entire roof. A double wall foam injected panel must be provided below the roof liner creating 3 layers of metal between the conditioned air tunnel and ambient air. Pitch roof with sufficient slope to ensure water drainage. Units over 137" wide require double sloped roof designs. Roof overhang to be provided around complete perimeter of the unit. No penetrations can be made to the roof.

R. BLOWER/MOTOR –

- Supply & Exhaust blowers: AF or BI blade direct drive plenum fans shall be provided. Fans shall be certified to bear the AMCA seal for air and sound performance. Fan motors must be selected to run at 90 Hz maximum at design conditions. Any fan/motor combination selected to run at a higher frequency will be rejected due to decreased motor life. This unit was selected with two supply and two exhaust blowers.
- Provide the following scheduled equipment:

SUPPLY FAN											SUPPLY
QTY	CFM	CLASS	SIZE (mm)	TYPE	TSP ("WC)	BHP	MHP	RPM	MOTOR RPM	VFD Hz	MOTOR TYPE
2	5000	N/A	450	Plenum	2.21	2.8	5.0	2074	1800	71.1	TEFC
TOTAL:	10000	-	-	-	2.21	5.6	10.0	-	-	-	-
TSP CALCULATION											
SA ESP ("WC)		0.75	Outside Filter Clean PD ("WC)			0.24	Plate Heat Exchanger ("WC)			0.44	-
Casing Loss ("WC)		0.30	Outside Filter Loading PD ("WC)			0.38	Electric Heater ("WC)			0.10	TSP: 2.21 "WC

EXHAUST FAN											EXHAUST
QTY	CFM	CLASS	SIZE (mm)	TYPE	TSP ("WC)	BHP	MHP	RPM	MOTOR RPM	VFD Hz	MOTOR TYPE
2	5000	N/A	450	Plenum	2.11	2.7	5.0	2059	1800	70.6	TEFC
TOTAL:	10000	-	-	-	2.11	5.4	10.0	-	-	-	-
TSP CALCULATION											
RA ESP ("WC)		0.75	Return Filter Clean PD ("WC)			0.24	Plate Heat Exchanger ("WC)			0.44	-
Casing Loss ("WC)		0.30	Return Filter Loading PD ("WC)			0.38	TSP:			2.11	"WC

- Motors shall be 3 phase TEFC with a NEMA frame, cast iron construction and a 1.15 service factor. Motor brake horsepower shall not exceed scheduled values. Fan brake horsepower shall not exceed 90% of motor horsepower. All motors shall be premium

efficiency with class F insulation. Shaft grounding will be provided on all VFD controlled motors 10 HP and larger.

4. Isolation: Blower and motor shall be mounted on a unitary base with 1" housed seismic rated spring isolators.
- S. Accessories:
1. Variable frequency drives: Provide variable speed drive for supply and exhaust fans. VFDs shall be factory provided and installed or provided by others and factory installed on the exterior of the unit or inside the unit behind an access door.
 1. Electric heat of capacity, voltage and steps of control specified shall be provided as an integral part of the unit. Field installed segments shall not be acceptable. The electric heater and control panel shall be a U.L. listed electric duct heater.

ELECTRIC HEATER			NONAIRSTREAM	
CFM	ENTERING DB (°F)	LEAVING DB (°F)	PD	kW
2325	6.2	81.0	0.10	55

2. All heaters will be supplied with internal wiring of controls, contactors, etc. including 120-volt, 60 hertz control circuit transformer, automatic reset thermal cut-out and fuses per N.E.C. and U.L. (on heaters exceeding 48 amps).
3. Provide a low temperature limit switch freezestat to shut off unit in the event that the supply air temperature falls to a minimum where the potential to freeze the building exists. Initially set freezestat set point to 40°F.

T. PLATE HEAT EXCHANGER

1. Provide Plate Heat Exchanger in accordance with the following scheduled capabilities:

PLATE HEAT EXCHANGER					SUPPLY & RETURN			
OUTSIDE AIR DATA					RETURN AIR DATA			
MODE	CFM	EAT (DB/WB)(°F)	LAT (DB/WB)(°F)	PD	CFM	EAT (DB/RH)(°F/%)	LAT (DB/RH)(°F/%)	PD
Cooling	2325	89.9/73.9	80.5/71.2	0.44	2325	75.0/55.0	84.3/40.7	0.44
Heating	2325	-20.0/-20.6	32.0/22.0	0.37	2325	60.0/34.9	17.2/100.0	0.40
MODEL: H-1-30A-750					DEFROST MODE SUPPLY LAT (°F): 6.2			

The plate heat exchanger shall be integral to the unit. Provide cross-flow aluminum plates, corrosion resistance, with no cross-leakage.

U. ECONOMIZER

1. Provide 100% economizer operation via bypass around the Plate Heat Exchanger section of the energy recovery unit.

V. CONTROLS

1. The control panel shall be factory provided, field installed remote from the unit.
2. The factory provided controls shall include heater stage control and the following operator interface:
 - a. Fan start and stop
 - b. Heater lockout (summer/winter switch)
 - c. Discharge air temperature set point adjustment
 - d. On and off indicator light. Provide unit status.
 - e. Heater on indicator light. Provide heater status.

- f. Dirty filter indicator light. Provide dirty filter dp switch.
 - g. Freezestat indicator light. Provide freezestat.
 - h. Flow switch. Provide airflow switch rated for 2500 CFM to 10000 CFM, for remote field mounting.
3. The control panel and controls shall be Factory Mutual and CSA Approved for use in a NEMA 4x Control Panel.

W. FILTERS

- The unit shall be provided with integral side-access filter rack holding 2" thick MERV 7 pleated pre-filters sized for maximum 500 fpm face velocity. Filter pressure drop shall be monitored via SPST differential pressure switch and provide remote indication of dirty filter condition.
- Provide Outside air filtration:

OUTSIDE FILTER									OUTSIDE
CFM	TYPE	DEPTH (in)	FACE VEL. (FPM)	MERV	QTY	WIDTH (in)	HEIGHT (in)	CLEAN PD	TOTAL PD
10000	Pleated	2	500	8	6	24	20	0.24	0.62

- Provide Return air filtration

RETURN FILTER									RETURN
CFM	TYPE	DEPTH (in)	FACE VEL. (FPM)	MERV	QTY	WIDTH (in)	HEIGHT (in)	CLEAN PD	TOTAL PD
10000	Pleated	2	500	8	6	24	20	0.24	0.62

X. LOW LEAK DAMPERS

- The unit shall be provided with integral two-position motorized inlet damper with blade edge and jamb seals.

Y. FACTORY START-UP

- A factory employed technician shall be present for unit start-up and specific calibration of control components.

Z. SINGLE POINT CONNECTION

- Unit shall be equipped with a single point electrical connection consisting of a disconnect branch fusing as required by standards referenced below, motor starters, control panels, lights, transformers, and wiring to all motors. The panels and all associated components shall be U.L. listed. All wiring shall comply with N.E.C. The panel shall contain a single point power connection, single-speed fan motor contactor(s) with overload device(s), three-phase ambient compensated overload heater elements, two primary control fuses, one secondary control line size fuse, terminal strip and on/off auto switch. In addition, the motor control panel shall contain a transformer for lights, receptacles and control devices.
- Provide the following electrical characteristics:

ELECTRICAL INFORMATION					UNIT POWER	
COMPONENT	VOLTS	PHASE	FREQ. (Hz)	MOP	MCA	
Electrical Enclosure	460	3	60	125	114.8	
AMP SUMMARY						
Electric Heater	69.0	Exhaust Fan	6.7 x 2	--	--	
Supply Fan	6.7 x 2	--	--	Total:	95.8	

AA. UNIT MOUNTED DISCONNECT

- Each unit shall be equipped with a unit mounted nonfused disconnect. The disconnect shall be in a separate NEMA 4x enclosure.

BB. Accessories

1. Outside air temperature sensor shall be furnished with the unit for field installation.
2. Supply air temperature sensor shall be factory provided, installed with unit.
3. Unit shall be provided with a factory installed return air smoke detector.

PART 3 - EXECUTION

3.1 GENERAL

- A. Verify that proper power supply is available.

3.2 EXAMINATION

- A. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- B. Examine roughing-in systems to verify the following:
 1. Systems are within the limitations established by the manufacturer.
 2. Each utility pipe and conduit is in the correct location.
- C. Examine walls, floors, roofs, and concrete bases for suitable conditions for installation, for example, all overhead work of other trades is complete.
- D. Verify that ground connections are in place and that installation of grounding described in Section "Grounding" is complete.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's printed instructions and in accordance with ARI 435.
- B. Install as shown on the Contract Drawings and in accordance with the manufacturer's installation instructions.

3.4 SPARE EQUIPMENT

- A. Provide one (1) additional set of pleated media filters. Furnish one (1) additional complete set of fan motor drive belts.

3.5 MANUFACTURER'S FIELD SERVICES

- A. Engage a factory-authorized service representative to perform the following inspections, checks, and supervision of testing:
 1. Inspect field-assembled components, equipment installation, and electrical connections for compliance with the manufacturer's installation recommendations and requirements.
 2. Set field-adjustable settings to the values recommended by the equipment manufacturer.

3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and components.
4. Supervise tests performed by independent testing firms. Witness initial energization and perform or supervise startup services.
5. Prepare written report to record the following:
 - a. Inspections and checks carried out on site.
 - b. Test procedures used.
 - c. Test results that comply with requirements.
 - d. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

3.6 DEMONSTRATION AND TRAINING

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the equipment.
 1. Train Owner's maintenance personnel for a minimum of 4 hours on procedures and schedules for energizing and de-energizing, troubleshooting, servicing, and maintaining equipment and schedules.
 2. Review data in Operation and Maintenance manuals.
 3. Schedule training with Owner, with at least 10 days advance notice.

3.7 PAINTING

- A. Perform field painting in accordance with the Section "Painting".

3.8 IDENTIFICATION

- A. Identify as specified in the Section "Identification for HVAC Piping and Equipment."

3.9 CLEANING

- A. On completion of installation, inspect interior and exterior of equipment. Remove dust, dirt, paint splatters and other spots from exterior and wipe down with damp cotton cloth. Touch up exposed surfaces to match original finish. Vacuum interior "white glove clean", removing all dirt and debris while taking care to protect static-sensitive and fragile parts from damage. Do not use compressed air to assist in cleaning.

3.10 PROTECTION

- A. Protect installed equipment from damage through Substantial Completion.

END OF SECTION

SECTION 23 82 00 ELECTRIC TERMINAL UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes Electric Terminal Units as shown on the Contract Drawings.
- B. Equipment includes:
 - 1. Electric Unit Heaters (EUH)
 - 2. Cabinet Unit Heaters (CUH)
 - 3. Electric Ductwork Heating Coils (EDH)
- C. Certain features of Electric Terminal Units shall be as scheduled on the Contract Drawings.

1.3 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American Society for Testing and Materials (ASTM)
 - 2. American National Standards Institute (ANSI)
 - 3. American Society of Mechanical Engineers (ASME)
 - 4. National Fire Protection Association (NFPA)
 - 5. International Fire Code
 - 6. International Building Code
 - 7. International Energy Conservation Code
 - 8. Underwriters Laboratories (UL)
 - 9. National Electrical Code (NEC).

1.4 SUBMITTALS

- A. Submit the following in accordance with the General Conditions.
- B. Product Data: "Catalog cuts" and spec sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.

1.5 QUALITY ASSURANCE

- A. Qualifications
 - 1. Manufacturer's Factory Qualifications: Manufacturing facilities shall have accreditation to ISO 9000:2000 or an equivalent quality management system acceptable to the Engineer.

1.6 WARRANTY

- A. Two year warranty against defects in materials and workmanship from date of Owner's Representative's acceptance.
- B. Provide parts and labor warranty in accordance with the General Conditions.

PART 2 - PRODUCTS

2.1 ELECTRIC UNIT HEATERS (EUH)

- A. Standard Unit Heaters
 - 1. Electric unit heaters shall consist of heating element, fan, motor, controls, and cabinet.
 - 2. Heating element shall be metal sheath type with built-in overheat protection.
 - 3. Fan shall be direct-drive axial-flow type. Fan shall be factory balanced.
 - 4. Controls shall be factory mounted and wired, and shall include magnetic contactors, control power transformer.
 - 5. Unit manufacturer shall provide pre-wired integral thermostat as scheduled.
 - 6. Cabinet shall be heavy-gauge steel with adjustable discharge louvers and rear protective grille.
 - 7. The heater shall be provided with the appropriate wall -mounting kit designed to bear the weight of the heater assembly.
 - 8. Provide the following:
 - a. 24-volt relay, [with] [without] transformer
 - b. 120-Volt control circuit
 - c. Fusing (under 48 amps)
 - d. Diffuser cones for vertically mounted heaters
 - e. Built-in disconnect switch (100 amps maximum).
 - f. Provide phenolic coating on all units' coils, except in the Electrical Room.
 - 9. Indeeco Model UCI or equal by Chromalox or Trane.
- B. Explosion Proof Unit Heaters
 - 1. Electric explosion-proof unit heaters shall have the KW rating, voltage and phase specified in the schedule. They shall be forced fan type, Factory Mutual and CSA approved for:
 - a. Class I, Divisions 1 and 2, Group D; Ignition Temperature Code No. T3C, 320 deg F (Standard construction).
 - 2. Unit heaters shall have dual automatic reset thermal cutouts for redundant over-temperature protection, controlling magnetic contractor and 24-volt control circuit transformer housed in a NEMA 7, cast aluminum enclosure.
 - 3. The heat exchanger shall be liquid-to-air design, utilizing a copper tube core with integral aluminum fins. Nontoxic, inhibited, propylene glycol heat transfer fluid shall be used that provides freeze protect freeze protection down to -49 deg F. Pressure relief valve setting to be 70 psig.
 - 4. Heat exchanger and aluminum fan blade shall be enclosed in an industrial grade, corrosion resistant cabinet fabricated from powder coated, 14 gauge steel. Adjustable outlet louvers to have minimum opening safety stops.

5. Fan motor shall include permanently lubricated ball bearings and built-in thermal overload protection. Motor to operate at line voltage and be prewired to the control enclosure to eliminate the need for separate field wiring to the motor.
6. The heater shall be provided with the appropriate wall -mounting kit designed to bear the weight of the heater assembly.
7. Dirty duty, corrosion-resistant construction with epoxy-coated chem-duty motor; iridite-plated heat exchanger; epoxy-coated fan blade; NEMA 4X, 7, 9 terminal box, conduit and fittings; stainless steel hardware.
8. Provide the following controls built-in and factory-prewired.
 - a. Adjustable built-in thermostat.
 - b. Disconnect switch with external handle.
 - c. Manual reset thermal cutout for triple over-temperature protection.
 - d. "Heater On" pilot light to indicate when heating elements are energized.
 - e. "Warning" pilot light to indicate when thermal cutouts have tripped and heater needs to be serviced.
 - f. Manual reset thermal cutout with backup contactor.
 - g. 120-volt control circuit for special external thermostat circuit.
 - h. "Heater On" pilot light to indicate when heating elements are energized.
9. Provide phenolic coating on coils.
10. Indeeco Ultra Safe or equal by Chromalox or Trane.

2.2 CABINET UNIT HEATERS (CUH)

- A. Each heater shall include chassis, coil, fanboard, fanwheel, housing, motor, and insulation. Chassis shall be galvanized steel wrap-around structural frame with all edges flanged. Insulation shall be faced, heavy density glass fiber. Heaters shall be as manufactured by Indeeco or approved equivalent as manufactured by Trane or Chromalox. Units shall be of type, capacity and configuration as shown in the schedule.
- B. Cabinets
 1. Cabinet shall be 16 gauge steel, cleaned, bonderized, phosphatized, and flow-coated with baked-on primer. A baked on enamel final finish shall be provided from a selection of seven (min.) decorator colors. Cabinets shall be semi-recessed, wall mounted type with architectural type bar grilles.
- C. Coils
 1. Electric coils shall be Nichrome elements with an open wire design.
- D. Fans
 1. Fan wheels centrifugal, forward-curved, double width of steel or aluminum. Fan housing of formed sheet metal.
- E. Motors
 1. Motors shall have integral thermal overload protection and start at 78% rated voltage. Motors shall operate satisfactorily at 90% of rated voltage on all speed settings and at 10% over voltage without undue magnetic noise. Temperature rise by winding resistance method shall not exceed 60C shaded pole motors and 50C for PSC motors on high speed. Motors shall be factory run tested assembled in unit prior to shipping. Motor cords shall be quickly detachable at junction box by locking prong connector on vertical cabinet and wall hung units.

- F. Filters
 - 1. Removable from horizontal units by pivoting hinged bottom panel. Filters shall be 1 inch woven glass 30% efficiency throwaway type filters. Contractor shall purchase one spare set of filters for replacement of factory shipped filters upon completion of start-up.
- G. Provide the following:
 - 1. Smooth finish back-mounting plate, when back of the heater is visible.
 - 2. Recess trim for non-surface mounted units.
 - 3. Sub-base for floor-mounted units.
 - 4. Manual reset for backup thermal protection.
 - 5. Fusing (under 48 amps).
 - 6. On / Auto fan switch; tamperproof and adjustable through the grille with a screwdriver.
 - 7. 24-volt relays instead of a switch or thermostat.
 - 8. Provide phenolic coating on coils.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- B. Examine walls, floors, roofs, and concrete bases for suitable conditions for installation, for example, all overhead work of other trades is complete.
- C. Verify that ground connections are in place and that installation of grounding described in Section "Grounding" is complete.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Equipment shall be installed, supported, cleaned, tested, and adjusted in accordance with manufacturer's recommendations and instructions.
- B. Install equipment as shown on the Contract Drawings and in accordance with the manufacturer's installation instructions.

3.3 IDENTIFICATION

- A. Identify equipment as specified in Section "Identification for HVAC Piping and Equipment."
- B. Emergency Operating Instructions: Frame and mount under clear acrylic plastic for wall mounting.

- C. Operating Instructions: Frame printed operating instructions. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchgear.

3.4 PROTECTION

- A. Protect installed equipment from damage through Substantial Completion.

END OF SECTION

SECTION 26 00 00 ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide complete, tested and fully functional electrical systems as shown on the Drawings and as specified herein.
- B. Electrical equipment and installed systems shall be suitable for the application, shall be safe for the intended use, shall be fully rated for the available fault current, and shall conform to local building codes and statutory requirements.

1.2 SCOPE OF WORK

- A. Electrical requirements specified in this Section apply to electrical work provided by all Contracts/trades.

1.3 PROJECT CONDITIONS

- A. Electrical equipment shall be suitable for the following environmental ranges unless otherwise specified:
 - 1. Exterior Temperature: -10 to 104 degrees F.
 - 2. Interior Temperature: 50 to 104 degrees F.
 - 3. Humidity: Less than 90 percent (non-condensing).
 - 4. Altitude: Not exceeding 100 feet.
- B. Allocated Space
 - 1. Electrical equipment shall be installed in the spaces allocated on the Drawings.
 - 2. Subject to review and approval by the Engineer, electrical equipment exceeding the allocated space may be provided. The Contractor shall bare all additional costs associated with its installation including re-design, relocations and costs to others.

1.4 DEFINITIONS

- A. In addition to the definitions in Definition of Terms, the following definitions apply to Divisions 26 and 27:
 - 1. Acceptance Tests: power distribution and control equipment testing performed in conformance with NETA Acceptance Testing Specification
 - 2. AEIC: Association of Edison Illuminating Companies
 - 3. AHJ: The statutory Authority Having Jurisdiction as defined in NEC Article 100 for enforcement of legally required compliance to local codes, standards, and ordinances.

4. ANSI: American National Standards Institute
5. ASQ: American Society for Quality
6. AWG: American Wire Gauge
7. Cable: an assembly of insulated conductors
8. CFR: Code of Federal Regulations
9. Commissioning: the process of testing system performance after the sequential steps of installation, testing, energization, startup (including initial adjustment and de-bugging) and functional testing of individual pieces of equipment have all been completed
10. Control panel: an electrical enclosure incorporating control logic devices and an operator control interface
11. Equipment: a general term including appliances, fixtures, apparatus, and the like, used as part of, or in connection with, an electrical installation
12. Fail-safe: Failure of a device without endangering personnel or causing major damage to facilities or the environment.
13. Field test: electrical test carried out on-site
14. Field wiring: on-site installation of raceways and conductors to connect equipment
15. FM: Factory Mutual, Inc.
16. Functional testing: verification of the satisfactory performance of controls under actual operating conditions
17. Furnish and install: same as "Provide" below.
18. HV: high voltage, operating voltage over 600 volts (NEC definition)
19. ICEA: Insulated Cable Engineers Association
20. IEEE: Institute of Electrical and Electronics Engineers, Inc.
21. ISO: International Standards Organization
22. Lineup: with respect to switchgear, switchboards, and motor control centers, a contiguous group of vertical sections with common main busbars.
23. LV: low voltage, operating voltage under 600 volts (NEC definition)
24. Materials: a general term including readily available construction items such as raceways, boxes, fittings, wire, cable, fasteners, hardware and the like.
25. Megger: insulation tester with megohm scale
26. NEC: NFPA 70, the National Electrical Code
27. NETA: InterNational Electrical Testing Association, Inc.
28. NFPA: National Fire Protection Association
29. NICET: National Institute for Certification in Engineering Technologies
30. Nonconformity: The nonfulfillment of a specified requirement (ASQ definition)
31. NRTL: Nationally recognized testing laboratory as defined in 29 CFR 1910.7 as it applies to testing and inspecting for safety in the workplace (OSHA definition)
32. "Or approved equal": proposed "equal" product shall be in conformance with all specified requirements, shall be equivalent in materials of construction to specified manufacturers' products, shall have equal or superior performance in the conditions anticipated for use of the product in this project, and shall be approved by the Engineer
33. OSHA: Occupational Safety and Health Act
34. Panel: with respect to power distribution centers, "panel" is equivalent to "panelboard"; with respect to control panels, refers either to the entire control panel itself or to a steel plate used for mounting devices inside the control panel
35. Provide: All tasks associated with procuring and placing in operation materials and equipment (unless otherwise noted) or all tasks associated with furnishing a service, including project administration, quality assurance, human resources,

tools & equipment, logistics and scheduling, submittals of shop drawings & samples for approval, managing suppliers, purchasing, manufacturing, factory testing, release for shipment, packing, delivery, storage, submittal of coordinated & dimensioned installation drawings for approval, installation, surface preparation & finishes, site testing, startup & commissioning, on-site supervision by equipment manufacturers' representatives, spare parts & tools, Operations and Maintenance (O&M) Manuals, training, guarantees and warranties, other work described in the Contract Documents, and the Contractor's duties, responsibilities, risks, and liabilities under the Contract.

- 36. Punch list: document containing descriptions of non-conformities
- 37. Quality: conformance to specified requirements.
- 38. Raceways: conduit, and associated boxes and fittings which enclose, support, and protect wires and cables
- 39. RMS: root mean square
- 40. Shop drawings: a complete package of manufacturer's equipment drawings, bill of materials, catalog data sheets, performance data, calculations, and other information provided to demonstrate conformance to the equipment specification
- 41. Substantial Completion: an electrical system may be considered substantially complete when the equipment has passed the specified tests required prior to energization, has been energized, has passed the Electrical Acceptance Tests, and all related Contract requirements have been met except for well-defined minor items which, in the opinion of the Engineer, may be repaired or replaced prior to Final Acceptance without adversely affecting process performance.
- 42. Substitution: an alternative, nonconforming product proposed by the Contractor in lieu of a specified, conforming product
- 43. Terminal box: an electrical enclosure containing labeled terminal blocks for connection of wiring
- 44. UL: Underwriters Laboratories, Inc.
- 45. Wiring: conductors, cables, conduits, fittings, supports and connections to equipment terminals. 'Wiring' and 'cabling' shall be considered equivalent terms. Fiber optic cables shall be included in the scope of electrical wiring where specified.

1.5 REFERENCE STANDARDS IN EFFECT

- A. Notwithstanding revision dates shown in this and other Sections of Divisions 26 and 27, the codes and standards applicable to this project shall be those in effect when bids are submitted.

1.6 QUALITY ASSURANCE

- A. In consultation with the equipment and material suppliers, the Contractor shall prepare and submit a Compliance Statement with submittals requiring approval when specified or requested. Compliance statement shall be as described in "SUBMITTALS".
- B. The Engineer's review of a submittal shall not relieve the Contractor of any Contractor responsibilities under the Contract. Review of a submittal that is incomplete, or one that has nonconformities that are not described in the Compliance Statement, followed by the discovery of unapproved nonconformities, will result in replacement of the non-conforming items at no additional cost to the Owner. Substitutions require the approval of the Engineer.

- C. Manufacturers of electrical equipment and materials shall have quality certification to ISO 9001:2000 or an equivalent Quality Management System acceptable to the Engineer.
- D. Equipment and materials shall be listed and labeled as defined by NEC Article 100 by an NRTL acceptable to the AHJ and marked for intended use.
- E. On-site electrical acceptance testing shall be performed as specified in Part 3 of other Sections of the Specification.
- F. Manufacturers, manufacturer's representatives, subcontractors, supervisors, installers, and testing agencies shall have qualifications and experience as described in other Sections of the Specification. Qualifications and experience submittals for firms and individuals shall be submitted, re-submitted, or updated whenever requested by the Engineer.

1.7 SAFETY IN THE WORKPLACE

- A. Electrical equipment and materials, and the Contractor's installation practices, shall conform to the following:
 - 1. Current edition of OSHA sections of the Code of Federal Regulations (CFR): Part 29 CFR 1910 for General Industry and Part 19 CFR 1926 for Construction Activities
 - 2. NFPA 70, the National Electrical Code
 - 3. Current edition of NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces
- B. These regulations and standards impose obligations on equipment manufacturers to obtain NRTL certification, listing, and labeling to comply with OSHA (Occupational Safety and Health Act) and Department of Labor regulations.
- C. All electrical equipment for which NRTL test procedures have been established shall be certified, listed, and labeled, or otherwise determined to be safe for its intended use, by a NRTL. The absence of a specific reference to NRTL-listing in other Sections shall not relieve the Contractor of the requirement to provide NRTL-listed equipment, and to obtain certification as required by the AHJ in cases where NRTL listing and labeling is not a manufacturer's standard offering for a specific product.
- D. Equipment shall not be modified in any manner adversely affecting safety for the intended use, nor shall any equipment be modified on-site without the approval of the manufacturer.
- E. Equipment sound levels shall not exceed limits established by the more stringent of reference standards, local regulations and equipment specifications. In the absence of reference standards, local regulatory requirements or equipment specifications, sound pressure levels shall not exceed 85 dB (A) measured twenty-three feet from the equipment.
- F. Equipment with moving parts shall be fully guarded in compliance with OSHA rules and regulations.

1.8 INSPECTIONS BY THE AHJ

- A. The Contractor shall arrange for electrical inspection of the project by the AHJ. Upon completion of the work, final certificate of approval documents shall be submitted to the Engineer for forwarding to the Owner. This certificate shall be submitted prior to request for final payment. The Contractor shall pay all fees required for inspection.

1.9 WORKMANSHIP AND MATERIALS

- A. Materials and equipment shall be new and undamaged, shall be marked by the manufacturer, and shall be delivered to the construction site in the original factory packaging.
- B. Materials and equipment shall be installed in accordance with the Contract Documents, the manufacturer's installation, operation, and maintenance instructions, and NECA installation standards that have been adopted by ANSI. In the event of apparent conflicts or discrepancies, the Engineer shall be informed of the apparent conflict or discrepancy in writing, and will instruct the Contractor how to proceed.
- C. Materials and equipment of the same type, classification or use shall be the products of the same manufacturer.

1.10 RESOURCES AND CONSTRUCTION SCHEDULE

- A. The Contractor shall provide sufficient resources, including qualified and experienced project managers, electrical engineers, superintendents, technicians, supervisors, electricians, tools and construction equipment to complete the electrical work in accordance with the activity durations and sequences shown on the Construction Schedule for this project.
- B. The construction schedule shall include the following activities, in sequence, for each major item of electrical equipment:
 1. Review of shop drawings
 2. Approval of shop drawings
 3. Factory testing
 4. Shipping
 5. Delivery to site
 6. Room ceiling, wall and floor finishing complete (ready for equipment installation)
 7. Concrete equipment pad or equipment platform installation
 8. Equipment installation
 9. Tests and inspections after installation (prior to energization)
 10. Energization
 11. Acceptance testing
 12. Functional testing
 13. Installation, acceptance testing, functional testing and commissioning complete
- C. The construction schedule shall include the following activities, in sequence, for electrical wiring in building:
 1. Materials delivery to site

2. Room ceiling, wall, and floor finishing complete (ready for exposed raceway installation)
3. Raceway installation
4. Wire and cable installation
5. Acceptance testing complete

1.11 CONTRACT DRAWINGS

- A. Electrical drawings are diagrammatic and functional only and are not intended to show exact circuit layouts, number of fittings, or other installation details. The Contractor shall furnish all labor, equipment and materials necessary to install and place in satisfactory operation all power, control and other electrical systems shown.
- B. Drawings show routing of selected site conduits. Interior conduit routings are not shown. Provide conduit routings in accordance with the Division 26 Section "Raceways and Boxes for Electrical Systems".
- C. Conduit schedules generally detail conduit sizes and conductor quantities from the point of origin and do not detail all branches and connections. Contractor shall provide branches and connections as necessary to facilitate circuit wiring as shown on the one-line diagrams, elementary diagrams, manufacturer's wiring diagrams and as required.

1.12 COORDINATION OF ELECTRICAL WORK WITH OTHER TRADES

- A. Work under this Division shall be performed in conjunction with the work of other trades. Coordinate electrical installation work with the overall construction schedule. Examine the plans, specifications and existing conditions prior to commencement of work and become familiar with all phases of work involved prior to commencing installation work.
- B. The Contractor shall be responsible for coordinating dimensions of equipment and working clearances in accordance with the NEC, and in all cases, shall bring to the attention of the Engineer any discrepancies on the plans and in the specifications prior to installation. Any work installed without conformance to NEC requirements shall be removed and reinstalled at the Contractor's expense. Examine drawings and approved submittals of other trades for factors affecting electrical work prior to roughing-in raceways, boxes, fittings, and outlets.

1.13 CODES AND STANDARDS

- A. All equipment and materials shall be manufactured, tested, and installed in accordance with the National Electrical Code (NEC), local codes and standards, in accordance with the requirements of the AHJ unless more stringent requirements are shown or specified.
- B. In addition, work shall be in accordance with the versions of the following referenced standards in effect at the time of bid opening:

1. American Association for Laboratory Accreditation (A2LA) (establishes NRTL accreditation)
2. American National Standards Institute (ANSI)
3. American Society for Testing and Materials (ASTM)
4. Code of Federal Regulations (29 CFR 1903, 1910, and 1926)
5. Factory Mutual Engineering & Research (FME&R)
6. Illuminating Engineering Society of North America (IESNA)
7. Institute of Electrical and Electronic Engineers (IEEE)
8. Insulated Cable Engineers Association (ICEA)
9. International Building Code (IBC)
10. International Organization for Standardization (ISO)
11. National Electrical Contractors Association (NECA)
12. National Electrical Manufacturers Associates (NEMA)
13. National Fire Protection Association (NFPA)
14. Occupational Safety and Health Act (OSHA)
15. Underwriters Laboratory, Inc. (UL) and other NRTL standards and test procedures

1.14 HAZARDOUS AREAS

- A. Electrical equipment for use in hazardous areas shall be NRTL listed and labeled for the application. Equipment, material and installation shall be in accordance with NEC requirements for the hazardous area classification indicated on the Drawings.
- B. Heat-producing equipment having a maximum temperature over 100 degrees C and installed in hazardous areas shall be marked for the temperature class or maximum operating temperature in accordance with the NEC. NEC Temperature Class shall be T3C (maximum operating temperature of 160 degrees C) unless a more stringent requirement is indicated elsewhere in the Documents.

1.15 SUBMITTALS

- A. In addition to conforming to the requirements described in the Division 1 Section "Submittal Procedures", submittals shall also conform to the requirements herein.
- B. One complete submittal is required for all equipment and material described in a single Division 26 or 27 Section of the Specification. Incomplete submittals, and out-of-sequence submittals, will be reviewed to the extent needed to determine incompleteness and out-of-sequence, and returned to the Contractor for re-submission.
- C. Compliance Statement: Statement listing each Specification Section, and Part 1, 2, and 3 Sub-Sections, stating, paragraph-by-paragraph, compliance with the Specification, each minor nonconformity that is within the intent of the Specification, and proposed nonconformities. Provide short description of minor nonconformities, and detailed explanation of other nonconformities.

D. Submittal Format

1. Each submittal shall be accompanied by a transmittal letter showing the submittal category and Specification Section reference number(s). Hardcopy submittals shall be 3-hole punched and neatly bound in a 3-pin or 3-ring binder. Stapled bindings are not acceptable.
2. Submittals shall have a complete Table of Contents with tabs corresponding to the Table of Contents headings.
3. Submittal transmittal letters shall clearly identify the reason for submittal, e.g., for approval, as manufactured, or as-built / record.
4. Each page of each submittal shall be numbered. Page numbers shall be listed on the Table of Contents. Hardcopy submittals shall have content printed on 8-1/2 x 11 inch paper, or 11 x 17 paper (folded). Larger size drawings shall be folded and placed in labeled individual clear plastic pockets.
5. Product Data shall be clearly marked to show which items are proposed for this project. Information that does not apply to this project shall be crossed out.

E. Submittal Categories

1. Preconstruction Submittals, including proposed substitutions, supplier and manufacturer qualifications and experience, construction scheduling
2. Shop Drawings, including equipment drawings with a complete bill of materials and supporting manufacturer's catalog data. One separate and complete shop drawing submittal for all equipment specified in each Section is required.
3. Product Data, marked to indicate precisely which items are proposed for this project. One complete and separate Product Data submittal for all equipment and materials described in each Section requiring a product data submittal, is required. See Submittals requirements in other Sections in Division 26 and 27 to determine if Product Data is to be included in submittals.
4. Samples, labeled by name, Specification Section and paragraph, and mounted on sample boards
5. Design Data, including manufacturer's design calculations, where specified
6. Test Reports, including prototype tests, factory tests, field tests, acceptance tests, and functional tests. A test report is required for each specified test.
7. Certificates, including, ISO certifications, welding certificates, factory training certificates for manufacturer's representatives
8. Manufacturer's Installation Instructions, including unloading, hoisting, rigging, short term storage, long term storage, method of field assembly, and other installation instructions
9. Manufacturer's Field Reports, including inspections and training records
10. Operation and Maintenance Manuals, including manufacturer's standard published literature and specially prepared descriptions of operation
11. Closeout Submittals, including black line paper copy of Record Drawings marked in red illustrating changes during construction
12. Spare Parts and Special Tools List

F. Shop Drawings shall be marked with revision blocks to indicate status as follows:

1. FOR APPROVAL
2. AS MANUFACTURED (incorporates Engineer's comments)
3. AS BUILT / RECORD (incorporates on-site modifications)

- G. Record Drawings: In addition to requirements in the Division 1 Section "Project Record Documents", maintain a full-size paper set of "black-line" working drawings throughout the project, and carefully record in red ink changes in the locations and sizes of each major item of electrical equipment, as well as underground conduit routing, to scale. Upon Substantial Completion of the work, deliver the marked-up set of prints to the Engineer. The Engineer reserves the right to withhold final payment until record drawings are received.
- H. Operation and Maintenance Manuals: In addition to requirements in the Division 1 Section "Operation and Maintenance Data", provide copies of electrical Operation and Maintenance Manuals as specified herein. O&M Manuals shall be organized according to Specification Section names. Hardcopy manuals shall be bound in a durable, 3-ring hardback binder, with sheets individually punched and reinforced to prevent tearout. Content shall be grouped to match the Table of Contents. Each hardcopy manual shall have an identifying label on the spine and front cover. Manuals shall include the following:
1. Table of Contents
 2. Copy of each of the following as applicable
 - a. Preconstruction Submittals
 - b. Shop Drawings
 - c. Product Data
 - d. Design Data
 - e. Test Reports
 - f. Certificates
 - g. Manufacturer's Instructions
 - h. Manufacturer's Field Reports
 - i. Operation and Maintenance Data
 - j. Closeout Submittals
 - k. Spare Parts and Special Tools List
 - l. Copy of Overcurrent Protective Device Coordination Study
 - m. Settings of adjustable parameters
 3. Include contact data (names, addresses, telephone numbers, fax numbers, e-mail addresses) for parts and service.
- I. Spare Parts and Special Tools List: 90 days prior to the scheduled Substantial Completion date, submit a complete list of spare parts and special tools specified in other Sections of Divisions 26 and 27 to the Owner, and request a time and location for delivery of the spare parts to the Owner.

1.16 OUTAGES

- A. Electrical outages: Do not interrupt electrical service to facilities occupied by Owner or in use by others unless permitted under the following conditions:
1. Submit written requests to the Owner for approval of proposed electrical outages a minimum of two weeks in advance of proposed interruption of electrical circuits, with step-by-step sequence and schedule for proposed outage. If required to maintain processes in operation during an outage, submit proposed method of providing temporary electrical circuits and power supplies.
 2. Confirm approved interruption of electrical service two days in advance of Owner-approved date.

3. Do not proceed with interruption of electrical circuits without written approval from the Owner.
4. Coordinate outages so as not to inconvenience or impede the progress of other trades.

1.17 TEMPORARY POWER AND LIGHTING

- A. Temporary power and lighting shall include all panels, feeders, lighting fixtures, outlets, branch circuits, etc.
- B. The Owner's electrical power shall not be used without permission of the Owner.
- C. All temporary work shall be in accordance with the NEC, OSHA, and NFPA safety requirements and shall be completely removed upon completion of the project.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

- A. Provide equipment and materials in compliance with this Section and other Sections of Division 26 and 27.

2.2 ELECTRICAL IDENTIFICATION

- A. Electrical equipment, raceways, boxes, fittings, wires and cables shall be marked in the field in accordance with the Division 26 Section "Identification for Electrical Systems".

2.3 ELECTRICAL ENCLOSURES

- A. Enclosures for electrical equipment shall be NEMA Type 1, except as modified below or otherwise specified:
 1. Electrical equipment enclosures located in above ground, outdoor, non-hazardous areas shall be NEMA Type 4 or NEMA Type 4X construction.
 2. Electrical equipment enclosures located in hazardous areas shall be rated for the class, division and group as indicated on the Drawings unless operating on intrinsically safe circuits. Electrical equipment located in hazardous areas and operating on intrinsically safe circuits shall be NEMA 4X.
 3. Where electrical equipment is installed in control panels or other assemblies, no additional enclosures are required except where specifically specified or shown.
 4. Motor enclosures shall be as specified in the Division 26 Section "Common Motor Requirements".
 5. Lighting fixture enclosures shall be as scheduled on the Drawings.
 6. Device boxes, junction boxes, pull boxes and other conduit system accessories shall be as specified in the Division 26 Section "Raceways, and Boxes for Electrical Systems".

2.4 DISSIMILAR METALS

- A. Dissimilar metals shall not be connected, spliced, or joined except where specifically approved in writing by the Engineer. Copper bus bars, aluminum bus bars, and copper-to-aluminum bus bar connections shall be tin-plated at joints and at cable lugs. Bolted electrical conductor connections shall be made with silicone-bronze or grade 3 or better plated steel bolts, nuts, and washers. Belleville washers and tin-plated flat washers shall be used at aluminum-to-copper and aluminum-to-aluminum bus bar joints.

2.5 WARRANTIES

- A. Provide an on-site parts and labor warranty for a minimum period of one year after Substantial Completion for all equipment and materials unless otherwise specified. In cases where the manufacturer offers a longer warranty period, the longer warranty period shall apply as described by the manufacturer.
- B. All components of electrical systems that are not fully functional at the time of Substantial Completion shall have warranties extended to provide minimum one year coverage of fully operational equipment unless otherwise approved by the Engineer.

PART 3 - EXECUTION

3.1 DELIVERY AND HANDLING

- A. Materials and equipment delivered to site shall be handled in accordance with manufacturer's recommendations by experienced riggers, crane operators, and fork lift truck operators.

3.2 STORAGE AND PROTECTION

- A. All electrical materials and equipment to be used in construction shall be properly stored and protected against the elements. General construction materials shall be stored in covered trailers. Electrical equipment shall be stored in a clean, dry, indoor location, under cover, until the area where the equipment is to be installed has been completed to the satisfaction of the Engineer, including completion of overhead work by other trades.
- B. Long and short term storage instructions of the manufacturer shall be followed.
- C. Equipment with anti-condensation heaters shall have the 120VAC anti-condensation heaters energized from temporary 120VAC supplies immediately after factory packaging has been opened.
- D. Equipment exposed to painting, dust, spackling, waterproofing, insulation etc. shall be covered and protected against damage.

3.3 INSPECTIONS PRIOR TO CONCEALMENT

- A. Raceways to be concealed shall be inspected in the presence of the Engineer prior to concealment. Sufficient time shall be allowed to make corrections if required.

3.4 ON-SITE INSPECTIONS AND NONCONFORMITIES

- A. Equipment and materials shall be inspected on delivery to site for physical damage and for compliance with the Specification and approved equipment shop drawings.
- B. Installed equipment, and materials shall be inspected on completion of installation for compliance with the Contract requirements.
- C. A Punch List will be prepared by the Engineer during inspections and testing, and issued to the Contractor for corrective action.
- D. Repairs, replacements, and other corrective actions considered in the opinion of the Engineer to be major items shall be completed prior to the scheduled date for Substantial Completion of the project.

3.5 ALTERATIONS TO EXISTING FACILITIES

- A. Provide all alterations to existing facilities as necessary to allow installation of new electrical systems as required.
- B. Visit the project site prior to submitting bids and examine existing facilities and the conditions in which work will be performed.
- C. While performing work in existing facilities, the Contractor shall take special care to protect existing features that are required to remain from dirt, debris and damage. Damage repair, including equipment replacement, shall be provided at no additional cost to the Owner.

3.6 CLEANING AND PAINTING

- A. After equipment installation and wiring work is completed, all dust and debris shall be removed from the interior and exterior of each electrical equipment enclosure by vacuum-cleaning with circuits de-energized. Do not use compressed air for cleaning. Vacuum cleaner wands and brushes shall be non-conducting. Anti-static protection shall be provided for static-sensitive devices.
- B. Clean and remove all rust, scale, oil, grease, and dirt from enclosures, conduits, pull, junction and terminal boxes, fittings and hangers.
- C. All ferrous materials that are concealed, or exposed, including fittings, hangers, junction, pull and terminal boxes, that are not plated or painted with a factory-applied finish, shall be painted by the Contractor with one coat of zinc-chromate primer and one finish coat of paint approved by the Engineer. Nonferrous materials shall be cleaned only and left unpainted.
- D. Equipment furnished with a factory finish coat shall have finish carefully touched-up where it is scratched or otherwise damaged. Touch-up work shall be match the color and type of the original finish.

3.7 INSPECTION AND TESTING ON-SITE

- A. The Contractor shall hire a NETA-certified or NICET-certified specialist electrical testing firm to perform on-site inspection and electrical testing.
- B. Perform Electrical Acceptance Tests in accordance with NETA Acceptance Testing Specifications ATS-2007 listed in Part 3 of each Section of Division 26 and 27.
- C. Submit manufacturer-endorsed field test data sheets and procedures for approval, test equipment and materials on-site prior to site visit by manufacturer's factory-trained representative, test equipment on-site under the supervision of the Engineer and the equipment manufacturer's factory-trained representative(s), and submit manufacturer's statement of acceptance of installation prior to energization of equipment. Invite the Owner and Engineer to witness field testing.
- D. Electrical equipment shall not be energized without the approval of the Engineer.
- E. A complete certified electrical test report shall be compiled by the electrical testing firm, checked for completeness, and submitted for the record.
- F. The Contractor shall notify all parties whose presence is necessary for the test; and in all cases, the Engineer shall be notified at least one week prior to the actual test.

3.8 TRAINING

- A. Upon completion of all work furnished and installed under Divisions 26, instruct and train the Owner's personnel in the operation and maintenance of all equipment to the complete satisfaction of the Engineer. Additional training requirements shall be as specified in Sections of Divisions 26. Training shall start when the installations have been completed, the equipment has been put in operational condition and has been tested as specified.
- B. Training shall take place at the project site at times convenient to the Owner. A complete Training Course syllabus shall be submitted with a Contractor's proposed schedule for instruction and training.
- C. Provide classroom and on-site training of the Owner's personnel by an authorized representative of the equipment manufacturer during commissioning of the following electrical equipment:
 - 1. Switchboard
 - 2. Motor control center
 - 3. Standby generator
 - 4. Automatic transfer switch
 - 5. Mobile generator connection cabinet

END OF SECTION

SECTION 26 00 20 COMMON MOTOR REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide electric motors as shown on the Drawings, as specified herein, and as specified in electric motor-driven equipment sections elsewhere in the Specification.
- B. This Section describes requirements for horizontal and vertical 3-phase squirrel cage induction motors up to nominal 500 HP in NEMA standard frame sizes.

1.2 DEFINITIONS

- A. The following definitions apply to this Section:
 - 1. ABMA: American Bearing Manufacturers Association
 - 2. AFBMA: Anti-Friction Bearing Manufacturers Association (former name of ABMA)
 - 3. BHP: brake horsepower
 - 4. HP: horsepower
 - 5. IP: International Protection Code
 - 6. ODP: Open drip-proof
 - 7. ODP FG: Open drip-proof, fully guarded
 - 8. TEFC: Totally enclosed fan-cooled
 - 9. TENV: Totally enclosed non-ventilated
 - 10. V_{peak} : single amplitude zero-to-peak line-to-line voltage
 - 11. V_{rated} : nameplate line-to-line voltage

1.3 REFERENCE STANDARDS

- A. Comply with the following standards:
 - 1. NEMA Standard MG1-2003 (Rev. 1 – 2004) Motors and Generators
 - 2. ANSI / IEEE Standard 112 Standard Test Procedure for Polyphase Induction Motors and Generators
 - 3. IEEE 841 Standard for Petroleum and Chemical Industry - Severe Duty Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors - Up to and Including 370 kW (500 hp)
 - 4. NEC: National Electrical Code (NFPA 70)
 - 5. Underwriters Laboratories, Inc. (UL)

1.4 QUALITY ASSURANCE

- A. Motors shall be designed, manufactured, and tested in accordance with the Codes and Standards referenced in this Section.

1.5 SUBMITTALS

- A. Motor submittal data shall be included with the shop drawings for the associated driven equipment.
- B. Motor submittal data shall include the following:
 - 1. Motor assembly drawings with the following information:
 - a. Enclosure type with degree of protection (IP rating)
 - b. Materials of construction of housing, stator, rotor, fan, fan guard
 - c. Bearing types, bearing construction, shields and seals
 - d. Lubrication system
 - e. Location of lubrication fittings
 - f. Location and type of breathers and drains for totally enclosed motors
 - g. Internal and external coatings
 - h. Direction of rotation
 - i. Electrical wiring diagrams for connection of windings and accessories
 - 2. Motor specification data sheets with the following motor nameplate information:
 - a. Manufacturer's type and frame designation
 - b. Horsepower output
 - c. Time rating
 - d. Maximum ambient temperature for which the motor is designed
 - e. Insulation system designation
 - f. Full load RPM
 - g. Voltage(s)
 - h. Frequency
 - i. Number of phases
 - j. Full load amperes
 - k. NEMA Code Letter for locked-rotor amperes (or locked rotor amperes)
 - l. NEMA nominal efficiency
 - m. Motor service factor for sine wave applications
 - n. Designation "Thermally Protected" or "OVER TEMP PROT – [type number per NEMA MG1]" as applicable
 - o. ABMA bearing ID number(s)
 - p. NRTL and listing for hazardous areas where applicable
 - 3. Where specified in other Sections of the Specification, submit motor guaranteed minimum efficiency data at $\frac{1}{2}$, $\frac{3}{4}$ and full load.
 - 4. Submittals shall include information for all specified motor options, with sufficient detail to demonstrate that the motor is suitable for the application.
 - 5. Factory Test Reports (when requested)

6. Manufacturer's Installation Instructions: including manufacturer's shipping, receiving, handling, rigging, storage and setting instructions, recommendations, cautions, and warnings.
7. Field Test Reports

PART 2 - PRODUCTS

2.1 DRIVE APPLICATION

- A. Motors shall be selected by the driven equipment manufacturer for the drive application, and for operation within the motor nameplate horsepower rating without applying the service factor.
- B. Motors shall have output torque characteristics, direction of rotation, rotational speed, dimensions, bearings, and accessories suitable for the drive application. Motor output shaft dimensions and keyway shall be suitable for connection to the driven equipment coupling.
- C. Motors shall be capable of successfully accelerating inertial loads tabulated in NEMA MG1-1998 Section 12.54 without injurious heating. In cases where the actual load inertia exceeds, these values, the driven equipment manufacturer shall select a larger motor capable of successfully accelerating the inertial load without injurious heating.
- D. Motor continuous output horsepower shall be limited to the 1.0 service factor rating.

2.2 VOLTAGE RATINGS

- A. Motors ½ HP and larger shall be 460 V or 208 V (as shown on the Drawings), three phase 60 Hertz, unless otherwise indicated.
- B. Motors 1/3 HP and smaller shall be 120 V, single phase, 60 Hertz, unless otherwise indicated.

2.3 EFFICIENCY

- A. Motors 1 HP and larger shall have nominal and minimum guaranteed efficiencies in accordance with NEMA MG1-2003 Table 12-12 Full-Load Efficiencies for NEMA Premium™ Efficiency Electric Motors Rated 600 Volts or Less (Random Wound). Efficiency shall be tested in accordance with IEEE 112 Method B.

2.4 STATOR WINDINGS AND INSULATION

- A. Motors shall have moisture-resistant Class F insulated copper stator windings. Motors shall be designed for both full-voltage and reduced-voltage starting.
- B. Motors shall have 1.15 minimum service factor for sine wave applications and Class B temperature rise when operated at rated HP at 1.0 service factor.
- C. Motors shall have minimum peak impulse voltage rating $V_{peak} = 1000$ V, with rise time as short as 2 microseconds, in accordance with NEMA MG1-2003 30.2.2.8.
- D. Motors shall have stall times of 12 seconds minimum when initially at normal operating temperature, in conformance with NEMA MG1-2003 12.49.

2.5 DEGREE OF PROTECTION

- A. Motors housings shall have enclosures with degree of protection ratings as specified below unless a higher degree of protection is specified in the driven equipment Sections of the Specification:
 - 1. Non-hazardous areas: TEFC or TENV.
 - 2. Hazardous areas: explosion-proof and dust ignition-proof TEFC or TENV, severe duty to IEEE 841 where available, NRTL-listed and labeled for the hazardous location classification and conforming to NEC Article 500 requirements.
- B. Maximum operating temperature for motors located in hazardous areas shall be in accordance with the Division 26 Section "Electrical" for heat-producing equipment installed in hazardous areas.

2.6 MOTOR FRAMES

- A. Motor frames shall be NEMA standard sizes.
- B. Motors over 2 HP and explosion-proof motors shall have cast iron frames.

2.7 AMBIENT CONDITIONS

- A. Motors shall have NEMA standard horsepower ratings for continuous duty under the following environmental conditions:
 - 1. Ambient Temperature: -25 to +40 deg. C.
 - 2. Altitude: Not exceeding 3300 feet (1000 m).
- B. Motors shall be suitable for any unusual service conditions indicated on the Drawings, or in other Sections of the Specification.

2.8 COOLING

- A. Motors shall be air-cooled, with internal or external fans.

2.9 INRUSH CURRENT

- A. Motors over 20 HP shall have inrush current equivalent to NEMA Code G, or lower.

2.10 MAXIMUM SPEED

- A. Unless otherwise indicated, motor synchronous speeds shall not exceed 1800 RPM.

2.11 NAMEPLATES

- A. Provide stainless steel motor nameplates with engraved or stamped markings in accordance with NEMA standards, and including the information specified in SUBMITTALS.

2.12 ROTORS

- A. Rotors shall be aluminum or copper, designed for 125% rotational speed in either direction without distortion or damage, and shall be statically and dynamically balanced as described in VIBRATION LIMITS.

2.13 BEARINGS

- A. Motors shall have re-greasable anti-friction bearings as recommended by motor manufacturer for the application. Oil lubricated ring, sleeve, and plate bearings shall be permitted only for special applications as specified in the mechanical equipment Section of the Specification, and for vertical hollow-shaft motors as described below.
- B. Motors shall have radial bearings and thrust bearings designed to carry all of the loads imposed on the motor in service.
- C. Grease fittings and either drain plugs or grease pressure relief fittings shall be provided for each bearing.
- D. Anti-friction bearings shall have minimum calculated ABMA L-10 life of 100,000 hours for flexible direct-coupled applications, and minimum calculated ABMA L-10 life of 26,280 hours in belt drive applications. Provide motors with longer calculated bearing life where indicated in other Sections of the Specification.
- E. Vertical hollow-shaft motors shall be equipped with oil lubricated spherical roller thrust bearings with oil reservoirs and visual indication of oil level, and lower grease lubricated radial guide bearings. Sufficient oil shall be provided to fill the oil reservoir(s) plus any additional oil required for one refilling. The oil shall be in a properly identified container. Running fit adjustment shall be provided by means of a lockable nut at the top of the shaft. Provide anti-backspin ratchets to prevent reverse rotation.

2.14 VIBRATION LIMITS

- A. For standard motors, unfiltered motor vibration velocities shall not exceed the limits in NEMA MG1 Table 7-1 when measured in accordance with Part 7 of NEMA MG1.
- B. For severe duty motors, unfiltered motor vibration velocities shall not exceed the limits in IEEE Standard 841-2001 6.9.
- C. Special motor vibration limits, when required for the application, shall conform to the requirements of the manufacturer of the driven equipment.

2.15 TERMINAL BOXES

- A. Motor terminal boxes and covers shall be cast iron, with diagonally-split bolted cover, gaskets or O-rings to IP55, and NPT-threaded conduit entry.
- B. Terminal boxes shall be suitable for top, bottom, drive end or non-drive end conduit entry by removing terminal box mounting bolts and rotating terminal box in 90 degree increments.
- C. Provide grounding lug inside terminal box for NEC-sized equipment grounding conductor.
- D. Terminal boxes shall be suitable for the conduit and wire sizes shown on the Drawings.

2.16 PROTECTION AGAINST CONDENSATION

- A. Totally enclosed motors shall be fitted with breathers and condensation drains.

2.17 REQUIRED ACCESSORIES

- A. Belt-drive motor applications: adjustable motor mounting bases.
- B. Motors shall include lifting lugs.

2.18 FACTORY TEST

- A. Routine test, reported on IEEE 112 Annex B routine test form.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install motors in accordance with the motor and driven equipment manufacturers' recommendations.

3.2 OVERLOAD RELAYS

- A. Set motor overload protection in accordance with motor, and motor controller manufacturers' recommendations.

3.3 FIELD TESTING

- A. Perform motor electrical acceptance testing in accordance with NETA ATS 7.15 Rotating Machinery / 1. Motors / 1. AC Motors / 1. Visual and Mechanical Inspection and 2. Electrical Tests – Induction Motors.
- B. Submit motor field test reports with the mechanical equipment field test reports, and incorporate test data into the mechanical equipment O&M Manuals.

END OF SECTION

SECTION 26 05 15 MEDIUM VOLTAGE CONDUCTORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide shielded medium voltage power conductors suitable for use in wet and dry locations in above ground and direct buried conduit as shown on the Drawings and in conformance with the requirements in this Section.
- B. Include related terminations and accessories required for a complete medium voltage conductor system.
- C. This Section describes 5 through 35 kV (nominal voltage) solid dielectric insulated conductor requirements.

1.2 DEFINITIONS

- A. In addition to the definitions in Division 26 Section "Electrical", the following definitions apply to this Section:
 - 1. Cable: When used in a standard or specification referenced by this Section, shall refer to single conductors as well as multi-conductor assemblies as applicable
 - 2. Corona: with regard to conductors, an electrical discharge across a void in the insulation
 - 3. Discharge-free: conductor corona properties in compliance with NEC Article 310.6
 - 4. Ozone-resistant: conductor ozone resistance properties in compliance with NEC Article 310.6
 - 5. Pothead: a liquid dielectric-filled cable, conductor and insulation termination device
 - 6. Stress Relief: application of semiconducting and insulating materials where shields are cut for splicing and terminations, to reduce the voltage gradient in the conductor insulation system
 - 7. Stress Cone: a termination device for shielded medium voltage conductor that reduces the voltage gradient across the insulation where the conductor shield is cut to make the conductor termination

1.3 QUALIFICATIONS

- A. The conductor and manufacturer shall have AEIC Qualification Test Reports available for the specified conductor and cable types as evidence of proven ability to meet or exceed the requirements of AEIC CS8-2000.

1.4 REFERENCE STANDARDS

- A. Comply with the following standards in effect at the time of bid submittal:
 - 1. AEIC CG5-90 Underground Extruded Power Cable Pulling Guide
 - 2. AEIC CS8-00 (1st Edition) Specification for Extruded Dielectric Shielded Power Cables Rated 5 through 46 kV
 - 3. ANSI/ICEA S-96-649-2000 Concentric Neutral Cables Rated 5 Through 46 kV

4. ASTM B-609 Aluminum 1350 Round Wire, Annealed and Intermediate Tempers
5. ICEA / NEMA S-93-639 Shielded Power Cables
6. ICEA P-32-382-1999 Short-Circuit Characteristics of Insulated Cable
7. ICEA P-34-359-1973 AC/DC Resistance Ratios @ 60Hz - 1973 Reprint
8. ICEA P-45-482-1999 Short-Circuit Performance of Metallic Shields & Sheaths
9. ICEA P-46-426 Power Cable Ampacities - Out of Print (See IEEE 835)
10. ICEA P-56-520-1984 Cable Tray Fire Test Report (Round Robin Project)
11. ICEA P-57-653-1995 Guide for the Implementation of Metric Units in ICEA Publications
12. ICEA P-60-573 Guide for Tapes, Braids, Wraps & Serving Specifications (Draft)
13. ICEA T-22-294-1983 Test Procedures for Extended Time-Testing of Wire and Cable Insulations for Service in Wet Locations
14. ICEA T-24-380-1994 Guide for Partial-Discharge Test Procedure
15. ICEA T-29-520-1986 Vertical Cable Tray Flame Tests @ 210,000 Btu
16. ICEA T-30-520-1986 Vertical Cable Tray Flame Tests @ 70,000 Btu
17. ICEA T-31-610-1994 Guide for Conducting a Longitudinal Water Penetration Resistance Test for Sealed Conductor
18. ICEA T-32-645-1993 Guide for Establishing Compatibility of Sealed Conductor Filler Compounds with Conductor Stress Control Materials
19. ICEA T-33-655-1994 Low Smoke, Halogen-Free Polymeric Jackets
20. ICEA T-34-664-1996 Conducting Longitudinal Water Penetration Resistance Tests on Cable
21. IEEE 48 -1996 Standard Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 kV Through 765 kV
22. IEEE 82 -1994 IEEE Standard Test Procedure for Impulse Voltage Tests on Insulated Conductors
23. IEEE 400 -2001 IEEE Guide Field Testing and Evaluation of the Insulation of Shielded Power Cable Systems
24. IEEE 404 -2000 IEEE Standard for Extruded and Laminated Dielectric Shielded Cable Joints Rated 2500 V to 500 000 V
25. IEEE 532 -1993 IEEE Guide for Selecting and Testing Jackets for Underground Cable
26. IEEE 576-2000 Recommended Practice for Installation, Termination, and Testing of Insulated Power Cable as Used in Industrial and Commercial Applications
27. IEEE 592 -1990 (R1996) IEEE Standard for Exposed Semiconducting Shields on High-Voltage Cable Joints and Separable Insulated Connectors
28. IEEE 635 -1989 (R1994) IEEE Guide for Selection and Design of Aluminum Sheaths for Power Cables
29. IEEE 835-1994 (R2000), IEEE Standard Power Cable Ampacity Tables
30. IEEE 848 -1996 IEEE Standard for the Determination of the Ampacity Derating of Fire-Protected Cables
31. IEEE 1026-1995 IEEE Recommended Practice for Test Methods for Determination of Compatibility of Materials with Conductive Polymeric Insulation Shields and Jackets

32. IEEE 1142-1995 IEEE Guide for the Design, Testing, and Application of Moisture-Impervious, Solid Dielectric, 5-35 kV Power Cable Using Metal-Plastic Laminates
33. IEEE 1210-1996 IEEE Standard Tests for Determining Compatibility of Cable-Pulling Lubricants with Wire and Cable (CSA)
34. IEEE 1235-2000 IEEE Guide for the Properties of Identifiable Jackets for Underground Power Cables and Ducts
35. IEEE 1299/C62.22.1-1996 IEEE Guide for the Connection of Surge Arresters to Protect Insulated, Shielded Electric Power Cable Systems
36. IEEE 1333-1994 IEEE Guide for Installation of Cable Using the Guided Boring Method

1.5 ENVIRONMENTAL CONDITIONS

- A. Environmental Conditions: Temperature range, humidity range, and elevation are specified in Division 26 Section "Electrical".
- B. Conductors installed underground shall be suitable for continuous submersion in water.

1.6 SUBMITTALS

- A. Product Data: For each type of conductor indicated on the Drawings, showing cross-section, materials of construction, and descriptions with applicable standards. Submit details for terminations. Data sheets shall have sufficient level of detail to indicate compliance with the requirements described in this Section.
- B. Samples: 16-inch lengths of each type of conductor provided upon request by the Engineer.
- C. Qualification Data: For conductor manufacturer, for termination kit manufacturer, and for testing firm.
- D. Material Certificates: For each conductor and accessory type, signed by manufacturers, certifying that products comply with requirements specified in Part 2 Article "Quality Assurance".
- E. Electrical Acceptance Test reports.
- F. Operation and Maintenance Data: For conductors, terminations, and accessories.
- G. Submittals to the Electrical Utility
 1. After Engineer's review and acceptance, and prior to purchase, submit product data for conductors and terminations to the electrical utility for approval. Incorporate any utility comments to their satisfaction and resubmit if required by the utility.
 2. After Engineer's review and acceptance, and prior to shipment, submit factory test reports to the electrical utility for approval. Incorporate any utility comments to their satisfaction and retest if required by the utility.
 3. After Engineer's review and acceptance, submit acceptance test reports to the electrical utility for approval. Incorporate any utility comments to their satisfaction and retest if required by the utility.
 4. The Engineer shall be copied on all utility submittals, on all review comments from the utility and on all resubmittals to the utility.

1.7 QUALITY ASSURANCE

- A. The conductor manufacturer shall supply a copy of the manufacturer's latest AEIC

Qualification Test Report with the product data sheet submittal to the Engineer. The results of the tests performed shall meet or exceed the requirements of AEIC CS8.

- B. Installer: Engage a licensed electrician, trained in the installation of medium voltage conductors and with a training certificate from an authorized representative of the termination manufacturer, to install, splice, and terminate medium-voltage conductor and cable.
- C. Testing Firm Qualifications: Testing firm as defined by OSHA in 29 CFR 1910.7 or a member company of the InterNational Electrical Testing Association and that is acceptable to authorities having jurisdiction.
 - 1. Testing Firm's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise testing specified in Part 3.
- D. Source Limitations: Obtain all medium voltage conductors through one source from a single qualified manufacturer.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.8 WARRANTY

- A. To demonstrate long term reliability and performance of the conductors, the manufacturer shall issue a forty-year warranty with replacement cost provisions on the product. The warranty shall be signed by an officer of the company and submitted with the product data sheet submittal to the Engineer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements described elsewhere in the Section, provide products by one of the following:
 - 1. Conductors and Cables:
 - a. Pirelli Cables & Systems NA.
 - b. The Kerite Co., Hubbell Incorporated
 - c. The Okonite Company
 - 2. Termination Products and Accessories:
 - a. G&W Electric Co.
 - b. Pirelli Cables & Systems NA
 - c. Raychem Corp., Telephone Energy and Industrial Division.
 - d. RTE Components, Cooper Power Systems, Inc.
 - e. The Scott Fetzer Co., Adalet, Inc.
 - f. Thomas & Betts Corporation.
 - g. Thomas & Betts / Elastimold.
 - h. 3M Company, Electrical Products Division.

2.2 CONDUCTORS

- A. Conductor Type: UL MV-105.
- B. Voltage Rating: 15 kV.
- C. Insulation Thickness: 133 percent insulation level.
- D. The conductor shall be rated 130 deg. C minimum for emergency overload operation, and 250 deg. C for short circuit conditions.
- E. Wire: The wire shall be aluminum, half hard or three quarters hard, Class B compressed stranded, in accordance with ASTM B 231.
- F. Strand Screen: An extruded layer of thermosetting semiconducting compound shall be applied over the wire. The thickness of the screen shall be per AEIC CS8.
- G. Insulation: The insulation shall be a thermosetting ethylene propylene based elastomer that meets or exceeds the electrical and physical characteristics of ICEA S-94-649, Class III type insulation, and AEIC CS8. The thickness shall be per Table I herein. The insulation shall be triple tandem extruded with the strand and insulation screens, and be applied in accordance with the above referenced industry standards.
- H. Insulation Screen: The insulation screen shall be an extruded semiconducting compound. The screen shall be applied in complete accordance with AEIC CS8.
- I. Concentric Neutral: Round copper conductors, 1/3 neutral, applied helically.
- J. Separator Tape (Optional): Jacket shall be easily removable for splicing and terminations. Moisture-resistant helically applied separator tape may be provided for easy removal of jacket at the discretion of the cable manufacturer.
- K. Jacket: The overall jacket shall be sunlight and oil resistant black polyvinylchloride or polyethylene and shall meet the requirements of ICEA S-94-649. The thickness shall not be less than 80% of the specified minimum average.

2.3 TERMINATIONS

- A. Shielded-Conductor Terminations: Comply with IEEE 48 Class 1 requirements. Minimum insulation class shall be same as conductor. Include shield ground strap for shielded conductor terminations.
 - 1. Switchgear Terminations: Heat-shrink type with heat-shrink inner stress control and outer non-tracking tubes; multiple, molded, non-tracking skirt modules; and compression-type connector.
 - 2. Transformer Terminations: insulated, load-break cable connectors.
- B. Load-Break Cable Connectors
 - 1. Modular system, complying with IEEE 386, with disconnecting, single-pole, cable terminators and with matching, stationary, plug-in, dead-front terminals designed for cable voltage and for sealing against moisture.
 - 2. Elbow-type units with 200-A load make/break and continuous-current rating. Coordinate with insulation diameter, conductor size, and material of cable being terminated.

2.4 ARC-PROOFING AND FIRE-PROOFING MATERIALS

- A. Tape for First Course on Metal Objects: 10-mil thick, corrosion-protective, moisture-resistant,

PVC pipe-wrapping tape.

- B. Arc-Proofing and Fire-Proofing Tape: Fireproof tape, flexible, conformable, intumescent to 0.3 inch thick, compatible with conductor jacket.
- C. Glass-Cloth Tape: Pressure-sensitive adhesive type, 1/2 inch wide.

2.5 QUALITY ASSURANCE

- A. Production Tests: The conductor shall meet the electrical resistance requirements of ICEA S-93-639 for shielded cable. The insulation resistance test shall be performed in accordance with the relevant ICEA standard, and shall have an insulation resistance constant of at least 50,000-megohms at 1000 ft. at 15.6 deg. C.
- B. High voltage AC high potential test: In accordance with the relevant ICEA standard, AC test voltages shall be as specified in Table I below.

TABLE I		
Voltage(kV)	Insulation Thickness (mils)	AC Test Voltage (kV)
5	115	23
15	220	44
35	345	69

- C. The shield resistance shall be measured and recorded from end to end on the completed conductor.
- D. The conductor shall be corona discharge tested in accordance with the relevant ICEA standard. The maximum allowable discharge in picocoulombs shall be 5 pc throughout the entire specified test voltage range.
- E. Certified factory test reports shall be furnished.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Ensure that conduits, duct banks and equipment to be connected are clean and clear of construction debris prior to conductor installation.

3.2 DELIVERY, STORAGE, AND HANDLING

- A. Deliver conductors to construction site just prior to installation.
- B. Store conductors on reels and transport reels in compliance with manufacturer's printed instructions.
- C. Conductor ends shall be capped and taped watertight until terminations and splices are installed.

3.3 LAYING AND PULLING

- A. Install conductors in accordance with IEEE 576 and AEIC CG5-90
- B. Installation: Do not exceed manufacturer's recommended maximum pulling tensions and

sidewall pressure values.

1. Lubricate conductors with pulling compound or lubricant that is approved by the conductor manufacturer and will not deteriorate materials of construction.
 2. Follow conductor manufacturer's recommendations for attaching pulling means to conductor, including fish tape, cable, rope, and basket-weave cable grips. Do not attach to cable jacket alone for pulling.
- C. Install conductors, in equipment manholes, conduit, and cable tray as shown or noted on the Drawings.
 - D. Support conductors in accordance with manufacturer's recommendations.
 - E. In manholes, and pull boxes, train conductors around perimeter from entry to exit, and support conductors at intervals adequate to prevent sagging.
 - F. Install conductors in equipment so as not to obstruct access to equipment for operation and maintenance.

3.4 TERMINATIONS

- A. Install terminations at ends of conductors unless otherwise indicated.
- B. Terminations shall be performed by experienced high voltage electricians, using kits with components that are selected specifically for the size and type of conductors being terminated. Termination kit manufacturer's instructions shall be carefully followed.
- C. Electricians shall be trained by the termination kit manufacturer's representative on a selected piece of conductor at the job site. Alternatively, evidence of factory-authorized training on a similar conductor using the same kit shall be submitted to the Engineer for approval of proposed personnel.

3.5 ARC-PROOFING AND FIRE-PROOFING

- A. Arc proof medium-voltage conductor inside air terminal compartments where circuits are not protected by conduit, or termination materials. Apply arc-proofing products in accordance with manufacturer's written instructions.

3.6 GROUNDING

- A. Ground concentric neutrals where indicated.

3.7 ACCEPTANCE TESTING

- A. Testing: Engage a qualified testing firm to perform the following field quality-control testing:
 1. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification Inspection and Test Procedure 7.3.3 "Cables, Medium- and High-Voltage".
 2. Certify compliance with test parameters.
- B. Remove malfunctioning conductor and terminations, and replace with new and retest as specified above.
- C. Acceptance Test reports: Prepare written reports to record the following:
 1. Test procedures used.

2. Test results that comply with requirements.
- D. Test results that do not comply with requirements and corrective actions taken to achieve compliance with requirements.

END OF SECTION

SECTION 26 05 19
LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLE

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide a complete system of low voltage conductors and cables, instrumentation conductors and cables, wire and cable pulling, splicing, and termination accessories, as shown on the Drawings and specified herein.

1.2 DEFINITIONS

- A. In addition to the definitions in Division 26 Section "Electrical", the following definitions apply to this Section:
1. Cable: When used in a standard or specification referenced by this Section, shall refer to single conductors as well as multi-conductor assemblies as applicable.
 2. TFFN: NEC and UL designation for heat resistant thermoplastic insulation, nylon jacketed fixture wire, 90 degree C. maximum.
 3. THHN: NEC and UL designation for flame-retardant and heat resistant thermoplastic insulation, gas and oil resistant nylon jacketed, suitable for dry locations only, 90 degree C. maximum in dry locations
 4. THWN: NEC and UL designation for flame retardant and moisture-resistant thermoplastic insulation, gas and oil resistant nylon jacketed, suitable for dry and wet locations, 75 degree C. maximum in wet locations
 5. TSP: twisted shielded pair
 6. XHHW: NEC and UL designation for (thermoset) cross-linked synthetic polymer insulation suitable for dry and wet locations, 90 deg. C. max in dry locations, 75 deg. C. max in wet locations.

1.3 QUALIFICATIONS

- A. Testing firm shall be qualified as defined by OSHA in 29 CFR 1910.7, shall be a member of the International Electrical Testing Association, shall be acceptable to the AHJ, and shall have supervision as follows:
1. Testing Firm's Field Supervisor: certified by the International Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

1.4 REFERENCE STANDARDS

- A. Comply with the following standards:
1. AEIC CG5-90 Underground Extruded Power Cable Pulling Guide
 2. ICEA P-51-432-1970 Copper Conductors, Bare & Weather Resistant
 3. ICEA S-58-679-1996 Standard for Control Cable Conductor Identification
 4. ICEA S-95-658 / NEMA WC70 Non-Shielded Power Cables Rated 2000 V or Less

5. ICEA T-22-294-1983 Test Procedures for Extended Time-Testing of Wire and Cable Insulations for Service in Wet Locations
6. ICEA P-56-520-1984 Cable Tray Fire Test Report (Round Robin Project)
7. ICEA T-29-520-1986 Vertical Cable Tray Flame Tests @ 210,000 BTU
8. ICEA T-30-520-1986 Vertical Cable Tray Flame Test @ 70,000 BTU
9. IEEE 576-2000 Recommended Practice for Installation, Termination, and Testing of Insulated Power Cable as Used in Industrial and Commercial Applications
10. UL 44 Thermoset-insulated Wires and Cables
11. UL 62 Flexible Cord and Fixture Wire
12. UL 83 Thermoplastic Insulated Wires and Cable
13. UL 486A Wire Connectors and Soldering Lugs for Use with Copper Conductors
14. UL 486C Splicing Wire Connectors
15. UL 486D Insulated Wire Connector Systems for Underground Use in Damp or Wet Locations
16. UL 493 Thermoplastic Insulated Underground Feeder and Branch Circuit Cables

1.5 SUBMITTALS

- A. Product Data: For each type of product specified herein, including catalog data, technical specifications, evidence of UL listing.
- B. Qualifications and experience for the electrical testing firm.
- C. Samples: 16-inch lengths of each size and type of conductor and cable provided upon request by the Engineer.
- D. Electrical Acceptance Test reports.
- E. Operation and maintenance data is not required, however, approved shop drawing submittals are required to be included for the record in the Operation and Maintenance Manuals, as described in Division 26 Section "Electrical".

PART 2 - PRODUCTS

2.1 APPLICATIONS

- A. Refer to Part 3 for conductor and cable applications.

2.2 BUILDING CONDUCTOR AND CABLE

- A. Manufacturers:
 1. American Insulated Wire Corp.
 2. Belden Wire and Cable Co.
 3. Cerro Wire and Cable Co., Inc.
 4. General Cable Industries Inc.
 5. Okonite Co.
 6. Pirelli Cable Corp.

- 7. Southwire Co.
- 8. Or equal.
- B. Wire Material: Copper, stranded conductor.
- C. Insulation Types: THHN-THWN, XHHW, 600 volt.

2.3 INSTRUMENTATION CONDUCTOR AND CABLE

- A. Manufacturers:
 - 1. Belden Wire and Cable Co.
 - 2. Brand-Rex Co.
 - 3. Clifford of Vermont / TVC
 - 4. Corning
 - 5. General Cable Co., Inc.
 - 6. Lucent Technologies
 - 7. Okonite Co.
 - 8. Southwire Co.
 - 9. Or equal.
- B. Category 6 (Ethernet) Cable
 - 1. Four pair, polyolefin insulated #23 AWG solid copper conductors, unshielded with overall PVC jacket. Belden catalog no. 11872A or equal.
- C. CAN Bus Cable
 - 1. Two pair, polyethylene insulated #24 AWG stranded copper conductors with foil shield, tinned copper braiding and overall PVC jacket.
- D. Twisted Shielded Pair and Twisted Shielded Triplex: UL Type TC tray cable:
 - 1. 600 volt TFFN insulated #16 AWG stranded tinned copper twisted pair or triplex with #18 AWG or larger stranded tinned copper drain wire, overall aluminum-on-mylar shield (100% coverage), with chrome PVC outer jacket. NRTL listed and suitable for installation in conduit, cable tray, and direct burial.
- E. Fiber Optic Cable
 - 1. Cables shall be multimode, tight buffer, indoor, multifiber type. Cable construction shall consist of 12 fiber strands, strand cladding, strand buffer coatings, central strength member, gel fill and overall polyethylene jacket.
 - 2. Fiber strand core/cladding size shall be 62.5/125 microns.
 - 3. Maximum attenuation shall be 3.5 dB/km at 850 nm and 1.0 dB at 1300nm.
 - 4. Strand color coding shall be in accordance with TIA/EIA-598B.
 - 5. Cables shall be suitable for conduit installation and operating temperatures of -40 degrees C to 70 degrees C.
 - 6. Cables shall be in conformance with ANSI/ICEA S-87-640 and applicable TIA/EIA standards.
 - 5. Manufacturers: Belden, Brand-Rex Co., Corning, General Cable Corporation, Lucent Technologies, equal.

2.4 CONDUCTOR AND CABLE CONNECTORS AND SPLICES

- A. Manufacturers:
 - 1. 3M Company, Electrical Products Division
 - 2. AMP Incorporated / Tyco International
 - 3. Burndy
 - 4. Square D
 - 5. Thomas and Betts
 - 6. Or equal.
- B. Description: Factory fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.
- C. Wirenuts: Spring type rated for copper wire, sized for the actual number of wires connected.
- D. Splices: Tin-plated copper compression type. Pre-insulated crimp-on connectors may be used for #14 AWG control wires. Long barrel splices shall be used for #1/0 AWG and larger.
- E. Connection lugs: Tin-plated copper compression type with NEMA drilling. Long-barrel lugs shall be used for #1/0 AWG and larger wire, and for ground wires as specified in Division 26 Section "Grounding and Bonding for Electrical Systems".
- F. Connections at molded case circuit breakers, disconnect switches, and other equipment provided with wire termination lugs: NRTL-listed, suitable for use with the copper wire size to be connected.

2.5 FIBER OPTIC CABLE CONNECTORS

- A. Connectors shall mechanically couple and align each end of fiber optic strands to the devices connected. Connectors shall be compatible with the fiber optic cables provided and the devices connected.
- B. Connectors shall be plug-in, Type ST with bayonet twist-lock connection providing quick connect/disconnect capability of the fiber optic cables. Connectors shall conform to intermateability standards in accordance with TIA/FOCIS.
- C. Connectors may be furnished as components of pre-terminated cable assemblies or may be field installed.
- D. All epoxies used in the field installation of connectors shall be suitable for the environmental ranges specified in the Division 16 Section "Electrical".

PART 3 - EXECUTION

3.1 INSPECTION

- A. Ensure that conduits, boxes and fittings are clean and clear of construction debris prior to installation of wire and cable.

3.2 DELIVERY, STORAGE, AND HANDLING

- A. Deliver conductor and cables to construction site and unload in accordance with manufacturer's recommendations.

- B. Store and transport reels in conformance with the manufacturer's printed instructions.
- C. Conductor and cable ends shall be taped watertight until terminations and splices are completed.

3.3 CONDUCTOR AND CABLE APPLICATIONS

- A. Conductors for medium voltage feeder equipment grounds: Type XHHW.
- B. Conductors for feeders and associated equipment grounds: Type XHHW.
- C. Conductors for branch circuits, associated equipment grounds: Type THHN-THWN.
- D. Conductors for control circuits: Type THHN-THWN.
- E. Conductors for network communication circuits: Category 6 (Ethernet) cable, CAN bus cable or fiber optic cable as indicated on the Drawings unless otherwise required.
- F. Conductors for signal circuits: Twisted shielded pair or twisted shielded triplex as scheduled or otherwise required.
- G. Conductors and cables shall be installed in conduit unless otherwise indicated.
- H. Conductors and cables for communications shall be as specified in the Division 27 Section "Communications".

3.4 LAYING AND PULLING

- A. Install conductors and cables in accordance with manufacturer's installation instructions, IEEE 576 and AEIC CG5-90.
- B. Install conductors and cables in raceways and cable trays as shown on the Drawings and as specified in Division 26 Section "Raceways and Boxes for Electrical Systems".
- C. Install conductors and cables in accordance with the manufacturer's installation recommendations and requirements, including the following:
 - 1. Do not exceed manufacturer's recommended maximum pulling tensions and side-wall pressure values
 - 2. Lubricate with pulling compound or lubricant that is approved by the conductor or cable manufacturer and will not deteriorate wire or insulation materials of construction.
 - 3. Follow conductor or cable manufacturer's recommendations for attaching pulling means, including fish tape, cable, rope, and basket-weave cable grips. Do not attach to conductor or cable jacket alone for pulling.
 - 4. Rig pulleys and use pull ropes for pulling.
 - 5. Use central strength member for pulling fiber optic cable.
 - 6. Use tension indicators and electric-motor driven capstan rollers for pulling conductor or cables that are too large for pulling by hand.
 - 7. Observe manufacturer's recommendations for the minimum conductor and cable bending radius for each type and size of conductor and cable provided for this project.
- D. In pull boxes and junction boxes, route cables around perimeter from entry to exit, and support conductors and cables at intervals adequate to prevent sagging.
- E. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

3.5 CONDUCTOR AND CABLE CONNECTIONS AND TERMINATIONS

- A. Tighten electrical connectors and terminals according to the manufacturer's published torque tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. For compression lugs and splices, use the lug manufacturer's compression tools and conform to the manufacturer's written instructions.
- C. Control wires shall be run from terminal to terminal without splices, and no more than two wires under a terminal screw.
- D. Splices and terminations shall be insulated with boots, heat shrink tubing, or tape to 600 volts in accordance with the insulation product manufacturer's written instructions.
- E. Fiber optic cables shall be installed without splices.
- F. Feeder taps shall be made with cast bronze 2-bolt or 4-bolt connectors with built-in conductor spacer, suitable for the run and tap conductor sizes. Split bolt connectors shall not be used unless approved by the Engineer.
- G. Wiring connections at transformers and bus bars shall be made with tin-plated copper compression connectors and insulated for 600 volts with tape, boots, or heat-shrink tubing rated for the temperature specified by the equipment manufacturer. Two-hole lugs shall be used for power cable terminations # 1/0 AWG and larger.
- H. Wiring connections to motor leads shall be made with compression connectors bolted back-to-back with silicone-bronze bolts and insulated for 600 volts. For motors with bus bar connections, connections shall be made with long-barrel two-hole tin plated copper lugs, copper-plated Belleville washers, and silicone bronze bolts.
- I. Wiring at Device Outlets: Install conductor at each outlet, leaving 8 inches of wire coiled in the box for connection to wiring devices. Wiring devices that are suitable for solid wire only shall be pigtailed to stranded wire with solid wire 6 inches long using wirenuts.
- J. Install a green insulated NEC-sized grounding jumper from a green ground screw in the outlet box to the device green ground screw.
- K. Shielded cable conductors shall be terminated with insulated crimp-on connectors suitable for the terminals provided with the equipment, or tinned for connection to terminals which are not suitable for crimp-on connectors. A minimum two-inch length of heat shrink tubing shall be applied over each insulated conductor and the insulated portion of the crimp-on connector, and a separate piece of larger diameter heat shrink tubing shall cover the end of the cable jacket and cut shield, and overlap the individual conductor heat shrink tubing. Connect drain wire to ground at the transmitter end only unless otherwise indicated.
- L. Provide connectors on all fiber optic strands including spare strands.

3.6 ELECTRICAL ACCEPTANCE TESTING

- A. Engage a qualified testing firm to perform the following field quality control testing:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test for conformance with requirements.
 - 2. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification, Section 7.3.2 "Cables, Low Voltage, 600 Volt Maximum" for conductor sizes 10 AWG and larger. Certify conformance with test parameters.

3. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification, Section 7.25 "Fiber-Optic Cable". Certify conformance with test parameters.
- B. Perform point-to-point verifications of control conductors to ensure proper connections. Control, signal and network conductors and cables shall be tested by operation to demonstrate proper installation. Replace controls damaged by erroneous connections.
- C. Prepare a written report to record the following:
 1. Test procedures used.
 2. Test results that conform to requirements.
 3. Test results that do not conform to requirements and corrective action taken to achieve conformance with requirements.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

1.1 GENERAL

1.2 SUMMARY

- A. Provide a complete system of grounding electrodes, grounding electrode conductors, equipment grounding conductors and bonding as shown on the Drawings and as specified herein.
- B. This Section includes requirements for grounding electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

1.3 DEFINITIONS

- A. Refer to NEC for definitions of grounding terms used in this Section.

1.4 QUALIFICATIONS

- A. Testing firm shall be qualified as defined by OSHA in 29 CFR 1910.7, shall be a member of the InterNational Electrical Testing Association, shall be acceptable to the AHJ, and shall have supervision as follows:
 - 1. Testing Firm's Field Supervisor: Qualifications and experience for the person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on- site testing specified in Part 3.

1.5 REFERENCE STANDARDS

- A. Comply with the following standards:
 - 1. IEEE 81-1983 Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1)
 - 2. IEEE 118-1978 (R1992) Standard Test Code for Resistance Measurements
 - 3. IEEE 142-1991 Recommended Practice for Grounding of Industrial and Commercial Power Systems (IEEE Green Book)
 - 4. IEEE 1100-1999 IEEE Recommended Practice for Powering and Grounding Electronic Equipment. (IEEE Emerald Book)
 - 5. NFPA 70 The National Electrical Code

1.6 SUBMITTALS

- A. Product Data: Submit manufacturer's catalog data and specification sheets for each manufacturer's product described in Part 2 of this Section, marked to show which products are proposed for this project.
- B. Qualification Data: For firms and persons specified in "Qualifications" in Part 1 of this Section.

C. Acceptance Test Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

A. Manufacturers: Subject to compliance with the requirements described in this Section, provide products by one of the listed manufacturers in the Sub-Sections below.

1. Ground Rods:
 - a. Copperweld Corp.
 - b. Eritech / Erico International Corporation
 - c. Galvan Industries, Inc.
 - d. Harger Lightning and Grounding, Inc.
 - e. Robbins Lightning, Inc.
2. Grounding connectors:
 - a. Exothermic type:
 - 1) Cadweld / Erico International Corporation
 - 2) Furseweld
 - 3) Harger Lightning and Grounding, Inc. (Ultraweld)
 - 4) ThermOweld, a division of Continental Industries
 - b. Copper compression type:
 - 1) Dossert Corp.
 - 2) Framatome Connectors / Burndy
 - 3) Harger Lightning and Grounding, Inc.
 - 4) ILSCO
 - 5) O. Z. Gedney / EGS Electrical Group
 - 6) Panduit Corp.
 - 7) Robbins Lightning, Inc.

2.2 GROUNDING ELECTRODES

- A. Ground Rods: 3/4 in. x 10 ft. copper-clad steel, sectional type, with silicone bronze threaded connectors.
- B. Ground Ring: #4/0 AWG Class A stranded bare copper conductor (7 strand).

2.3 GROUNDING ELECTRODE CONDUCTORS

- A. Grounding Electrode Conductors: 4/0 AWG, Class A stranded (7 strand), ASTM B3, bare copper conductor.

2.4 BONDING JUMPERS

- A. Main Bonding Jumper: copper, furnished with the service equipment by the equipment manufacturer.

- B. System Bonding Jumpers: copper conductor, sized in accordance with the NEC.
- C. Equipment Bonding Jumpers: insulated copper building wire, sized to match the largest equipment grounding conductor in the associated conduits.
- D. Bonding Jumper: insulated copper wire, protected by conduit where exposed to physical damage

2.5 EQUIPMENT GROUNDING CONDUCTORS

- A. Equipment Grounding Conductors: Insulated building wire in accordance with Division 26 Section "Low Voltage Electrical Power Conductors and Cable". #6 AWG and smaller shall have green insulation, #4 AWG and larger shall have green insulation or shall be marked with green tape at each end.

2.6 CONNECTOR PRODUCTS

- A. Comply with IEEE 837 and UL 467. Products shall be NRTL-listed and shall be suitable for use for specific types, sizes, and combinations of conductors and connected items.
- B. Bolted Connectors: two-hole long barrel tin-plated copper compression type at equipment bus bars, at equipment frames and for connections to structural steel.
- C. Ground Clamps for Metal Pipe Connections: all cast bronze with bronze bolts.
- D. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions for ground ring connections.
- E. Wirenuts: Use only for branch circuit wiring in switch and receptacle outlet and junction boxes containing #10 AWG and smaller wires.

PART 3 - EXECUTION

3.1 INSTALLATION – GENERAL

- A. Install grounding electrodes, grounding electrode conductors, equipment grounding conductors, equipment bonding jumpers, and bonding, in accordance with NEC requirements, as shown on the Drawings and as specified herein.
- B. Provide only copper and bronze grounding materials.
- C. Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
 - 2. Make connections with clean, bare metal at points of contact.
 - 3. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- D. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

3.2 GROUNDING ELECTRODES

- A. Ground Rods: Provide ground rods as shown on the Drawings.
 - 1. Drive ground rods such that tops are 36 inches below final grade.
 - 2. Interconnect ground rods with grounding ring conductors. Use exothermic welds. Make connections without exposing steel core of ground rod or damaging copper coating.
- D. Metal Pipe: Provide grounding electrode conductor, routed from each metal piping system to the ground ring. Connect grounding electrode conductor to piping with grounding clamp or bolted connector on piping flange. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting.
- E. Remove paint and surface corrosion at grounding connection points down to bright metal. Coat dissimilar metals with anti-corrosion compound after making bolted grounding connections wrench-tight.
- F. Ground Ring: Bury 36 inches minimum below grade.

3.3 GROUNDING ELECTRODE CONDUCTORS

- A. Grounding Electrode Conductors: Route along shortest and straightest paths possible. Avoid obstructing access or placing conductors where subject to strain, impact, or damage.
- B. Grounding electrode conductors may be direct buried without conduit enclosure.
- C. Exposed surface mounted grounding electrode conductors shall be installed in 1" conduit.
- D. Grounding electrode conductors routed from below grade to platform mounted equipment shall be installed in 1" conduit.
- E. Grounding electrode conductors shall be routed from interior mounted equipment through foundation walls and connected to the ground ring. Provide foundation wall penetrations as detailed on the Drawings.
 - 1. A single grounding electrode conductor routed through the building interior and connected to the ground ring on opposite sides of the building, may be used to connect all interior equipment required to have a grounding electrode conductor. Provide branch connections from this conductor to the equipment.
- D. In addition to the grounding electrode conductors that may be specified or shown on the Drawings, provide grounding electrode conductors for the following equipment:
 - 1. Exterior equipment platforms (two conductors each at opposite ends of platform)
 - 2. Switchboard
 - 3. Automatic Transfer Switch
 - 4. Manual Transfer Switch
 - 5. Mobile Generator Connection Cabinet
 - 6. Standby Generator
 - 7. Motor Control Center
 - 8. Dry type transformer
 - 9. Panelboards

3.4 EQUIPMENT GROUNDING CONDUCTORS

- A. Provide separate insulated equipment grounding conductors in raceways, boxes, and fittings, as shown on the Drawings and specified herein.

B. Equipment Grounding Conductor Terminations:

1. At equipment with ground bus bar(s), provide two-hole long-barrel tin-plated compression connector bolted to ground bus bar(s) with tin-plated or silicone bronze bolts.
2. At other equipment, connect to ground terminals with wire termination lugs in accordance with the Division 26 Section "Low Voltage Electrical Power Conductors and Cable."

3.5 BONDING JUMPERS

- A. Main Bonding Jumper: Provide bonding of service neutral conductor in the service equipment (Switchboard).
- B. System Bonding Jumper: Provide bonding of neutral conductor for separately derived systems served by panelboards in accordance with the Division 26 Section "Panelboards".
- C. Service supplied systems and separately derived systems shall be grounded at one location only as specified. Generator supplied systems connected with transfer switches that do not have neutral switching shall be grounded by means of the service main bonding jumper and shall not have their neutrals bonded at the generator.
- D. Equipment Bonding Jumpers:
 1. At sheet metal junction, pull and outlet boxes, use conduit hubs bolted to box or double locknuts to bond box to conduit, and connect grounding bushings to equipment grounding conductors. Install equipment bonding jumpers between conduit bushings entering and leaving boxes, using the lugs provided with the grounding bushings.
 2. At cast boxes, connect equipment grounding conductors together with a mechanical connector. Use connection lugs in conformance with Division 26 Section "Low Voltage Electrical Power Conductors and Cables".
- E. Provide bonding jumpers as necessary between electrical system components to maintain ground path continuity.
- F. Install bonding jumpers so equipment vibration is not transmitted to other assemblies.
- G. Use long-barrel tin-plated compression connectors and galvanized steel or silicone bronze hex head cap screws in drilled and tapped holes to bond miscellaneous equipment to equipment grounding conductors.

3.6 CONNECTIONS

- A. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.
- B. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

3.7 ACCEPTANCE TESTING

- A. Engage a qualified testing firm to perform the following field quality-control testing:

1. After installing grounding materials and before electrical circuitry has been energized, test for conformance with requirements.
 2. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification, Section 7.13 "Grounding Systems". Certify conformance with test parameters.
- B. Prepare a written report to record the following:
1. Test procedures used.
 2. Test results that conform to requirements.
 3. Test results that do not conform to requirements and corrective action taken to achieve conformance with requirements.
- C. Ground resistance shall be 5 ohms or less.

END OF SECTION

SECTION 26 05 33
RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide a complete system of raceways, including conduit, fittings, junction boxes, hangers, supports, and accessories, as indicated on the Drawings and specified herein.

1.2 DEFINITIONS

- A. In addition to the definitions in Division 26 Section "Electrical", the following definitions apply to this Section:
1. Clamp-back: spacer used with conduit one-hole strap to provide air gap between surface and conduit
 2. Equipment bonding jumper: suitable for connecting sections of conduit used for equipment grounding conductor (NEC definition)
 3. ID: inside diameter
 4. LFMC: Liquidtight flexible metal conduit (NEC definition)
 5. NPT: National pipe thread
 6. OD: Outside diameter
 7. PVC: Polyvinyl chloride
 8. RAC: Rigid aluminum conduit
 9. RGS: Rigid galvanized steel conduit
 10. RMC: Rigid metal conduit (NEC definition)

1.3 REFERENCE STANDARDS

- A. Comply with the following standards:
1. NEMA Standards applicable to raceways, boxes, and fittings.
 2. UL Standards applicable to raceways, boxes, and fittings. Each raceway, box, and fitting shall be NRTL-listed and labeled.
 3. ANSI and ASTM standards mentioned in this Section and included in the UL and NEMA Standards applicable to raceways, boxes, and fittings.

1.4 ENVIRONMENTAL CONDITIONS

- A. Provide raceways, boxes, and fittings fabricated from materials resistant to corrosion and suitable for the application in the locations where installed, in conformance with NEC requirements for installation in "damp" and "wet" areas.

1.5 SUBMITTALS

- A. Submit the following in accordance with Specification entitled "Submittal Procedures".
1. Product Data: For raceways, boxes, fittings, hangers, supports and accessories.

1.6 QUALITY ASSURANCE

- A. PVC-coated conduit, boxes and fittings shall be by the same manufacturer.
- B. Installers of PVC-coated conduit shall be certified by the manufacturer.

PART 2 - PRODUCTS

2.1 CONDUIT, BOX, AND FITTING MANUFACTURERS

- A. Provide products by the following manufacturers:
 1. Adalet / A Scott Fetzer Company
 2. AFC Cable Systems, Inc.
 3. Alflex Inc.
 4. Allied Tube & Conduit Corporation
 5. Allied Tube and Conduit Div. / A TYCO International Ltd. Company
 6. Anamet Electrical, Inc.; Anaconda Metal Hose.
 7. Appleton
 8. Bell
 9. Carlon
 10. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
 11. Electri-Flex Co.
 12. Emerson/General Signal; Appleton Electric Company.
 13. Erickson Electrical Equipment Co.
 14. Hoffman
 15. Hubbell, Inc. / RACO
 16. Hubbell, Inc./ Killark Electric Manufacturing Co.
 17. Lew Electric Fittings Co.
 18. LTV Steel Tubular Products Company
 19. Myers
 20. O-Z Gedney
 21. Perma-Cote
 22. Pittsburgh Standard Conduit Co.,
 23. RACO; Division of Hubbell, Inc.
 24. Robroy Industries
 25. Scott Fetzer Co.; Adalet-PLM Division.
 26. Spring City Electrical Manufacturing Co.
 27. Thomas & Betts Corporation.
 28. Triangle PWC Co.
 29. Wheatland Tube Co.
 30. Equal.

2.2 RIGID METAL CONDUIT (RMC)

- A. Rigid Galvanized Steel Conduit (RGS): hot dip galvanized exterior and interior to ANSI C80.1, threads hot dip galvanized after fabrication, for use in accordance with NEC Article "Rigid Metal Conduit: Type RMC", NRTL-listed and labeled under UL 6. Threads shall be hot dip galvanized after fabrication.

- B. PVC-Coated RGS: RGS with 0.040 inch PVC exterior coating and 0.002 inch urethane or epoxy interior coating. Threads shall be protected with urethane coating over galvanizing.
- C. Rigid Aluminum Conduit (RAC): threaded high purity 6063 aluminum alloy with T-1 temper to ANSI C80.5, for use in accordance with NEC Article "Rigid Metal Conduit: Type RMC", NRTL-listed and labeled under UL 6A.
- D. Provide RMC locknuts, bushings, fittings, conduit bodies, junction boxes, pull boxes, and outlet boxes as follows:
 - 1. Locknuts: galvanized steel.
 - 2. Bushings: galvanized steel or malleable iron, insulated-throat grounding type, with thermoset plastic insulation insert, complete with mechanical ground lug for connection to ground wire.
 - 3. Fittings: ANSI 80.4, hot-dip galvanized cast steel or malleable iron for use with steel conduit, aluminum for use with aluminum conduit. Conduit hubs or similar approved fittings shall be provided for conduit entry to water and dust-resistant enclosures.
 - 4. Seal-off fittings: For preventing the transmission of gas through the conduit system, cast metal, combination horizontal and vertical type, oversized for 40% wire fill to match allowable wire fill in conduit, with breather and drain.
 - 5. Conduit bodies for steel conduit: galvanized cast steel or malleable iron, Cooper Crouse-Hinds Form 8 or equal, with oil-resistant gasket and galvanized cast steel or malleable iron cover in non-hazardous areas. Cast or malleable iron body with screw or bolted cover in hazardous areas.
 - 6. Conduit bodies for aluminum conduit: malleable iron or copper-free aluminum, Cooper Crouse-Hinds Mark 9 or equal, with oil-resistant gasket and malleable iron cover.
 - 7. Junction boxes for steel conduit: galvanized cast steel or malleable iron with oil-resistant gasket and galvanized cast steel or malleable iron cover in non-hazardous areas in accordance with NEMA FB 1. Cast or malleable iron external screw cover type in hazardous areas.
 - 8. Junction boxes for aluminum conduit: malleable iron or copper-free aluminum in accordance with NEMA FB 1 with aluminum cover.
 - 9. Pull boxes for steel conduit: painted or stainless steel fabricated sheet metal type with hinged or screw cover in non-hazardous areas. Cast aluminum with hinge bolted cover in hazardous areas.
 - 10. Pull boxes for aluminum conduit: painted aluminum fabricated sheet metal type with hinged cover.
 - 11. Outlet boxes: Type FS or FD, cast aluminum, cast iron or malleable iron in non-hazardous areas in accordance with NEMA FB 1. Cast or malleable iron external screw cover type in hazardous areas.
 - 12. Boxes, fittings, conduit bodies, seal-off fittings, outlet boxes for use with PVC-coated conduit: Same as described above for use with steel conduit, with exterior and interior coatings similar and equal to PVC-coated RGS conduits, and shall have PVC sleeves extending approximately one conduit diameter beyond threaded hub for conduit overlap. Provide stainless steel cover screws.

2.3 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Liquidtight flexible metal conduit flexible with PVC jacket, for use in accordance with NEC Article "Liquidtight Flexible Metal Conduit: Type LFMC", NRTL-listed and labeled under UL 360. Non-UL listed LFMC is not acceptable.
- B. Conduit shall be Type UA with steel construction for connection to steel conduit and Type EL with aluminum construction for connection to aluminum conduit.
- C. Fittings: Insulated-throat screw-in connectors, NEMA FB 1, UL 514B, galvanized malleable iron or steel. Connectors shall be suitable for use as grounding fittings. Provide fittings with bonding jumper connections for exterior bonding jumpers at motors.

2.4 EXPLOSION PROOF FLEXIBLE COUPLINGS

- A. U.L. listed and labeled for the hazardous (classified) area with stainless steel outerbraid. Non-stainless steel parts shall be PVC coated when used with PVC coated RGS conduit.

2.5 SINGLE CONDUIT HANGERS

- A. Manufacturers:
 - 1. Appleton
 - 2. Crouse-Hinds
 - 3. Erico International Corporation (Caddy)
 - 4. Killark
 - 5. Thomas and Betts (Kindorf, Steel City)
 - 6. Unistrut
 - 7. Equal
- B. Single RGS attachment to concrete and masonry surfaces: galvanized malleable iron one-hole clamp and galvanized malleable iron clamp-back, or galvanized steel clevis hangers on galvanized steel threaded rods attached to galvanized steel rod hanger fitting bolted to concrete with expansion bolts. Bolts shall be galvanized steel.
- C. Single RAC attachment to concrete and masonry surfaces: aluminum one-hole clamp and aluminum clamp-back, or stainless steel clevis hangers on stainless steel threaded rods attached to stainless steel rod hanger fitting bolted to concrete with expansion bolts. Bolts shall be cadmium plated.
- D. Single RGS attachment to structural steel: galvanized malleable iron PC (parallel clamp), EC (edge clamp), and RC (right angle clamp) type conduit-to-structural-steel clamps, or galvanized steel clevis hangers on galvanized steel threaded rods attached to galvanized malleable iron beam clamps. Bolts shall be galvanized steel.
- E. Single RAC attachment to structural steel: stainless steel PC (parallel clamp), EC (edge clamp), and RC (right angle clamp) type conduit-to-structural-steel clamps, or stainless steel clevis hangers on stainless steel threaded rods attached to stainless steel clamps. Bolts shall be cadmium plated.
- F. PVC-coated rigid galvanized steel conduit hangers shall be same as specified for RGS except with epoxy or PVC coating, and stainless steel bolts.

2.6 MULTIPLE CONDUIT HANGERS (CHANNEL SUPPORTS)

- A. Manufacturers:
 - 1. Aickinstrut
 - 2. Cooper B-Line
 - 3. GS Metals Inc.
 - 4. Thomas & Betts (Kindorf)
 - 5. Unistrut
 - 6. Equal
- B. Steel channel and associated hardware and fittings:
 - 1. 1-1/2 x 1-1/2 inch nominal size, minimum. UL 5B listed and labeled. Thickness as required for the application, minimum 0.071 inches.
 - 2. Deflection of individual support channels shall not exceed 1/180 of span when loaded with conduit plus 200 pounds.
 - 3. Electro-galvanized: Electrolytically zinc coated conforming to ASTM B633 Type III SC1.
 - 4. Bolts and fittings: Electroplated. Grade 3 or better bolts.
 - 5. Conduit straps: electro-galvanized.
- C. Aluminum channel and associated hardware and fittings:
 - 1. 1-1/2 x 1-1/2 inch nominal size, minimum. UL 5B listed and labeled. Thickness as required for the application, minimum 0.071 inches.
 - 2. Deflection of individual support channels shall not exceed 1/180 of span when loaded with conduit plus 200 pounds.
 - 3. Bolts and fittings: cadmium plated bolts, cadmium plated or aluminum fittings.
 - 4. Conduit straps: aluminum.
- D. Fiberglass channel and associated hardware and fittings:
 - 1. 1-1/2 x 1-1/2 inch nominal size, minimum. UL 94VO listed and labeled. Thickness as required for the application, minimum 1/8 inch.
 - 2. Deflection of individual support channels shall not exceed 1/180 of span when loaded with conduit plus 200 pounds.
 - 3. Materials of construction: fiberglass reinforced vinyl ester or polyester.
 - 4. Bolts and fittings: Stainless steel materials, size and type as recommended by the fiberglass reinforced channel manufacturer for the application and loading.
 - 5. Conduit straps: PVC-coated galvanized steel with cadmium plated bolts.

2.7 CONDUIT INTERIOR SEALING FITTINGS

- A. Manufacturers:
 - 1. Crouse-Hinds
 - 2. O.Z. Gedney
 - 3. Thomas & Betts
- B. Conduit-to-Cable Sealing Fittings:
 - 1. For exposed conduit ends without pull and junction boxes: Conduit fitting with synthetic elastomeric sealing gland with galvanized stainless steel compression

- plates drilled for the conduit ID and cable(s) OD, retained by threaded collar at the end of the conduit.
- 2. For exposed conduit ends entering pull or junction box: Conduit fitting suitable for installation of locknuts at conduit entry to sheet metal box, and bushing with synthetic elastomeric sealing gland with galvanized stainless steel compression plates drilled for the conduit ID and cable(s) OD, retained by threaded collar at the end of the conduit.
- 3. Seal shall be watertight at 20 feet minimum of continuous water pressure.

2.8 CONDUIT INTERIOR SEALANT

- A. Manufactures:
 - 1. Polywater FST
 - 2. Equal
- B. Sealant
 - 1. Sealant shall be a two-part aerosol closed-cell urethane foam, UL recognized, suitable for use in steel conduit and with the conductor insulation or jacket materials specified. Sealant shall be removable to permit future conductor replacements or additions.
 - 2. Sealant shall be watertight at 20 feet minimum of continuous water pressure.

2.9 CONDUIT EXPANSION AND DEFLECTION FITTINGS

- A. Manufacturers:
 - 1. Crouse-Hinds
 - 2. Spring City Electric
 - 3. O.Z. Gedney
 - 4. Thomas & Betts
- B. Conduit Expansion and Deflection Fittings:
 - 1. Suitable for expansion joint elongation and deflection. Comply with UL 467 and UL 514B.
 - 2. Materials of construction: Hot dip galvanized ductile iron body, neoprene sealing sleeve, stainless steel clamps, tinned flexible copper equipment bonding jumper.

2.10 CONDUIT SPACERS

- A. Conduit spacers shall provide stability and consistent separation of underground conduits within a group. Spacers shall be sized for the conduits with which they are used. They shall provide both vertical and horizontal spacing where multiple rows are necessary. Spacing between adjacent conduits shall be 2" unless otherwise shown on the Drawings. Manufacturer shall be Carlon, Underground Devices, or equal.

2.11 BURIED ELECTRICAL LINE WARNING TAPE

- A. Tape shall be of the detectable type and shall consist of a 4 mil or heavier, 6" wide polyethylene tape with an aluminum foil detection strip. Tape text shall be black lettering on red background, two lines wide, letters 2" tall. Text shall be: "CAUTION ELECTRIC

LINE BURIED BELOW". Manufacturer shall be Panduit Corp. HDTU Series, Thomas & Betts E-Z Code, Blackburn Detectable Tape or approved equal.

2.12 FACTORY FINISHES

- A. Finish: For painted steel enclosures, provide manufacturer's standard commercial and industrial coating in ANSI 49 or 61 light gray color, unless otherwise required.
- B. Field painting shall be required for uncoated cast iron, steel and factory primed surfaces. Products shall be degreased and made suitable for field painting prior to packaging for shipment.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATIONS

- A. Interior Above Grade Non-Hazardous Areas: RGS.
- B. Interior Below Grade Non-Hazardous Areas: RAC
- C. Interior Hazardous Areas: PVC-Coated RGS.
- D. Direct Buried: PVC-Coated RGS.
- E. Exterior above grade: PVC-Coated RGS.
- F. Steel channel supports shall be used with RGS.
- G. Aluminum channel supports shall be used with RAC.
- H. Fiberglass channel supports shall be used with PVC-coated RGS.
- I. Connections to transformers, motor-driven equipment, vibrating equipment and equipment requiring position adjustment in non-hazardous areas: LFMC.
- J. Connections to motor-driven equipment, vibrating equipment and equipment requiring position adjustment in hazardous areas: Explosion-Proof Flexible Couplings
- K. Minimum Raceway Size: 3/4-inch trade size.

3.2 INSTALLATION – GENERAL

- A. Deliver raceways, boxes, and fittings to job site in factory packaging. Store in clean, dry, weatherproof locations. Handle in accordance with manufacturer's recommendations.
- B. Install raceways, boxes, and fittings in accordance with manufacturer's installation instructions and NEC requirements as a minimum, and comply with the additional requirements described in this Section.
- C. Conduits shall be mechanically continuous. Metallic conduits shall also be electrically continuous and suitable for use as an equipment-grounding conductor. Make up threaded joints wrench tight.

- D. Fasten boxes using external mounting feet where provided. Do not drill through boxes.
- E. Comply with NEC requirements for sizing outlet and junction boxes to accommodate wires, splices, and devices.
- F. Bends and offsets between pull points shall not exceed a cumulative total of 270 degrees unless otherwise approved by the Engineer. Maximum distance between pull points in conduit systems inside buildings shall be 100 feet unless otherwise approved by the Engineer.
- G. Signal System Raceways, 2-Inch Trade Size and Smaller: In addition to above requirements, install raceways with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.
- H. Raceways shall be routed in conformance with the following guidelines:
 - 1. Install conduits exposed or concealed as specified herein.
 - 2. Do not obstruct access to equipment for operation and maintenance. Coordinate conduit routings with the work of other trades. Plan conduit routings to avoid obstruction of lighting fixtures and HVAC registers. Leave space for easy access to access hatches and doors.
 - 3. Route conduits around doors, windows, hatches, louvers and other building openings.
 - 4. Do not route raceways on floor, grating or walkway top surfaces or otherwise in a manner creating a tripping hazard.
 - 5. Group conduits on horizontal trapeze hangers or on wall-mounted steel channel where long horizontal runs are required.
 - 6. Maintain eight feet minimum clearance above finished floor wherever it is physically possible to do so. Comply with OSHA requirements for minimum headroom.
 - 7. Where conduits enter the top of electrical equipment enclosures and control panels, install conduit interior sealing fittings to prevent entry of water and condensation from conduit.
- I. Cut conduits square with roller-wheel pipe cutter. Hacksaw cuts are acceptable only if the entire conduit is swabbed clean after cutting and threading is completed. Conduits cut in the field shall be threaded with sharp, standard NPT dies to achieve a fully cut tapered thread with a minimum of five full tapered threads at the end of the conduit. Running threads are not acceptable. Over- and under-threading are not acceptable. After threading, ream conduit ends, remove cuttings and debris from inside and outside of conduit, degrease, and apply cold spray-on zinc-rich paint.
- J. Conduit bends shall be made with conduit bending tools manufactured for the purpose. Comply with conduit and bending tool manufacturers' instructions.
- K. Do not cut or drill holes in structural beams and columns, or other structural members. Do not weld raceway supports to structural steel.
- L. Join raceways with fittings designed and approved for that purpose and make joints wrench tight.
- M. Provide expansion and deflection fittings at building expansion joints.

- N. Three-piece (Erickson) couplings shall be used where it is not possible to turn conduits to make up threaded joints. Application for permission to use threadless fittings at specific locations shall be made in writing to the Engineer, and threadless fittings shall not be used unless approved.
- O. Complete raceway installation before starting conductor installation.
- P. When core drilling holes, use non-destructive testing method to locate reinforcing steel and core drill to avoid reinforcing wherever possible.
- Q. Make bends and offsets such that ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel.
- R. Stub-up connections: Extend conduits through floors and above grade for connection to equipment. Arrange so curved portions of bends are not visible above floor level or grade.
- S. Terminations:
 - 1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished surface against box. Use two locknuts, one inside and one outside box. Install bushings wrench-tight.
 - 2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub such that end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.
 - 3. Install temporary closures to prevent foreign matter from entering raceways.
- T. Where conduits pass from outdoor locations to interior locations, seal conduit interior at first interior enclosure. Use duct seal or other acceptable non-hardening compound after conductor installation.
- U. Install pull wires in spare raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- V. Install explosion-proof seal-off fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. Locate and install seal-off fittings in accordance with NEC requirements.
- W. Flexible Connections:
 - 1. Maximum 36 inches of LFMC up to 2 inch trade size, up to 72 inches in larger sizes.
 - 2. Install separate equipment bonding jumper across flexible connections where required by the NEC.
- Y. PVC-Coated Rigid Galvanized Steel Conduits: Use only fittings approved for use with that material.
- Z. Telephone and Signal System Raceways, 2-Inch Trade Size and Smaller: In addition to above requirements, install raceways in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.

3.3 INSTALLATION – EXPOSED RACEWAYS, BOXES AND FITTINGS

- A. Raceways and boxes in interior locations may be installed exposed.
- B. Install exposed raceways parallel or at right angles to nearby surfaces or structural members.
- C. Do not use mechanical piping to support conduit.
- D. Make concentric bends in parallel exposed conduit runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- E. Suspended (trapeze) channel supports shall be 1-1/2 inch x 1-1/2 inch channels suspended from 3/8 inch minimum diameter threaded rod. Fasten rods to structural steel with beam clamps or channel assemblies designed specifically for each application. Fasten threaded rods to concrete with expansion bolts and threaded rod hanger, or concrete channel inserts.
- F. Surface mounted and suspended raceways shall have a maximum support spacing of 6 feet. Maximum unsupported raceway drop length shall not exceed 8 feet.
- G. Keep raceways at least 6 inches away from parallel runs of mechanical piping. Install horizontal raceway above water piping where possible.
- H. Install electrical enclosures and cabinets plumb. Support wall mounted enclosures at each corner.

3.4 INSTALLATION – CONCEALED RACEWAYS, BOXES AND FITTINGS

- A. Install conduits direct buried where indicated on the Drawings.
- B. Install direct buried raceways with a minimum of bends in the shortest practical distance. Provide adjustments to the conduit routings shown as necessary to avoid obstructions.
- C. Do not install conduits over yard piping, except for right-angle crossings. Allow 1:2 cut slope for future excavation of underground piping. Notify the Engineer where these requirements cannot be met.
- D. Provide excavation, backfill and restoration of surfaces for direct buried conduit installation in accordance with all applicable Division 31 and 32 Sections.
- E. Conduit spacers shall be used where direct buried conduits are grouped. Conduit spacers shall be installed at intervals of 8 feet or less.
- F. Install buried electrical line warning tape as indicated on the Drawings.
- G. Bends in direct buried conduits shall have 24 inch minimum bending radius.
- H. Provide conduit risers on building exterior walls for direct buried raceways that are required to enter the building. Penetrate exterior walls above the flood design elevation of 12'-6".

3.5 PENETRATIONS AND SEALING

- A. Core drills and rectangular openings shall be provided as necessary in structures for routing raceways.
- B. Penetration of Waterproof Construction: Coordinate the work to minimize penetration of waterproof construction including exterior walls and roofs. Make each penetration in waterproof construction watertight.
 - 1. Exterior wall penetrations below the flood design elevation of 12'-6" shall not be permitted.
 - 2. Penetrations in exterior slabs shall not be permitted.
 - 3. Where penetrations are necessary in exterior walls, cut or core drill structure above flood wall and seal opening with an acceptable sealing compound.
 - 4. Where penetrations are necessary in the roof, penetrations shall be in accordance with the roofing manufacturer's requirements. Cut or core drill roof deck and provide all flashing, fittings, sealants and other materials as required. Roof warranty shall not be impacted by the installation of penetrations.
- C. Penetration of Interior Hazardous Area Boundaries: Where it is necessary to penetrate an interior wall or floor that separates a hazardous and non-hazardous area, cut or core drill structure and seal opening around conduit with an acceptable sealing compound.

3.6 PROTECTION DURING CONSTRUCTION

- A. Provide protection and maintain conditions that prevent damage or deterioration to coatings and finishes until time of Substantial Completion.
 - 1. Repair damage to galvanize finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC-coated conduits using manufacturer's recommended products.
 - 3. Repair damage to paint finishes with matching touchup coating as recommended by manufacturer.

3.7 CLEANING

- A. Swab conduits clean after installation and plug ends until conductors are installed.
- B. Remove dust and construction debris from raceways, boxes, and fittings after all trades have completed their work.

3.8 IDENTIFICATION

- A. Identify raceways, boxes, and fittings as described in Division 26 Section "Electrical Identification for Electrical Systems".

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

1.1 GENERAL

1.2 SUMMARY

- A. This Section includes product and installation requirements for identification of electrical equipment, receptacles, raceways and conductors.
- B. This Section includes product and installation requirements for warning signs.

1.3 REFERENCE STANDARDS

- A. Comply with the following standards:
 - 1. National Electrical Safety Code (NESC)
 - 2. Nationally Recognized Testing Laboratory (NRTL)
 - 3. NFPA 70E Standard for Electrical Safety in the Workplace®
 - 4. NFPA 79 Electrical Standard for Industrial Machinery

1.4 SUBMITTALS

- A. Submittals shall include the following:
 - 1. Product data
 - 2. Complete list of all engraved nameplates titles.
 - 3. Sample of each of the following (when requested):
 - a. engraved nameplate
 - b. computer-generated label
 - c. wiremarker
 - d. warning sign

PART 2 - PRODUCTS

2.1 EQUIPMENT NAMEPLATES

- A. Provide custom nameplates for all equipment listed in Part 3 of this Section and where indicated elsewhere in the Contract Documents.
- B. Unless otherwise specified, nameplates shall have white letters engraved on black field, and shall be fabricated from 3-layer (black-white-black) thermoset plastic.
- C. Nameplate lettering to be uppercase Roman block letters, minimum height as follows:
 - 1. Switchboard: 1 inch
 - 2. Automatic Transfer Switch: 1 inch
 - 3. Manual Transfer Switch: 1 inch
 - 4. Mobile Generator Connection Cabinet: 1 inch
 - 5. Motor Control Center: 1 inch
 - 6. Pump Protection Panel: 1 inch
 - 7. Panelboards: 1 inch

- 8. Main Control Panel: 1 inch
- 9. All others: 1/4 inch

2.2 PUNCHED TAPE LABELS (RECEPTACLE IDENTIFICATION)

- A. Punched Tape Labels for identification of receptacle circuits shall be 1/2 -inch black tape with white raised lettering.
- B. Manufacturer: Dymo or approved equal

2.3 WIREMARKERS

- A. Wiremarkers shall be in accordance with the General Specifications.
- B. Manufacturer: Brady, T&B, Panduit, or approved equal.

2.4 WIRE COLOR CODING

- A. Comply with NEC requirements for applying color-coding.
- B. Color Coding for service, feeder, and branch circuit wiring shall be as follows:
 - 1. 480/ 277 VOLTS A-B-C-N-G Brown - Orange - Yellow - Gray - Green
 - 2. 208 / 120 VOLTS A-B-C-N-G Black - Red - Blue - White - Green
- C. Color coding for 120 VAC control wiring shall be as follows:
 - 1. Line - Black
 - 2. Neutral - White
 - 3. Ground - Green
 - 4. Switched - any color except black, white, and green.
- D. Color coding for twisted shielded pair and twisted shielded triple signal cable conductors shall be the manufacturer's standard insulation colors.
- E. Color coding for DC power and control circuit wires:
 - 1. Negative polarity - Black
 - 2. Positive polarity - Red
 - 3. Switched - any color except black, red, white, and green

2.5 CONDUIT IDENTIFICATION

- A. Identify exposed unpainted conduits with a black indelible felt-tip marker.
- B. Identify exposed painted conduits with laminated tags fastened with nylon ties.

2.6 WARNING SIGNS

- A. Provide warning signs on electrical equipment, electrical room doors, and automatically started mechanical equipment in accordance with NEC and OSHA requirements.
- B. Electrical Room warning signs shall have the legend "Danger - High Voltage - Authorized Personnel Only".

- C. Automatically started motor-driven and engine-driven equipment shall have warning signs with the legend: "Warning - This Equipment Starts and Stops Automatically".

PART 3 - INSTALLATION

3.1 NAMEPLATES

- A. Fabricate nameplates with titles identifying the equipment name, equipment served and/or its function. Utilize designations as shown on the Drawings.
- B. Provide equipment nameplates for the following:
 - 1. Switchboard
 - 2. Each Switchboard Circuit Breaker
 - 3. Automatic Transfer Switch
 - 4. Manual Transfer Switch
 - 5. Mobile Generator Connection Cabinet
 - 6. Mobile Generator Auto Start/Stop Terminal Box
 - 7. Motor Control Center
 - 8. Each Motor Control Center Compartment
 - 9. Pump Protection Panel
 - 10. Panelboards
 - 11. Main Control Panel
 - 12. Control Panels
 - 13. Disconnect Switches
 - 14. Control Stations
 - 15. Battery Charger
 - 16. Instruments
- C. Each operator interface device on switchboard, automatic transfer switch, motor control center, control panels and control stations shall be provided with a nameplate identifying its function unless a legend plate is provided.
- D. Fasten nameplates to clean flat metal surfaces with pressure-sensitive two-sided adhesive tape.

3.2 RECEPTACLES

- A. Label all receptacle circuits on device faceplates with punched (Dymo) tape.
- B. Provide the following information after load balancing is complete:
 - 1. Panel Designations (as shown on the Panelboard Schedules)
 - 2. Branch Circuit Breaker Number

3.3 WIRE COLOR CODING AND MARKING

- A. Color code each phase, neutral, and ground wire for feeders, and branch circuits, at all locations the wiring is accessible. Wire color shall remain the same for its entire length.
- B. Provide wiremarkers with identification. Utilize control panel or equipment wire numbers when available. Otherwise, develop wire numbering scheme as necessary to uniquely identify each conductor and cable.

3.4 CONDUIT IDENTIFICATION

- A. Clean unpainted conduit surfaces with mineral spirits. Write conduit or circuit number shown on the Drawings or panelboard directory on each conduit at each exposed conduit termination point.

3.5 WARNING SIGNS

- A. Fasten Electrical Room warning signs to doors with self-tapping tamper-resistant stainless screws.
- B. Fasten automatically started equipment warning signs on equipment, adjacent to equipment or suspended above the equipment with chain hangers. Review locations with the Engineer prior to installation.
- C. Install warning signs required by OSHA in accordance with OSHA recommendations.

END OF SECTION

SECTION 26 05 73
OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide an Overcurrent Protective Device Coordination Study for the upgraded Crotonville Pumping Station.
- B. The Overcurrent Protective Device Coordination Study shall be for the power distribution system beginning at the utility transformer and include 480 volt equipment, 480 volt standby generator, 208 volt equipment, and related circuits. Include alternate switching configurations for multiple utility owned primary feeders and for using the standby generator in lieu of the utility source.
- C. Coordination Study shall include the following:
 - 1. Fault-current calculations
 - 2. Overcurrent protective device trip coordination and setting
 - 3. Arc flash analysis and labeling

1.2 DEFINITIONS

- D. In addition to the definitions in Division 26 Section "Electrical", the following definitions apply to this Section:
 - 1. ATS: with respect to NETA, Acceptance Testing Specifications
 - 2. NETA: InterNational Electrical Testing Association
 - 3. PPE: Personal Protective Equipment
 - 4. SLG: Single Line to Ground
 - 5. X/R; Reactance to Resistance Ratio
 - 6. Z: Impedance

1.3 REFERENCE STANDARDS

- E. Comply with the following standards:
 - 1. ANSI/IEEE Std. C37 Family of Guides and Standards for Circuit Breakers, Switchgear, Relays, Substations, and Fuses, with emphasis on the following:
 - a. IEEE Std. C37.48.1TM -2002 IEEE Guide for the Operation, Classification, Application and Coordination of Current-Limiting Fuses with Rated Voltages 1-38 kV
 - b. ANSI/IEEE Std. C37.46. Specifications for Power Fuses and Fuse Disconnecting
 - c. ANSI/IEEE Std. C37.102.1995IEEE Guide for AC Generator Protection 1995
 - 2. ANSI/IEEE Std. C57 Family of Standards for Distribution, Power, and Regulating Transformers, with emphasis on the following:
 - a. IEEE C57.12

- b. IEEE C57.96 Guide for Loading Dry-Type Distribution and Power Transformers
- 3. ANSI/IEEE Std. C2-1997 National Electrical Safety Code
- 4. IEEE 620-1996 IEEE Guide for the Presentation of Thermal Limit Curves for Squirrel Cage Induction Machines
- 5. ICEA P-32-382-1999 Short-Circuit Characteristics of Insulated Cable
- 6. IEEE Std. 141-1993 IEEE Recommended Practice for Electric Power Distribution for Industrial Plants (IEEE Red Book)
- 7. IEEE Std. 242-2001 IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems (IEEE Buff Book)
- 8. IEEE Std. 399-1997 IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis (IEEE Brown Book)
- 9. IEEE Std. 1015-1997 IEEE Recommended Practice for Applying Low Voltage Circuit Breakers in Industrial and Commercial Power Systems (IEEE Blue Book)
- 10. IEEE Std. 1584 Guide for Performing Arc-Flash Hazard Calculations
- 11. NEMA Publication MG 1 Motors and Generators
- 12. NFPA 70 - National Electrical Code
- 13. NFPA 70E – Standard for Electrical Safety in the Workplace
- 14. OSHA - Occupational Safety and Health Administration
- 15. PESH – Public Employee Safety and Health

1.4 SUBMITTALS

- F. Qualifications and Experience:
 - 1. Submit for approval the qualifications and experience of the coordination-study specialist.
 - 2. Provide photocopies of the specialist's software manufacturer's training certificates.
 - 3. Include a minimum of 10 past projects completed by the proposed specialist within the last 2 years. Supply a list of past projects with supplier, contractor, and end-user names and contact telephone numbers.
- G. Submit Overcurrent Protective Device Coordination Study report for approval.
- H. Submit certified "as set" overcurrent protective device tabulations for the record. Include these settings in the Operation & Maintenance Manual.
- I. Arc flash label product type and text. Include sample when requested.

1.5 QUALITY ASSURANCE

- J. Software Qualifications: Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are not acceptable.
- K. Overcurrent Protective Device Coordination Study Specialist Qualifications: An organization experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices. The organization shall have an individual in responsible charge of the study who shall be a New York State registered professional engineer.

- L. The overcurrent protective device settings in the approved Coordination Study shall become part of the database for Electrical Acceptance Testing.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

- A. Computer Software: SKM Power Tools for Windows shall be used for the modeling software.

2.2 COMPUTER SOFTWARE PROGRAM REQUIREMENT

- M. Analytical features of the computer software program shall include "mandatory," "very desirable," and "desirable" features as listed in IEEE 399, Table 7-4.
- N. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices within the scope of the study.

PART 3 - EXECUTION

3.1 PREREQUISITES

- A. Obtain data from the electrical utility as necessary to perform the study.
- B. Obtain damage curves, overcurrent protective device characteristic curves, conductor impedances and other data for equipment, devices and wiring necessary to perform the study. Coordinate with equipment manufacturers and others to obtain the required data.
- C. Proceed with overcurrent protective device coordination study only after relevant data has been collected.

3.2 FAULT-CURRENT CALCULATIONS

- A. Use approved computer software program to calculate values. Include system-switching configurations and alternate operations that could result in maximum and minimum fault conditions.
- B. Calculate momentary and interrupting duties on the basis of maximum available fault current.
- C. Calculations shall comply with the following:
 1. ANSI/IEEE Std. C37.13
 2. ANSI/IEEE Std. C37.46.
 3. ANSI/IEEE Std. C37.50
 4. IEEE Std 399-1997 (IEEE Brown Book)
 5. IEEE Std. 242-2001 (IEEE Buff Book)
 6. IEEE Std. 1015-1997 (IEEE Blue Book)
- D. Enter calculated X/R ratios and interrupting (5-cycle) fault currents on an electrical distribution system diagram in the report. List other output values from computer analysis, including

momentary (1/2-cycle), interrupting (5-cycle), and 30-cycle fault-current values for 3-phase, phase-to-phase, and phase-to-ground faults.

- E. Equipment Short Circuit Ratings Evaluation: Evaluate the adequacy of overcurrent protective device fault-current ratings by comparing devices with calculated fault-current momentary and interrupting duties.

3.3 OVERCURRENT PROTECTIVE DEVICE TRIP COORDINATION

- A. Study shall provide recommended overcurrent protective device settings for the electrical distribution system to coordinate with the electrical utility, to properly protect equipment and wiring and to provide selective coordination of the devices. Provide selective coordination with the utility's upstream overcurrent protective device per utility requirements.
- B. Develop and assemble into the report the following input data to support the study:
 - 1. Electrical distribution system one-line diagram showing the following:
 - a. Utility supply voltage and impedance.
 - b. Circuit-breaker and fuse-current ratings and types.
 - c. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance, and X/R ratios.
 - d. Generator kilovolt amperes, voltage, and source impedance
 - e. Conductors and cables. Indicate conduit material, sizes of conductors, conductor insulation, and length.
 - f. Bus ampere rating, fault current rating and impedance.
 - g. System grounding provisions.
 - h. Motor horsepower and code letter designation according to NEMA MG 1
 - 2. Manufacturer's product data for overcurrent protective devices specified in other Sections. Identify with equipment designation tags that are consistent with electrical distribution system one-line diagrams.
 - 3. Data sheets to supplement electrical distribution system one-line diagram and product data, cross-referenced with tag numbers on diagram:
 - a. Magnetic inrush current and overload capabilities of transformers.
 - b. Transformer, generator and conductor damage curves in log-log graphical format.
 - c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve. Special considerations, including starting inrush currents and frequent starting and stopping.
 - d. Time-current-characteristic curves of overcurrent protective devices in log-log graphical format.
 - e. Manufacturer, frame size, interrupting rating in amperes rms symmetrical for circuit breakers.
- C. Perform coordination study incorporating the results of fault-current study and approved computer software program.
- D. Recommendations shall comply with the following:
 - 1. IEEE Std. 242-2001 (Buff Book) recommendations for fault currents and time intervals.
 - 2. IEEE Std. 399-1997 (Brown Book) recommendations for analysis.
 - 3. NEC for overcurrent protection of circuit elements and devices.

- E. Transformer Primary Overcurrent Protective Devices:
 - 1. Device shall not operate in response to the following:
 - a. Self-cooled, full-load current.
 - b. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.
 - 2. Device shall protect transformer according to IEEE C57.12.00, for fault currents.
- F. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves in IEEE 242 (Buff Book). Verify adequacy of phase conductors at maximum three-phase bolted fault currents, equipment grounding conductors, and grounding electrode conductors at maximum ground-fault currents.

3.4 ARC FLASH ANALYSIS

- A. Provide an arc flash analysis in accordance with OSHA 29 CFR 1910.132(d), IEEE 1584, and, NFPA 70E Article 130 and Annex D.
- B. Arc flash hazard analysis shall compute incident energy levels, proper ratings of PPE, NFPA 70E shock approach boundary distances, arc flash and shock protection boundaries, and warning label requirements. Incident energy and arc flash protection boundaries shall be computed using IEEE 1584, "IEEE Guide for Performing Arc Flash Hazard Calculations".
- C. The PPE determination shall be based upon potential arc flash incident energy exposure levels with respect to fault current calculations and overcurrent protective device settings including enabling of arc energy reduction features. Analysis shall be based on the distribution system source and configuration resulting in the most stringent requirements.
- D. Provide recommendations for mitigating arc flash incident energy where possible without compromising reliability of the distribution system.
- E. Provide permanent labeling on electrical equipment indicating the specific arc flash hazard. Labels shall include the following minimum information:
 - 1. Equipment Description
 - 2. Equipment Voltage Rating
 - 3. Flash Hazard Category
 - 4. Arc Flash Protection Boundary (inches)
 - 5. Arc Flash Incident Energy at the Working Distance (cal/cm²)
 - 6. Working Distance Boundary (inches)
 - 7. Recommended Protection (including glove rating)
 - 8. Limited, Restricted and Prohibited Approach Distances Boundaries (inches)
 - 9. Bolted Fault Current
 - 10. Date of Issue
 - 11. Contractor Contact Information
 - 12. For systems having arc energy reduction features, include text advising personnel that arc flash data is based on the arc energy reduction features being enabled
- F. Provide labeling on the following minimum equipment:
 - 1. Switchboard
 - 2. Automatic transfer switch
 - 3. Manual transfer switch

4. Motor control center
5. Panelboards
6. Disconnect switches
7. Control panels

3.5 REPORT

- A. Overcurrent Protective Device Coordination Study Report: Prepare a report with the following:
 1. Include input data and study results identified in the Subsections "Prerequisites", "Fault-Current Calculations", "Overcurrent Protective Device Trip Coordination" and "Arc Flash Analysis".
 2. Updated One-line diagram as shown on the Drawings.
 3. One-line diagram as developed in the modeling software showing the following:
 - a. Service voltage characteristics
 - b. Distribution system schematic
 - c. Circuit-breaker and fuse-current ratings and types.
 - d. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance, and X/R ratios.
 - e. Generator kilovolt amperes, size, voltage, and source impedance.
 - f. Conduit material, sizes of conductors, conductor insulation, and length.
 - g. Motor horsepower and code letter designation according to NEMA MG 1
 4. Coordination Curves: Graphically illustrate that adequate time separation exists between series devices for selective coordination. Provide the following specific information:
 - a. Device tags correlated to tags on the one-line diagram.
 - b. Voltage and current ratio for time-current curves.
 - c. Three-phase and single-phase damage curves for transformers and generator.
 - d. No-damage, melting, and clearing curves for fuses.
 - e. Cable damage curves
 - f. Transformer inrush points.
 - g. Maximum fault-current cutoff point.
 5. General description of arc flash boundaries and PPE applicable to the study.
 6. Tabular format summarizing study results:
 - a. Comparison of calculated fault currents to equipment fault current ratings.
 - b. Overcurrent protective device recommended settings.
 - c. Calculated arc flash information.
 7. Data sheets for setting other protective devices (e.g. motor controller protective features).

8. Recommendations to correct any deficiencies presented in the study results.

3.6 OVERCURRENT PROTECTIVE DEVICE SETTING

- A. After overcurrent protective devices have been installed, and prior to startup and energization of electrical power distribution system components, perform the following:
 1. Verify that overcurrent protective devices match the manufacturer's model and type used in the study.
 2. Adjust existing and new devices to values listed in study report.
- B. Submit marked-up tabulations matching "as-set" conditions for the record.

END OF SECTION

SECTION 26 09 16 ELECTRICAL CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide electrical controls as shown on the Drawings and specified herein.

1.2 REFERENCE STANDARDS

- A. Comply with the following standards:
 - 1. NFPA 70 – The National Electrical Code (NEC)
 - 2. NFPA 79-2002 Electrical Standard for Industrial Machinery
 - 3. National Electrical Manufacturers Association - NEMA
 - 4. Underwriters Laboratories, Inc. - UL

1.3 SUBMITTALS

- A. Submit manufacturer's catalog data for each electrical control component, clearly marked to show what is proposed for this project. Cross out inapplicable data. Include manufacturers catalog data with the Shop Drawings for the equipment making reference to this Section.

PART 2 - PRODUCTS

2.1 CONTROL POWER TRANSFORMERS

- A. Control power transformers have 120 volts AC grounded single phase secondary for control circuits. Provide two primary fuses rated 100,000 amperes interrupting capacity at 600 volts, and one secondary fuse rated 300 volts.
- B. Minimum capacities shall be as shown on the Drawings. Provide additional capacity if necessary for control circuit loads as actually installed.

2.2 POWER SUPPLIES

- A. Power supplies shall be solid state, linear regulated type with 120 VAC input, 24 VDC output, minimum capacity as shown on the Drawings and pin socket mounting. Include mounting socket with wiring terminal connectors.
- B. Manufacturer shall be Acopian, Phoenix Contact or equal.

2.3 CONTROL AND TIMING RELAYS

- A. Control relays shall be encapsulated, general purpose plug-in type. Provide restraining straps and relay bases recommended by the relay manufacturer. Coils shall operate at 120 VAC unless otherwise shown.

- B. Control relays shall be provided with integral check push-button for testing operation of the relay contacts.
- C. Control relays shall be provided with an integral indicating light showing the position of the relay (de-energized or energized).
- D. Contact quantities and types shall be as shown on the Drawings and shall have silver cadmium oxide construction with the following NEMA Standard ICS5 A300 contact ratings:
 - 1. 10 amps continuous, 1/3 HP at 120 VAC
 - 2. 10 amps continuous, 1/2 HP at 240 VAC
 - 3. 10 amps continuous at 24 VDC
- E. Provide multiple relays with parallel coil connections where necessary to obtain the required contact quantities.
- F. Timing relays shall be solid state type having adjustable time settings within adjustable time ranges.
 - 1. Time delay range shall be field-adjustable from 0.6 to 60 seconds unless otherwise indicated on the Drawings.
- G. Control and timing relays shall be as manufactured by:
 - 1. Square D
 - 2. Idec
 - 3. Potter & Brumfield
 - 4. Equal

2.4 PUSHBUTTONS, SELECTOR SWITCHES, INDICATING LIGHTS

- A. General
 - 1. Devices shall be heavy duty, watertight and oiltight, with die cast operator bodies in non-corrosive areas, non-metallic bodies in corrosive areas, nominal 1-1/4 inch (30.5 mm) diameter, and molded modular type contact blocks.
 - 2. Devices shall be rated NEMA 4 and NEMA 13 in non-hazardous areas. Devices in hazardous areas shall be suitable for the hazardous areas classification as shown on the Drawings.
 - 3. Pushbuttons and selector switches, and indicating lights shall be suitable for operation on 120 volts, 60 Hertz.
- B. Pushbuttons
 - 1. Pushbuttons shall have button operator with color inserts and guards, engraved legend plates, and contact blocks as required for the specified functionality.
 - 2. Emergency Stops shall be maintained contact type pushbuttons (push to stop/pull to enable) with red mushroom head operators.
 - 3. Start pushbuttons shall be fully guarded, with green color insert, and momentary contacts.
 - 4. Stop pushbuttons shall be unguarded (button extends above ring), with red color insert, and momentary contacts.

- C. Selector Switches
 - 1. Selector switches shall have gloved hand type operators, engraved legend plates, and contact blocks as required for the specified functionality.
- D. Indicating Lights
 - 1. Indicating lights shall be LED type with color caps matching the LED color and engraved legend plates.
 - 2. Provide integral flashing feature where indicated on the Drawings.
- E. Manufacturers
 - 1. General Electric
 - 2. Square D
 - 3. Allen Bradley
 - 4. Equal.

2.5 CONTROL STATIONS

- A. Control stations shall have enclosure ratings and types in conformance with Division 26 Section "Electrical", with factory provided openings for pushbuttons, indicator lights and selector switches.

2.6 DOOR SWITCHES

- A. Door switches shall be surface mounting type consisting of a door mounted encapsulated magnet and an encapsulated reed switch mounted on the adjacent door frame. Reed switch shall actuate when within a 1" air gap of the magnet.
- B. Reed switch shall be SPDT and suitable for use at 120 volts. Switch shall include a three-conductor cable with overall jacket or armor, 12" length minimum. Provide a wall mounted junction box located adjacent to the switch for connection of cable to building wiring.
- C. Provide all hardware, brackets and fasteners as necessary for mounting on the required doors/door frames.
- D. Manufacturer shall be George Risk Industries or equal.

2.7 SMOKE DETECTORS

- A. Smoke detector shall be ceiling mounted, photoelectric type with 120 VAC operating voltage, relay contacts, integral alarm horn and test switch. Detector shall be UL 217 and UL 1730 listed.
- B. Manufacturer shall be Gentex Model 9123F or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- B. Install electrical controls in conformance with the manufacturer's installation instructions and recommendations, and as shown on the Drawings.

- B. Provide all calibration, programming and adjustments as necessary for a fully functioning control system.
- C. Provide identification of electrical controls in accordance with the Division 26 Section "Identification for Electrical Systems".
- D. Door switches shall be mounted on the interior side of exterior doors and on the header portion of the door frames.

3.2 ACCEPTANCE TESTS

- A. Acceptance testing shall be performed as specified in the individual Specification Sections utilizing the control components.

END OF SECTION

SECTION 26 21 00 ELECTRICAL SERVICE ENTRANCE

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide electrical incoming secondary electrical service as shown on the Drawings and specified herein.
- B. The Contractor shall be responsible for arranging with the serving utility to complete the installation of the incoming service in conformance with the approved Project Schedule, and to coordinate with the utility's material and installation requirements.
- C. Electrical utility: Consolidated Edison
- D. The Owner will pay all utility charges related to the installation of incoming service.

1.2 QUALITY ASSURANCE

- A. The incoming service installation shall be inspected and approved by the utility.
- B. The incoming service shall be inspected and approved by the AHJ.
- C. Provide compliance with applicable utility standards.
- D. Inspection certificates shall be submitted prior to energization of the incoming electrical service.

1.3 COORDINATION REQUIREMENTS

- A. Coordinate layout and installation of incoming service equipment and wiring with the work of other trades.
- B. Pre-Installation Meetings: The Contractor shall request a meeting with the Owner and the utility prior to commencing work. The agenda shall include the following items as a minimum:
 - 1. Review of scheduling requirements
 - 2. Discussion of the coordination requirements
 - 3. Review of Owner's needs for continuity of service
- C. Scheduling: The following milestones and activities shall be included in the Contractor's schedule for the project:
 - 1. Kickoff meeting with the utility
 - 2. Procurement of equipment and materials, including utility equipment and materials
 - 3. Installation of equipment and materials, including utility equipment and materials
 - 4. Inspections
 - 5. Energization
- D. Submit shop drawings, product data and test reports associated with the medium voltage conductors and switchboard to the utility for approval in accordance with the Division 26 Sections "Medium Voltage Conductors" and "Switchboard".

- E. Coordinate with the utility regarding handling and reinstallation of existing utility owned switchgear.
- F. Coordinate with the utility regarding handling and installation requirements of utility owned transformer.

1.4 SUBMITTALS

- A. Certificates: copy of the inspection certificates from the AHJ, and copy of the inspection certificate from the utility.
- B. Test Reports for equipment and materials specified in other Sections.

PART 2 - PRODUCT

2.1 MATERIALS

- A. All material shown on the Contract Drawings, specified below, or required by the utility shall be in accordance with applicable sections of the specifications and utility standards.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Electrical Service
 - 1. The utility will perform the following:
 - a. Disconnect existing primary feeders from existing overhead lines at riser pole.
 - b. Remove existing utility owned pad mounted transformer.
 - c. Remove existing revenue meter.
 - d. Furnish pad mounted transformer for platform mounting.
 - e. Provide connection of conduit MF-1A and MF-1B conductors to overhead lines.
 - f. Furnish metering transformers.
 - g. Provide revenue meter.
 - h. Inspect and approve the completed installation prior to connecting the incoming service.
 - 2. Contractor shall perform the following:
 - a. Remove existing utility owned primary feeder conductors.
 - b. Provide relocation of existing utility owned pad mounted switchgear to new equipment platform. Installation shall be in accordance with utility requirements.
 - c. Install utility owned pad mounted transformer on equipment platform. Installation shall be in accordance with utility requirements.
 - d. Provide switchboard with provisions for mounting utility metering transformers.
 - e. Install and connect utility metering transformers.

- f. Provide primary feeders from existing riser pole to existing/relocated utility owned switchgear and from existing/relocated utility owned switchgear to utility owned transformer including equipment connections.
- g. Provide secondary feeder from utility owned transformer to switchboard including connections.
- h. Provide wiring from utility metering transformers located in switchboard to revenue meter including connections.
- i. Provide all distribution equipment and wiring on the load side of the switchboard.
- j. Provide any additional materials or labor required by the utility.
- k. Comply with all applicable utility standards.
- l. Arrange for inspection by the local inspection agency responsible for such inspections.

END OF SECTION

SECTION 26 22 13

LOW VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide dry type transformers (600V and less) as shown on the Drawings and specified herein.

1.2 DEFINITIONS

- A. In addition to the definitions in Division 26 Section "Electrical", the following definitions apply to this Section:
 - 1. FCAN: full capacity above normal
 - 2. FCBN: full capacity below normal

1.3 QUALIFICATIONS

- A. The manufacturer of the core and coil shall procure all other transformer components, and shall assemble, factory test, and prepare the transformer for shipping.
- B. Testing firm shall be qualified as defined by OSHA in 29 CFR 1910.7, shall be a member of the InterNational Electrical Testing Association, shall be acceptable to the AHJ, and shall have supervision as follows:
 - 1. Testing Firm's Field Supervisor: certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

1.4 REFERENCE STANDARDS

- A. Comply with the following standards:
 - 1. IEEE C2 National Electrical Safety Code.
 - 2. IEEE 259-1999 IEEE Standard Test Procedure for Evaluation of Systems of Insulation for Dry-Type Specialty and General Purpose Transformers
 - 3. IEEE C57 Family of Guides and Standards for Distribution, Power, and Regulating Transformers, with emphasis on the following:
 - a. IEEE C57.12.01-1998 IEEE Standard General Requirements for Dry-Type Distribution and Power Transformers Including Those with Solid Cast and/or Resin Encapsulated Windings
 - b. IEEE C57.12.55-1987 (R1998) American National Standard for Transformers--Dry-Type Transformers Used in Unit Installations, Including Unit Substations--Conformance Standard
 - c. IEEE C57.12.70 IEEE Standard Terminal Markings and Connections for Distribution and Power Transformers
 - d. IEEE C57.12.80 IEEE Standard Terminology for Power and Distribution Transformers
 - e. IEEE C57.12.91 IEEE Standard Test Code for Dry-Type Distribution and Power Transformers

- f. IEEE C57.96-1999 IEEE Guide for Loading Dry-Type Distribution and Power Transformers
- g. IEEE C57.105-1978 (R1999) IEEE Guide for Application of Transformer Connections in Three-Phase Distribution Systems
- h. IEEE C57.110-1998 IEEE Recommended Practice for Establishing Transformer Capability When Supplying Nonsinusoidal Load Currents
- 4. NEMA Standard ST-20
- 5. NEMA Standard TP-1 for Energy Efficient Transformers
- 6. NEMA Standard TP-2 for Test Requirements for Energy Efficient Transformers
- 7. NFPA 70 National Electrical Code
- 8. UL Standard 1561
- 9. Other applicable NRTL Standards

1.5 ENVIRONMENTAL CONDITIONS

- A. Temperature, humidity and elevation shall be as specified in Division 26 Section "Electrical".

1.6 SUBMITTALS

- A. Product Data: Technical data sheets, marked to show equipment selected for this project.
- B. Shop Drawings
 - 1. Specially prepared shop drawings including the following:
 - a. Equipment nameplate data and electrical ratings
 - b. Weights and overall dimensions
 - c. General arrangement, section view, and sub-assembly drawings cross-indexed to a complete bill of materials listing all components and part numbers
 - d. Connection diagrams and details.
 - e. Location of field wiring and conduit connections
- C. Qualifications and experience for the electrical testing firm.
- D. Acceptance test reports

1.7 COORDINATION

- A. Coordinate layout and installation of transformers with the work of other trades, including mechanical equipment and piping, ceilings (where applicable), and adjacent surfaces. Maintain required clearances for workspace and equipment access panels.
- B. Coordinate concrete equipment pad dimensions with dimensions of approved transformer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Acme

2. General Electric
3. Square D / Groupe Schneider NA
4. Sola

2.2 DRY-TYPE DISTRIBUTION TRANSFORMERS

- A. Dry type distribution transformers shall be energy efficient type with the following ratings:
 1. Capacity (kVA) as shown on Drawings at 30 deg. C average, 40 deg. C max. ambient air temperature in accordance with IEEE C57.96-1999
 2. 220 deg. C insulation system.
 3. Insulation Temperature Rise: 150 deg C, maximum rise above 40 deg C.
 4. Primary voltages as shown on Drawing, three phase delta 60 Hz primary
 5. Secondary voltages as shown on Drawings, solidly grounded wye secondary
 6. Two-2.5% FCBN, two-2.5% FCAN primary taps (minimum).
- B. Insulation Materials: IEEE C57.12.01, NEMA ST20, non-hygroscopic, thermosetting varnish.
- C. Core and Coil Assemblies: Transformer coils shall be copper wound on a core of electrical grade steel with high magnetic permeability and insulated laminations.
- D. Grounding: Provide equipment grounding terminal.
- E. Enclosure shall be ventilated, floor mounted type fabricated from heavy gauge steel, cleaned, degreased, primed and painted, ANSI 61 light gray.

2.3 QUALITY ASSURANCE

- A. Factory Tests: Perform design and routine tests according to standards specified for components. Conduct transformer tests according to NEMA ST-20 for standard transformers.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of conduits and grounding systems to verify the following:
 1. Wiring entries comply with layout requirements.
 2. Entries are within conduit-entry tolerances specified by manufacturer and wiring will not have to cross section barriers to reach load or line lugs.
- B. Examine area for suitable mounting conditions where transformers will be installed.
- C. Verify that grounding electrode conductors and equipment grounding conductors are in place.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 DELIVERY, STORAGE, AND HANDLING

- A. Store transformers in rooms with a temporary dehumidifier and heating to maintain the storeroom between 5 and 40 deg. C with humidity less than 90%. Comply with manufacturer's additional written instructions for storing and periodic inspection and

testing. Transformers shall be megger-tested monthly during storage. Units that have absorbed excessive moisture due to poor humidity and temperature control shall be returned to the manufacturer for drying-out and re-establishing acceptable megger test values at no additional cost to the Owner.

3.3 INSTALLATION

- A. Use steel channel for wall support assemblies.
- B. Floor mounted enclosures shall be mounted on 4 inch high concrete equipment pads. Coordinate size of concrete equipment pads with approved transformer shop drawings.
- C. Place and secure anchorage devices. Use equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
- D. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and the NEC.

3.4 CONNECTIONS

- A. Provide primary tap connections as necessary to achieve rated secondary voltage.

3.5 ACCEPTANCE TESTING

- A. Engage a qualified testing firm to perform the following field quality contract testing:
 - 1. After installing transformers but before primary is energized, verify that grounding system is tested at specified value or less.
 - 2. Perform electrical test and visual and mechanical inspection described in NETA Acceptance Testing Specification 7.2.1.1 "Transformers, Dry-Type, Air-Cooled, Low-Voltage, Small".
- B. Certify compliance with test parameters.
- C. Remove malfunctioning units, replace with new units, and retest as specified above.
- D. Test Reports: Prepare written reports to record the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Test results that do not comply with requirements and corrective actions taken to achieve compliance with requirements.

END OF SECTION

SECTION 26 24 13 SWITCHBOARD

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the switchboard as specified herein and as shown on the Drawings.

1.2 REFERENCES STANDARDS

- A. Comply with the following standards:
1. ANSI/NFPA 70 - National Electrical Code (NEC)
 2. NEMA AB-1 - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures
 3. NEMA PB 2 - Deadfront Distribution Switchboards, File E8681
 4. NEMA PB 2.1 - Proper Handling, Installation, Operation and Maintenance of Deadfront Switchboards Rated 600 Volts or Less
 5. UL 50 - Cabinets and Boxes.
 6. UL 489 - Molded-Case Circuit Breakers and Circuit Breaker Enclosures
 7. UL 891 - Dead-Front Switchboards
 8. Federal Specification W-C-375B/Gen - Circuit Breakers, Molded Case, Branch Circuit And Service

1.3 SUBMITTALS

- A. Product Data: Overcurrent protective device, accessory, and components indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: Submit the following:
1. Specially prepared drawings showing dimensions, busbars, circuit breakers, and complete bill of materials listing all components. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details.
 - b. Bus configuration, current, and voltage ratings.
 - c. Short-circuit current rating of switchboard and overcurrent protective devices.
 - d. UL listing for series rating of installed devices.
 - e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - f. One-line or three-line power distribution diagrams.
- C. Time-current curves, including selectable ranges for each type of adjustable overcurrent protective device.
- D. Factory test results.

- E. Field quality control test reports including the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- F. Operation and Maintenance Data: Include the following:
 - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
- G. Submittals to the Electrical Utility
 - 1. After Engineer's review and acceptance, and prior to fabrication, submit product data for switchboard to the electrical utility for approval. Incorporate any utility comments to their satisfaction and resubmit if required by the utility.
 - 2. After Engineer's review and acceptance, and prior to shipment, submit factory test reports to the electrical utility for approval. Incorporate any utility comments to their satisfaction and retest if required by the utility.
 - 3. After Engineer's review and acceptance, submit acceptance test reports to the electrical utility for approval. Incorporate any utility comments to their satisfaction and retest if required by the utility.
 - 4. The Engineer shall be copied on all utility submittals, on all review comments from the utility and on all resubmittals to the utility.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain switchboard, components, and accessories through one source from a single manufacturer.

1.5 ENVIRONMENTAL CONDITIONS

- A. Temperature, humidity and elevation shall be as specified in Division 26 Section "Electrical".

1.6 COORDINATION

- A. Coordinate layout and installation of switchboard with other equipment, raceways, piping, and obstructions to workspace clearance requirements.
- B. Coordinate concrete equipment pad dimensions with dimensions of approved switchboard.

PART 2 - PRODUCT

2.1 GENERAL

- A. Switchboard shall be rated for 480 VAC, three phase, four wire, 60 Hertz with main bus ampacity as shown on the Drawings. Switchboard shall be UL listed for service entrance.
- B. Switchboard shall be rated for short circuit currents of 65,000 amps RMS symmetrical at 480 VAC, three phase, 60 Hertz.
- C. Enclosure shall have the following features:
 - 1. Free-standing, floor-mounted, steel construction with front access. Rear access shall not

- be necessary.
- 2. Removable steel base channels (1.5 inch floor sills) bolted to the frame to rigidly support the entire shipping section for moving on rollers and floor mounting.
- 3. Paint finish on all surfaces. The paint finish shall be a medium gray, ANSI #49, applied by the electro-deposition process over an iron phosphate pre-treatment.
- 4. Covers with screw fasteners removable with a single tool and hinged doors with removable hinge pins.
- 5. Top and bottom conduit areas.
- D. Busses shall be copper. The switchboard bussing shall be of sufficient cross-sectional area to meet UL Standard 891 temperature rise requirements. Tapered bus is not acceptable. Bus connections shall be with Grade 5 bolts and conical spring washers.
- E. Ground bus shall be sized per NFPA 70 and UL 891 Tables 25.1 and 25.2 and shall extend the entire length of the switchboard.
- F. Switchboard shall have provisions to terminate the size and quantity of incoming line and outgoing feeder conductors as shown on the Contract Drawings.
- G. Provide identification of switchboards in accordance with the Division 26 Section "Identification for Electrical Systems".
- H. Manufacturers:
 - 1. Square D
 - 2. General Electric
 - 3. Eaton/Cutler-Hammer
 - 4. Siemens
 - 5. Equal

2.2 COMPONENTS

- A. Switchboard shall include main circuit breaker, customer metering, utility metering transformer compartment and all accessories necessary for a complete assembly.
- B. Main circuit breaker: stationary, insulated case type with ratings as shown on the Drawings.
 - 1. Breaker trip unit shall be solid state with long time, short time, instantaneous and ground fault adjustments.
 - 2. Breaker shall include an arc energy reduction feature. Feature shall provide a temporary instantaneous trip setting to be used during maintenance activities. Feature shall be enabled by a switch mounted on the front of the switchboard and shall include an indicating light showing enabled-disabled status.
 - 3. Breaker shall have operating handle accessible from the switchboard exterior. Handle shall be capable of being pad locked in the open position.
- C. Instrument transformers for customer metering: comply with IEEE C57.13.
 - 1. Potential Transformers: Secondary voltage rating of 120 V and NEMA accuracy class 0.3.
 - 2. Current Transformers: Ratios as necessary for the application, burden and accuracy class suitable for connected meters and instruments.
- D. Customer metering: Provide a NRTL-listed or NRTL-recognized, microprocessor-based digital power monitor suitable for the electrical system as specified and equipped with the following features:
 - 1. Accept inputs from current sensors or 5 amp current-transformer secondaries and

voltages up to 600 V.

2. Provide keypad-selectable digital display of the following:
 - a. Phase Currents, each phase: plus or minus 1 percent.
 - b. Phase-to-Phase Voltages, three phase: plus or minus 1 percent.
 - c. Phase-to-Neutral Voltages, three phase: plus or minus 1 percent.
 - d. Three-Phase Real Power: plus or minus 2 percent.
 - e. Three-Phase Reactive Power: plus or minus 2 percent.
 - f. Power Factor: plus or minus 2 percent.
 - g. Frequency: plus or minus 0.5 percent.
 - h. Integrated Demand, with demand interval selectable from 5 to 60 minutes: Plus or minus 2 percent.
 - i. Accumulated energy, in megawatt hours plus or minus 2 percent; stored values unaffected by power outages for up to 72 hours.
3. Mounting: Display and control unit flush or semi-flush mounted on switchboard front.
- E. Utility metering compartment: suitable for mounting the utility's metering transformers. Provide all necessary space, bus connection points, isolation, locking provisions and other features as required by the utility. Include installation of metering transformers furnished by the utility.

2.3 FACTORY TESTING

- A. Provide factory tests in accordance with UL 891 and NEMA PB 2.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide installation in accordance with the manufacturer's installation recommendations.
- B. Switchboard shall be mounted on a 4 inch high concrete equipment pad.
- C. Grounding shall be in accordance with the Division 26 Section "Grounding and Bonding for Electrical Systems".
- D. Paint all scratches, mars, etc., resulting from installation. Use matching paint.
- E. Circuit breaker trip adjustments shall be in accordance with results of the Overcurrent Protective Device Coordination Study specified herein.

3.2 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 1. Test insulation resistance for switchboard busses, components and connecting supply, feeder.
 2. Test continuity of each incoming and outgoing circuit.
 3. After installing switchboard but before main is energized, verify that grounding system tested at the specified value or less.
 4. Verify that switchboard is installed and connected according to the Contract Documents.
 5. Verify that field-installed wiring complies with Division 26 requirements.

6. Verify that equipment is ready for pre-commissioning checks in accordance with manufacturer's written instructions.
7. Check that field-adjustable circuit-breaker trip adjustments have been set in accordance with project requirements.
- B. Engage a qualified testing agency to perform the following field tests and inspections and prepare test reports:
 1. Perform visual and mechanical inspection and electrical tests in conformance with NETA Acceptance Testing Specification Inspection and Test Procedures applicable to the installed systems and devices, including the following:
 - a. 7.1 "Switchgear and Switchboard Assemblies"
 - b. 7.13 "Grounding Systems:"
 - c. 7.14 "Ground-Fault Protection Systems, Low-Voltage"
 2. Certify compliance with test parameters.
 3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.3 FOLLOWUP SERVICE

- A. Infrared Scanning: One month after Substantial Completion, perform an infrared scanning of the switchboard in conformance with NETA Acceptance Testing Specification 9. "Thermographic Survey". Remove panel fronts so joints and connections are accessible to scanner.
- B. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of the switchboard 6 months after date of Substantial Completion.
- C. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 1. Record of Infrared Scanning: Prepare a certified report that identifies the switchboards checked and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action. Provide a color photo together with an infrared photo of the switchboard in the report.
 2. Retest until satisfactory results are obtained.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide Panelboard PP and Panelboard LP as shown on the Drawings and specified herein.
- B. Panelboard voltage characteristics, current ratings, main type, number of branch circuits and branch circuit breaker trips/poles shall be as shown on the Drawings.

1.2 QUALIFICATIONS

- A. Testing firm shall be qualified as defined by OSHA in 29 CFR 1910.7, shall be a member of the InterNational Electrical Testing Association, shall be acceptable to the AHJ, and shall have supervision as follows:
 - 1. Testing Firm's Field Supervisor: certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

1.3 SUBMITTALS

- A. Product Data: For each type of panelboard, overcurrent protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment, submit the following:
 - 1. Specially prepared drawing for each panelboard showing dimensions, busbars, circuit breakers, doors and trim, latches and locking devices, and complete bill of materials listing all components. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details
 - b. Bus configuration, current, and voltage ratings.
 - c. Short-circuit current rating of panelboard and overcurrent protective devices
 - d. UL listing
 - e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 2. Wiring Diagrams: Show internal distribution.
- C. Qualification Data: For testing firm.
- D. Field quality-control test reports including the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

- E. Panelboard Circuit Directory: For installation in panelboards.
- F. Operation and Maintenance Data: For panelboards and components to include in the Operation, and Maintenance Manuals. Include the following:
 - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 - 2. Time-current curves, including selectable ranges for each type of adjustable overcurrent protective device.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NEMA PB 1.
- D. Comply with NFPA 70.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the ambient temperature, altitude, and humidity conditions described in the Division 26 Section "Electrical".

1.6 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Keys: Two spares for each type of panelboard cabinet lock.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
 - 1. Eaton Corporation: Cutler-Hammer Products
 - 2. General Electric Co.: Electrical Distribution & Protection Div.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D
 - 5. Equal

2.2 PANELBOARDS

- A. Enclosures: Surface-mounted cabinets in conformance with NEMA PB 1.
 - 1. Rated for environmental conditions at installed locations, and in conformance with Division 26 Section "Electrical" for enclosure requirements.
 - 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions.
 - 3. Door: Hinged to trim with full height piano hinge.
 - 4. Gutter Extension and Barrier: Same gauge and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
 - 5. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
 - 6. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.
 - 7. The manufacturer's nameplate shall be of corrosion resistant metal such as stainless steel and have the pertinent ratings embossed in raised letters and numerals. The pertinent ratings shall include at least the following; amperage, voltage, phase, wires, AIC, manufacturer and model number.
- B. Phase and Neutral Buses: Tin-plated Hard-drawn copper, 98 percent conductivity.
- C. Equipment Ground Bus: Hard-drawn copper, adequate connections for feeder and branch-circuit equipment ground conductors; bonded to box.
- D. Main Device: Main lugs (MLO) or main circuit breaker (MCB), as indicated on the drawings.
- E. Conductor Connectors: Suitable for use with conductor material.
 - 1. Main and Neutral Lugs: Mechanical type.
 - 2. Ground Lugs: Mechanical type.
- F. Circuit Breakers: Molded case, bolt-on type.
- G. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

2.3 SURGE PROTECTIVE DEVICE

- A. Panelboard LP shall be provided with an integral mounted surge protective device in accordance with the Division 26 Section "Surge Protective Devices".

2.4 PANELBOARD SHORT-CIRCUIT RATING

- A. Fully rated to interrupt symmetrical short-circuit current available at terminals as scheduled on the Drawings.

2.5 OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker: UL 489, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Number of poles and trip ratings as indicated on the Drawings.
 - 2. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Mount top of trim 74 inches above finished floor, unless otherwise indicated.
- C. Mount plumb and rigid without distortion of box.
- D. Install overcurrent protective devices and surge protective devices.
 - 1. Set field-adjustable circuit-breaker trips.
- E. Install filler plates in unused spaces.
- F. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.2 IDENTIFICATION

- A. Identify panelboards as specified in Division 26 Section "Identification for Electrical Systems."
- B. Provide typed or computer-generated directory card with description of each circuit.

3.3 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems".
- B. For panelboards serving separately derived systems, provide system bonding jumper from panelboard neutral bus to panelboard ground bus.
- C. Connect wiring according to Division 26 Section "Low Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each panelboard bus and connecting supply feeder.
 2. Test continuity of each circuit.
- B. Engage a qualified testing firm to perform the following field tests and inspections and prepare test reports:
1. Perform electrical test and visual and mechanical inspections described in the following NETA Acceptance Testing Specification Inspection and Test Procedures that are applicable to the products furnished for this project:
 - 7.1 "Switchgear and Switchboard Assemblies"
 - 7.6.1.1 "Circuit Breakers, Air, Insulated-Case, Molded-Case"
 - 7.19.1 "Surge Arresters, Low-Voltage"
 2. Certify compliance with test parameters.
 3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

END OF SECTION

SECTION 26 24 19 MOTOR CONTROL CENTERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide motor control centers as shown on the Contract Drawings and specified herein.
- B. This Section includes motor control centers for use on AC circuits rated 600 V and less.

1.1 DEFINITIONS

- A. In addition to the definitions in Division 26 Section "Electrical", the following definitions apply to this Section:
 - 1. MCC: motor control center

1.2 QUALIFICATIONS

- A. The motor control center structure, buses, circuit breakers, and motor controllers shall be the products of a single manufacturer and shall be designed, tested, and manufactured in accordance with the standards referenced in this Specification.
- B. Testing Firm Qualifications: An independent firm, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 - 1. Testing Firm's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

1.3 REFERENCE STANDARDS

- A. Comply with the following standards:
 - 1. ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
 - 2. National Electrical Code
 - 3. NEMA 250 Enclosures for Electrical Equipment
 - 4. NEMA ICS 2 - General Standards for Industrial Control Systems
 - 5. NEMA ICS 3 - Standards for Industrial Control Devices, Controllers and Assemblies
 - 6. NEMA ICS 18 - Motor Control Centers
 - 7. NFPA 79 - Electrical Standard for Industrial Machinery
 - 8. UL 508 - Industrial Control Equipment
 - 9. UL 845 - Motor Control Centers

1.4 ENVIRONMENTAL CONDITIONS

- A. Temperature, humidity and elevation shall be as specified in Division 26 Section "Electrical".

1.5 SUBMITTALS

- A. Shop drawings: For each motor control center, submit specially prepared shop drawings including the following:
 - 1. Equipment nameplate data and electrical ratings
 - 2. Weights and overall dimensions
 - 3. General arrangement, section view, and sub-assembly drawings cross-indexed to a complete bill of materials listing all components and part numbers
 - 4. Three-line power schematic diagrams with control, protection and metering connection diagrams, and details.
 - 5. Plans, elevations, sections, and details showing installation dimensions, required clearances for access, operation and maintenance, installation details, and special instructions.
 - 6. Include product data sheets with the shop drawings.
 - 7. Time-current curves for circuit protective devices.
- B. Product data sheets: showing manufacturer's standard products, and marked to show equipment selected for this project.
- C. Manufacturer's Installation Instructions: including manufacturer's shipping, receiving, handling, rigging, storage and setting instructions, recommendations, cautions, and warnings. Foundation details showing leveling channel, concrete, and anchor bolt details.
- D. Qualification Data: for testing firm
- E. Factory test reports.
- F. Acceptance test reports.
- G. Operation and Maintenance Data: For motor control centers, all installed devices, and components to include in the Operation and Maintenance Manuals. Include the following:
 - 1. Routine maintenance requirements for motor control centers and all installed components.
 - 2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
- H. Overload-Relay Heater List: Compile after motors have been installed.

1.6 QUALITY ASSURANCE

- A. Manufacturer's repair service. Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing firm acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

1.7 COORDINATION

- A. Coordinate size and location of concrete bases with dimensions of approved MCC.
- B. Coordinate features, accessories, and functions of each feeder unit and each combination motor starter unit with ratings and characteristics of supply circuit, load and required control sequence.
- C. Coordinate selection of motor overcurrent protection devices with motors to be installed.
- D. Coordinate features of motor control center assembly, installed units, and accessory devices with external equipment, devices and control circuits to which they connect.
- E. Installation Pathway: Coordinate motor control center dimensions with dimensions of existing building openings. Provide shipping splits as necessary to facilitate installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the requirements in this Section, provide motor control centers by the following manufacturer:
 - 1. Asea Brown Boveri (ABB)
 - 2. Equal

2.2 GENERAL

- A. Motor control centers shall be suitable for the voltage, phase, and frequency shown on the Drawings.
- B. Each motor controller size and ratings shall be suitable for the required motor nameplate full load current at rated voltage and starting method.
- C. Motor control centers shall be modular arrangements of incoming supply unit, feeder units, combination motor starter units, control devices, and other items mounted in individual compartments of vertical motor control center sections.
- D. Circuit breakers shall have external operating handles lockable in the open position.

2.3 CLASS, TYPE, AND RATINGS

- A. Wiring: NEMA ICS 3, Class II, Type B. Specially prepared control wiring diagrams showing each remote device connection are required for each motor controller.
 - 1. Equip units with pull-apart control terminal strips or draw-out terminal boards for external control connections.
- B. Enclosures:
 - 1. Compartments: Modular; individual doors with concealed hinges and quick-captive screw fasteners. Interlocks on units with disconnecting means requiring disconnecting means to be open before door can be opened or closed. Interlocks shall be capable of being bypassed by use of a tool.
 - 2. Interchangeability: Compartments constructed to allow for removal of units without opening adjacent doors, disconnecting adjacent compartments, or disturbing operation of other units in motor control center; same size compartments to permit interchangeability and ready rearrangement of units, such as replacing three single units with a unit requiring three spaces, without cutting or welding.

3. Install combination starter units up to and including Size 3 on drawout mountings with connectors that automatically line up and connect with vertical-section buses while being racked into their normal, energized positions.
 4. Individual feeder-tap units through 225-A rating shall have drawout mountings with connectors that automatically line up and connect with vertical-section buses while being racked into their normal, energized positions.
 5. Wireways: Separate vertical wiring channel in each vertical section for vertical wiring to each unit compartment; with supports to hold wiring in place. Bottom wireway and top wireway for external wiring.
- C. Short-Circuit Current Rating for Each Section: Fully rated and NRTL-listed and labeled for an available fault current of 65,000 amps RMS symmetrical at the system voltage shown on the Drawings.

2.4 BUSES

- A. Material: Hard-drawn copper, tin-plated full length of main and plug-in busbars.
- B. Continuous Current Ratings: As shown on the Drawings for horizontal main buses. Vertical plug-in busbars shall be minimum 300 amps.
- C. Neutral Busses (when required): Full size.
- D. Equipment Ground Bus: Bare $\frac{1}{4}$ x 2 inch copper main (horizontal) ground bus bolted to enclosure. Vertical ground buses shall be same materials of construction as vertical phase plug-in buses, sized per NEC minimum requirements for equipment grounding conductors; bond to enclosure and each plug-in compartment.
- E. Horizontal Bus Arrangement: Main and ground bus extended with same capacity the entire length of motor control center, with provision for future extension at both ends by bolt holes and captive busbar splice sections or equivalent.
- F. Short-Circuit Withstand Rating: Same as short-circuit current rating of vertical section.

2.5 INCOMING SUPPLY UNITS

- A. Incoming supply: Terminal only compartment or molded case main circuit breaker as shown on the Drawings, suitable for top or bottom entry as necessary.

2.6 SURGE SUPPRESSION DEVICES

- A. SPDs shall be as specified in the Division 26 Section "Surge Protective Devices".

2.7 FEEDER UNITS

- A. Feeder Units: Molded case thermal magnetic circuit breakers.
 1. Thermal inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 2. Three pole unless otherwise indicated with frame sizes, trip ratings as shown on the Drawings.
 3. Lugs suitable for the wire sizes shown on the Drawings.
- B. Short Circuit Rating: fully rated for the available fault current as specified.

2.8 COMBINATION MOTOR STARTER UNITS

- A. Combination Motor Starters: Combination disconnecting means and motor starters as specified in this Section and shown on the Drawings.
 - 1. Controller Disconnecting Means and Overcurrent Protection:
 - a. Molded Case Circuit Protector: NEMA AB 1, motor circuit protector with field-adjustable magnetic trip coordinated with motor locked-rotor amperes.
 - 2. FVNR Magnetic Starter:
 - a. Contactor: NEMA ICS 2, Class A, with continuous current rating as specified in NEMA standards, NEMA Size 1 minimum, full voltage non-reversing.
 - b. Overload Relay: Ambient-compensated type with inverse-time-current characteristic and NEMA ICS 2 Class 20 tripping characteristics. Provide with heaters or sensors in each phase selected in accordance with actual motor nameplate full-load current and with appropriate adjustment for duty cycle.
 - c. Auxiliary Contacts: As required for the control as shown on the Drawings plus one N.O. and one N.C. spares.
 - 3. Solid State Reduced Voltage Starter:
 - a. Suitable for use with NEMA MG 1 polyphase induction motors.
 - b. Adjustable acceleration rate control utilizing voltage or current ramp, and adjustable starting torque control with up to 500 percent current limitation for 20 seconds.
 - c. Integral motor overload protection.
 - d. Surge suppressor in solid-state power circuits providing 3-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
 - e. Integral bypass contactor to automatically close when motor reaches full voltage.
 - f. Keypad/display mounted on MCC compartment door showing motor and control status, including controller on, overload trip, loss of phase, shorted silicon-controlled rectifier.
 - g. Control interfaces as shown on the Drawings.
 - 4. Control Circuits: 120 volts obtained from integral control power transformer.
 - 5. Control Devices: As shown on the Drawings and in accordance with the Division 26 Section "Electrical Controls".
 - 6. Control Wiring: Provide control wiring as shown on the Drawings.
 - 7. Short Circuit Rating: fully rated for the available fault current as specified.

2.9 SPARE UNITS

- A. Spare Units: Type, sizes, and ratings as shown on the Drawings.
- B. Short Circuit Rating: fully rated for the available fault current as specified.

2.10 SPACES

- A. Spaces: Compartments fully bused and equipped with guide rails or equivalent, ready for insertion of draw-out units.

2.11 FACTORY FINISHES

- A. Finish: Manufacturer's standard ANSI 61 light gray paint applied to factory-assembled and -tested, motor control centers before shipping.

2.12 FACTORY CERTIFICATION AND TESTS

- A. Factory Quality Certification
 - 1. Submit copy of factory quality assurance certificate.
- B. Factory Assembly
 - 1. Motor control centers shall be manufactured in conformance with the factory quality certification documents.
- C. Factory Tests
 - 1. Each MCC shall be factory tested as follows:
 - a. Manufacturer's standard inspections and tests
 - b. 1000V megohmmeter test on each busbar, phase-to-phase and phase-to-ground, after disconnecting devices sensitive to 500 VDC.
 - 2. Submit factory test report for approval prior to shipment.

2.13 SPARE PARTS AND SPECIAL TOOLS

- A. Furnish a minimum of 10 spare fuses of each size and type installed.
- B. Furnish one pint of spare touchup paint for each MCC provided.

2.14 PACKAGING FOR SHIPMENT

- A. Wrap motor control centers with dessicant in heavy polyethylene film taped shut.
- B. Bolt MCC shipping sections to wooden pallets to prevent tipping over and to provide method for transporting shipping sections.
- C. Shipping sections shall be padded and corner-protected to protect components from damage during shipping.

PART 3 - EXECUTION**3.1 PRE-INSTALLATION REQUIREMENTS**

- A. Floor, wall, and ceiling finishes and overhead welding operations shall be substantially complete, and area shall be "broom clean", prior to commencing installation of the motor control centers.

3.2 INSTALLATION

- A. Install motor control centers on 4 inch high concrete equipment pads in conformance with MCC manufacturer's installation instructions. Cast anchor bolt inserts into concrete bases.

3.3 IDENTIFICATION

- A. Identify motor control center, motor control center components, and wiring according to Division 26 Section "Identification for Electrical Systems".

3.4 WIRING INSTALLATION

- A. Connect wiring for motor control centers in accordance with shop drawings and in conduit access areas as designated by the MCC manufacturer.

3.5 GROUNDING AND BONDING

- A. Ground MCCs in accordance with Division 26 Section "Grounding and Bonding for Electrical Systems."

3.6 MANUFACTURER'S FIELD SERVICES

- A. Engage a factory-authorized service representative to perform the following inspections, checks, and supervision of testing:
 - 1. Inspect field-assembled components, equipment installation, and electrical connections for compliance with the manufacturer's installation recommendations and requirements.
 - 2. Set field-adjustable overcurrent protective device trip characteristics to the values tabulated in the report specified in Division 26 Section "Overcurrent Protective Device Coordination Study".
 - 3. Provide programming of solid state reduced voltage motor starters. Witness commissioning of the equipment controlled and provide adjustments to programming as necessary for satisfactory operation of the equipment.
 - 4. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and components.
 - 5. Supervise tests performed by independent testing firm. Witness initial energization and perform or supervise startup services.
 - 6. Prepare written report to record the following:
 - a. Inspections and checks carried out on site.
 - b. Test procedures used.
 - c. Test results that comply with requirements.
 - d. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements

3.7 ACCEPTANCE TESTING

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each motor control center bus, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.
- B. Testing Firm: Engage a qualified testing firm to perform the following field tests and inspections and prepare test reports:
 1. Perform each electrical test and visual and mechanical inspection described in the following NETA Acceptance Testing Specification Inspection and Test Procedures applicable to the equipment furnished for this project:
 - a. 7.6.1.1 "Circuit Breakers, Air, Insulated-Case/Molded-Case"
 - b. 7.13 "Grounding Systems"
 - c. 7.16.2.1 "Motor Control, Motor Control Centers, Low-Voltage."
 - d. 7.19.1 "Surge Arrestors, Low-Voltage"
 2. Certify compliance with test parameters.
 3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.8 TRAINING

- A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain components of motor control centers.
- B. Review each page of the Operation and Maintenance Manuals during the training sessions.

3.9 FOLLOW-UP SERVICE

- A. Infrared Scanning: One month after Substantial Completion, perform an infrared scanning of each Motor Control Center in conformance with NETA Acceptance Testing Specification 9 "Thermographic Survey". Open motor control center doors such that joints and connections are accessible to portable scanner.
- B. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each motor control center 6 months after date of Substantial Completion.
- C. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
- D. Record of Infrared Scanning: Prepare a certified report that identifies motor control center checked and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action. Provide a color photo together with an infrared photo of each motor control center in the report.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide receptacles, switches, occupancy sensors and accessories required for a complete and fully functional installation, as shown on the Drawings and specified herein.
- B. Provide Mobile Generator Connection Cabinet as shown on the Drawings and specified herein.

1.2 REFERENCE STANDARDS

- A. Comply with the following standards:
 - 1. American National Standard Institute (ANSI)
 - 2. National Electrical Code (NEC)
 - 3. National Electrical Manufacturers Association (NEMA)
 - 4. Underwriters Laboratories, Inc. (UL)

1.3 SUBMITTALS

- A. Manufacturer's Catalog Data
 - 1. Submit manufacturer's catalog data describing the material and demonstrating conformance to the Specification and associated standards.
- B. Samples
 - 1. Samples are not required for specified manufacturers and part numbers. If "equal" products are proposed, samples of both the "equal" and the specified product shall be submitted for comparison purposes. Equal products will not be considered unless samples are submitted.

PART 2 - PRODUCTS

2.1 GENERAL- RECEPTACLES, SWITCHES, OCCUPANCY SENSORS

- A. Provide industrial grade heavy-duty wiring devices, in types, characteristics, grades, colors, and electrical ratings for applications indicated. Devices shall be UL listed and comply with NEMA WD 1 and other applicable UL, Federal, and NEMA standards.
- B. Enclosures shall be in accordance with the Division 26 Section "Electrical".
- C. Provide ivory color wiring devices.
- D. Model or series numbers, where indicated, refer only to the specified manufacturer. Identical numbers by other manufacturers are not considered equal.

2.2 DUPLEX RECEPTACLES

- A. Duplex receptacles shall be NEMA 5-20R rated 20 amperes at 120 VAC of the two-pole, three-wire type. They shall be suitable for use with a three-wire polarized plug having two

parallel blades and shall have the third leg grounded. They shall meet the requirements of Federal Specification WC596.

B. Duplex Receptacle Manufacturers:

1. Hubbell 5362 Series heavy-duty industrial grade.
2. Leviton 5362 Series heavy-duty industrial grade
3. Equal.

2.3 DUPLEX GFI RECEPTACLES

A. Receptacles marked as GFI shall be duplex, NEMA 5-20R, 20 amp, 120 VAC ground fault interrupter type. They shall be UL rated Class A, Group 1. Single GFI receptacles providing "downstream" protection shall not be acceptable. GFI breakers used with conventional receptacles shall not be acceptable where GFI receptacles are shown.

B. Manufacturers:

1. Hubbell Series GFR5362TR Series
2. Equal

2.4 SWITCHES - NON-HAZARDOUS AREAS

A. Wall switches shall be rated 20 amperes at 277 VAC, toggle operated, plastic enclosed, three-way or four-way, single or two pole, as shown or required. They shall meet Federal Specification WS896. Switches shall have silver alloy contacts and provisions for side and back wiring.

B. Manufacturers:

1. Hubbell 1221 Series heavy-duty industrial grade
2. Leviton 1221 Series heavy-duty industrial grade
3. Arrow Hart 1221 Series heavy-duty industrial grade
4. Equal

2.5 SWITCHES - HAZARDOUS AREAS

A. Wall switches shall be rated 20 amperes at 277 VAC, toggle operated, plastic enclosed, three-way or four-way, single or two pole, as shown or required housed in explosion-proof enclosures. They shall meet Federal Specification WS896. Switches shall have silver alloy contacts and provisions for side and back wiring.

B. Manufacturers:

1. Appleton EDSC Series
2. Crouse-Hinds EDS Series
3. Equal

2.6 OCCUPANCY SENSORS

A. Occupancy sensors shall be wall switch type suitable for control of the load type (incandescent, fluorescent, LED or low voltage), load capacity, and branch circuit voltage of the lighting fixtures controlled.

- B. All occupancy sensors shall be dual-technology type with self-adjusting time delay and sensitivity. Features shall include:
 - 1. Manual and automatic ON/OFF control switches.
 - 2. Single level control switch or as indicated on the drawings.
 - 3. Bypass override ON switch in the event of product failure.
 - 4. 120/277V operation.
 - 5. Provide sensors appropriate for the room size coverage.
- D. Manufacturer shall be Watt Stopper DW-100 or equal.

2.7 ACCESSORIES

- A. Wall Plates
 - 1. Unless otherwise specified, wall plates for receptacles and switches in non-hazardous areas shall be galvanized steel.
 - 2. Plates for receptacles designated as weatherproof shall be of the corrosive resistant, gasketed weatherproof design.
 - a. Thermoplastic construction with spring-shut, while-in-use type cover.
 - b. Manufacturer shall be Hubbell or equal.
- B. Device boxes for wiring devices shall be as specified in the Division 26 Section "Raceways and Boxes for Electrical Systems".

2.8 MOBILE GENERATOR CONNECTION CABINET

- A. Mobile generator connection cabinet shall provide means to temporarily connect cables from a mobile generator to fixed wiring for standby power to the pumping station. Cabinet shall comply with UL Standard 1008.
- B. Cabinet shall facilitate input and output of 480 VAC, 3 phase, 4 wire power with ground conductor (5 wire system). Continuous current rating shall be as indicated on the Drawings, Short circuit rating shall be 22,000 amps rms symmetrical at 480 VAC, 3 phase.
- C. Enclosure shall be free-standing, NEMA 3R rated, constructed of powder coated 12 gauge galvanized steel. Enclosure shall have lockable cable access door. Finish shall be ANSI 61 grey.
- D. Input cable connections shall consist of 3 rows of 5 receptacles. Receptacles shall be single pole, female, Series 16 cam-type. Provide receptacle color coding to equal wire color coding requirements as specified in the Division 26 Section "Identification for Electrical Systems".
- E. Output wiring connections shall be copper busses enclosed in a separate compartment in the cabinet. Provisions shall be included to connect the conduit and conductor sizes, quantities and types as shown on the Drawings and as specified.
- F. Manufacturer shall be Lex Products Corp. PowerGATE or equal.

PART 3 - EXECUTION

3.1 INSTALLATION-RECEPTACLES, SWITCHES, OCCUPANCY SENSORS

- A. Install wiring devices in outlet boxes with cubic inch capacity in conformance with NEC requirements.
- B. Receptacles shall be mounted at 18 inches to the centerline of the device box above finished floor, unless otherwise indicated.
- C. Switches shall be mounted 44 inches to the centerline of device box above finished floor on the handle side of doors unless otherwise indicated.
- D. Coordinate switch and receptacle locations and construction sequence with the work of other trades to avoid conflicts.
- E. Install outlet boxes, wiring devices and accessories as indicated, in accordance with manufacturer's written instructions, and applicable requirements of the NEC.
- F. Protect installed outlet boxes from dirt and paint.
- G. Install wiring devices after wiring is completed.
- H. Protect installed wiring devices from paint.
- I. Install cover plates after painting work is completed.
- J. Label receptacles as described in Division 26 Section "Identification for Electrical Systems".
- K. Occupancy Sensors: Aim for proper sensing in accordance with manufacturer's requirements.

3.2 INSTALLATION-MOBILE GENERATOR CONNECTION CABINET

- A. Equipment platform installation shall be complete prior to commencing installation of the mobile generator connection cabinet.
- B. Place and secure anchorage devices in accordance with manufacturer's setting drawings, templates, diagrams and instructions.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems".
- D. Connect wiring according to Division 26 Section "Low Voltage Electrical Power Conductors and Cables".
- E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- F. Provide identification in accordance with the Division 26 Section "Identification for Electrical Systems".

3.3 TESTING

- A. Test installed, energized receptacles and switches for correct connection to phase, neutral, and ground conductors.
 - 1. Correct incorrectly wired switches and receptacles.

- B. Test occupancy sensors by operation to verify proper performance.

END OF SECTION

SECTION 26 28 16 ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide enclosed switches rated 600 volts and less, of the following types:
 - 1. Non-Fused Disconnect Switches
 - 2. Manual Transfer Switch
 - 3. Automatic Transfer Switch

1.2 QUALIFICATIONS

- A. Automatic Transfer Switch Manufacturer Qualifications: A qualified manufacturer. Maintain within 100 miles of Project site, a service center capable of providing training, parts and emergency maintenance and repairs.
- B. Testing firm shall be qualified as defined by OSHA in 29 CFR 1910.7, shall be a member of the InterNational Electrical Testing Association, shall be acceptable to the AHJ, and shall have supervision as follows:
 - 1. Testing Firm's Field Supervisor: Qualifications and experience for the person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

1.3 SUBMITTALS

- A. Product Data: For each type of enclosed switch. Include dimensions, manufacturer's technical data on features, performance, electrical characteristics, ratings and UL listing.
- B. Shop Drawings: For automatic transfer switch.
 - 1. Provide elevations, sections, and details including required clearances, service space around equipment and component locations, Describe equipment features, operation and ratings. Include the following:
 - a. Sequence of operation.
 - b. Nameplate legends.
 - c. Short-circuit withstand current rating.
 - 2. Wiring Diagrams: Power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: Include the following:
 - 1. Routine maintenance requirements.
 - 2. Manufacturer's instructions for testing and adjusting.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Enclosures for switches shall be of the type specified in the Division 26 Section "Electrical".
- B. Lugs for wiring connections on switches shall be suitable for the type, size and quantity of conductors to be terminated as specified, indicated on the Drawings or otherwise as necessary for the application.

2.2 MANUFACTURERS

- A. Non-Fused Disconnect Switches and Manual Transfer Switch: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Corporation; Cutler-Hammer Products
 - 2. General Electrical Company
 - 3. Siemens
 - 4. Square D
 - 5. Equal
- B. Automatic Transfer Switch: Subject to compliance with requirements, provide products by one of the following:
 - 1. Automatic Switch Company (ASCO)
 - 2. Russelectric
 - 3. Equal

2.3 NON-FUSED DISCONNECT SWITCHES

- A. Non-fused disconnect switches shall be heavy-duty, 3-pole, 600 volt, motor-rated, visible blade type, with enclosure door interlock to prevent opening the door with the switch closed.
- B. Current rating of switches shall be as indicated on the Drawings.
- C. Provide external operating handle with padlocking provisions. Switch shall be closed when the handle is in the up position, and open in the down position. Rotary handles are not acceptable.

2.4 MANUAL TRANSFER SWITCH

- A. Manual transfer switch shall be heavy duty, multi-pole, double throw, 600 volt, with continuous ampere ratings and number of poles as shown on the Drawings.
- B. Provide cover interlock to prevent opening the door with the switch closed.
- C. Provide external operating handle with padlocking provisions in all positions.
- D. Manual transfer switch shall have withstand rating suitable for an available fault current of 10,000 amps rms symmetrical at 480 volts, 3 phase. Series ratings with separate overcurrent protection device or fusible manual transfer switch with current limiting fuses are acceptable for meeting the specified withstand rating.
- E. Provide copper neutral bus when neutral conductor is shown on the Drawings.

F. Provide copper ground bus for equipment grounding conductors.

2.5 AUTOMATIC TRANSFER SWITCH

A. General

1. Automatic transfer switch shall be two position, open transition type with bypass feature.
2. The automatic transfer switch shall have voltage, continuous current rating and number of poles as shown on the Drawings.
1. The switch enclosure shall be floor mounted, front and rear accessible for maintenance, inspection or conductor terminations. Conduit entry shall be top and/or bottom as necessary for the application.
2. Enclosure shall be fabricated from 12 gauge steel with manufacturer's standard finish.
3. The enclosure shall be sized to exceed minimum wire bending space required by UL 1008.
4. The switch main contacts shall be capable of being replaced without removing the main power cables.
5. The main contacts shall be visible for inspection without major disassembly of the transfer switch.
6. All bolted bus connections shall have Belleville compression type washers.
7. Control components and wiring shall be front accessible. All control wires shall be multi-conductor 18 gauge 600-volt SIS switchboard type with point to point harness. All control wire terminations shall be identified with tubular sleeve-type markers.
8. The switch shall be equipped with 90 degrees C rated copper/aluminum solderless mechanical type lugs.
9. The complete transfer switch assembly shall be factory tested to ensure proper operation and compliance with the specification requirements. A copy of the factory test report shall be available upon request.

B. Automatic Transfer Switch Mechanism

1. The switch shall be double throw, actuated by a single electrical operator momentarily energized, and connected to the transfer mechanism by a simple over center type linkage. Total transfer time shall not exceed one half second.
2. The normal (utility source) and emergency (standby generator source) contacts shall be positively interlocked mechanically and electrically to prevent simultaneous closing. Main contacts shall be mechanically locked in both the normal and emergency positions without the use of hooks, latches, magnets, or springs, and shall be silver-tungsten alloy. Separate arcing contacts with magnetic blowouts shall be provided. Interlocked circuit breakers or contactors are not acceptable.
3. The transfer switch shall be equipped with an external manual operator, designed to prevent injury to operating personnel. The manual operator shall provide the same contact to contact transfer speed as the electrical operator to prevent a flashover from switching the main contacts slowly. The external manual operator shall be safely operated from outside of the switch enclosure while the enclosure door is closed.

C. Bypass Feature

1. The bypass feature shall allow isolation of the automatic transfer switch mechanism for inspection, testing and maintenance without interrupting power to the load. Bypass shall have the same ratings as the automatic transfer switch mechanism.
2. Bypass feature shall be quick-make/quick-break, draw-out design capable of transferring loads between live sources.
3. Feature shall be manually enabled and disabled by a maximum of two operating handles. Mechanical indicators shall be provided to show bypass positions.

D. Automatic Transfer Switch Controls

1. The transfer switch shall be equipped with a microprocessor based control system to provide all the operational functions of the automatic transfer switch. The controls shall have a real time clock with NiCad battery back-up.
2. The controls shall be equipped with self-diagnostics to perform periodic checks of the memory I/O with a watchdog/power fail circuit.
3. The controls shall have password protection to limit access to qualified and authorized personnel.
4. The controls shall include a 20 character, LCD display, with a keypad, which allows access to the system.
5. The controls shall include three phase over/under voltage detection, three phase over/under frequency detection and phase sequence detection on both normal and emergency sources.
6. The controls shall store the following records in memory for access either locally or remotely:
 - a. Number of hours transfer switch is in the emergency position (total since record reset).
 - b. Number of hours emergency power is available (total since record reset).
 - c. Total transfer in either direction (total since record reset).
 - d. Date, time, and description of the last four source failures.
 - e. Date of the last exercise period.
 - f. Date of record reset.

E. Sequence of Operation

1. When the voltage on any phase of the normal source drops below 80% or increases to 120%, or frequency drops below 90%, or increases to 110%, or phase reversal is detected and after a programmable time delay period to allow for momentary dips, the standby generator starting contact shall close to start the standby generator.
2. The switch shall transfer to emergency when the standby generator has reached specified voltage and frequency on all phases.
3. After restoration of normal power on all phases to a preset value of at least 90% to 110% of rated voltage, and at least 95% to 105% of rated frequency, and proper phase rotation, an adjustable time delay period shall delay retransfer to allow stabilization of normal power. If the emergency power source should fail during this time delay period, the switch shall immediately return to the normal source.
4. After retransfer to normal, the standby generator shall be allowed to operate for a programmable period.

F. Automatic Transfer Switch Features

1. Programmable three phase sensing of the normal source to pick-up at 90% and dropout at 80% of rated voltage and overvoltage to pick-up at 120% and dropout out at 110% of rated voltage. Programmable under frequency pick-up at 95% and dropout at 90% of rated frequency and over frequency pick-up at 110% and dropout at 105% of rated frequency.
2. Programmable three phase sensing of the emergency source set to pick-up at 90% and dropout at 80% of rated voltage and overvoltage set to pick-up at 120% and dropout out at 110% of rated voltage. Programmable under frequency pick-up at 95% and dropout at 90% and over frequency pick-up at 110% and dropout at 105% of rated frequency.
3. Time delay for override of momentary normal source power outages (delays standby generator start signal and transfer switch operation). Programmable 0-9999 seconds. Factory set at 3 seconds.
4. Time delay to control transition time to either source. Programmable 0-9999 seconds, factory set at 3 seconds. The load shall be disconnected from both sources during this period.
5. Time delay on transfer to emergency, programmable 0-9999 seconds, factory set at 3 seconds.
6. Time delay on retransfer to normal, programmable 0-9999 seconds, factory set at 300 seconds with override.
7. Time delay for standby generator stop, programmable 0-9999 seconds, factory set at 300 seconds, unloaded standby generator operation after retransfer to normal.
8. A load test switch shall be included to simulate a normal power failure, keypad initiated.
9. Capability for connection of a remote load test switch shall be included to simulate a normal power failure.
10. A time delay bypass on retransfer to normal shall be included. Keypad initiated.
11. Two standby generator start/stop contacts, rated 10 Amps 30 volts DC.
12. Light emitting diodes shall be provided to indicate: switch is in normal position, switch is in emergency position and microprocessor is operational.
13. A generator exerciser shall be provided to initiate daily, weekly or monthly exercising of the generator with adjustable starting time and duration. Exerciser shall include selection of either "no load" (switch shall not transfer loads to generator) or "load" (switch shall transfer loads to generator). Feature shall be keypad initiated.
14. Provision to select either "no commit" or "commit" for the transfer operation in the event of a normal power failure shall be included. In the "no commit position," the load shall transfer to the standby generator unless normal power returns before the standby power source has reach 90% of its rated values (switch shall remain in normal power position). In the "commit position" the load shall transfer to the emergency position after any normal power failure. Feature shall be keypad initiated.
15. Two auxiliary SPDT contacts rated 1 amp, 120 VAC shall be provided, one to indicate load is on utility power and one to indicate load is on standby power. Contacts shall be wired to a terminal strip.
16. An auxiliary SPDT contact rated 1 amp, 120 VAC shall be provided to indicate failure of utility power. Contact shall be wired to a terminal strip.
17. An auxiliary SPDT contact rated 1 amp at 120 VAC shall be provided to indicate transfer switch is in the automatic (non-bypass) position.

18. A three phase digital LCD voltage readout, with 1% accuracy shall display all three separate phase to phase voltages simultaneously, for both the normal and emergency sources.
19. A digital LCD frequency readout with 1% accuracy shall display frequency for both normal and emergency sources.
20. An LCD readout shall display normal source and emergency source availability.

G. Withstand Ratings

1. The transfer switch shall have UL-1008 3 cycle short circuit closing and withstand ratings in series with circuit breakers as follows:

3 Cycle Short Circuit Closing and Withstand Ratings to UL-1008	
Switch Rating (Amperes)	Closing and Withstand Rating at 480 VAC (Amperes RMS Sym.)
100-400	42,000
600-800	65,000
1000-1200	85,000
1600-4000	100,000

2. 3 cycle closing and withstand tests shall not result in contact welding or damage. The 3 cycle tests shall be performed without the use of current limiting fuses. The test shall verify that contact separation has not occurred, and there is contact continuity across all phases. Test procedures shall be in accordance with UL-1008, and testing shall be certified by Underwriters' Laboratories, Inc.
3. When conducting temperature rise tests to UL-1008, the manufacture shall include post-endurance temperature rise tests to verify the ability of the transfer switch to carry full rated current after completing the overload and endurance tests.

H. Microprocessor Controller

1. The microprocessor controller shall meet the following requirements:
 - a. Storage conditions - 25 degrees C to 85 degrees C
 - b. Operation conditions - 20 degrees C to 70 degrees C ambient
 - c. Humidity 0 to 99% relative humidity, noncondensing
 - d. Capable of withstanding infinite power interruptions
 - e. Surge withstand per ANSI/IEEE C-37.90A-1978
2. Manufacturer shall provide copies of test reports upon request.

I. Service and Support

1. The automatic transfer switch manufacturer shall employ a nationwide factory-direct, field service organization, available on a 24-hour a day, 365 days a year, call basis.
2. The manufacture shall include a toll-free telephone number, for field service contact, affixed to each enclosure.
3. The manufacturer shall maintain records of each transfer switch, by serial number, for a minimum 20 years.

2.6 SPARE PARTS

- A. Furnish spare parts described below that equal products installed. Provide packaging with protective covering for storage and identification labels describing contents.
 - 1. Spare Fuses: Furnish three spares of each type and rating.

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. Provide all brackets, fasteners and hardware necessary for mounting.
- B. For wall-mounted disconnect switches and manual transfer switches, provide channels bolted to wall and bolt switch to channels. For disconnect switches not located near walls, provide freestanding racks constructed from 1- 1/2 x 1-1/2 inch channels.
- C. For floor mounted manual transfer switches and automatic transfer , provide a 4 inch high concrete equipment pad.

3.2 IDENTIFICATION

- A. Identify enclosed switches, circuit breakers and wiring in conformance with Division 26 Section "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each enclosed switch.
 - 2. Test continuity of each circuit.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative for the automatic transfer switch to perform the following:
 - 1. Inspect automatic transfer switch, wiring, components, connections and equipment installation.
 - 2. Provide all adjustments and settings in automatic transfer switch.
 - 3. Assist in field testing of automatic transfer switch.
 - 4. Report results in writing.
- C. Engage a qualified testing firm to perform the following field quality control testing and prepare test reports:
 - 1. Perform each electrical test and visual and mechanical inspection, except optional tests, stated in the following NETA Acceptance Testing Specification Inspection and Test Procedures:
 - a. 7.5.1.1 "Switches, Air, Low-Voltage"
 - b. 7.22.3 "Emergency Systems, Automatic Transfer Switches".
 - 2. Certify compliance with test parameters.

3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

END OF SECTION

SECTION 26 32 13
DIESEL ENGINE DRIVEN GENERATOR SET

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide diesel engine driven generator set (standby generator) for legally required standby service, as shown on the Drawings and as specified herein.
- B. This Section includes packaged diesel engine driven generator set with the following major components and accessories:
 - 1. Engine
 - 2. Generator
 - 3. Generator set control panel
 - 4. Generator circuit breaker
 - 5. Engine starting batteries with charger
 - 6. Engine block heater
 - 7. Control panel heater
 - 8. Alternator heater
 - 9. Engine exhaust silencer
 - 10. Exhaust piping external to engine
 - 11. Weatherproof sound attenuating enclosure
 - 12. Base mounted fuel tank
- C. Generator set shall be factory assembled to the extent possible with regard to shipping limitations.

1.2 DEFINITIONS

- A. In addition to the definitions in Division 26 Section "Electrical", the following definitions apply to this Section:
 - 1. EPSS: emergency power supply system (NFPA 110 definition)
 - 2. Generator: rotating brushless alternator
 - 3. Generator set: a complete assembly of engine and generator with components capable of generating electricity
 - 4. Legally Required Standby Systems: refer to NEC Section 701 for definition
 - 5. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.
 - 6. Steady-State Voltage Modulation: The uniform cyclical variation of voltage within the operational bandwidth, expressed in Hertz or cycles per second.

1.3 QUALIFICATIONS

- A. Supplier Qualifications: Manufacturer's authorized representative who is factory-trained and manufacturer-approved for installation of the unit required for this Project. Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.
- B. Testing Firm Qualifications: An independent firm, with experience and capability to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRRL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 - 1. Testing Firm's Field Supervisor: Person currently certified by the International Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

1.4 REFERENCE STANDARDS

- A. Comply with the following standards:
 - 1. ANSI/IEEE C37.13-1990, Standard for Low-Voltage AC Power Circuit Breakers Used in Enclosures,
 - 2. ANSI/IEEE C37.14-1993, Standard for Low-Voltage DC Power Circuit Breakers Used in Enclosures,
 - 3. ANSI C37.50-1989 (R1995), Test Procedures for Low-Voltage AC Power Circuit Breakers Used in Enclosures,
 - 4. ANSI/IEEE 43-2000, IEEE Recommended Practice for Testing Insulation Resistance of Rotating Machinery
 - 5. ANSI/IEEE 112-1996, IEEE Standard Test Procedure for Polyphase Induction Motors and Generators
 - 6. ANSI/IEEE 115-1995 (R2002), IEEE Guide: Test Procedures for Synchronous Machines, Part 1--Acceptance and Performance Testing, Part II--Test Procedures and Parameter Determination for Dynamic Analysis
 - 7. ANSI/IEEE 117-1974 (R1991), IEEE Standard Test Procedure for Evaluation of Systems of Insulating Materials for Random-Wound AC Electric Machinery
 - 8. ANSI/IEEE 275-1992, IEEE Recommended Practice for Thermal Evaluation of Insulation Systems for Alternating-Current Electric Machinery Employing Form-Wound Preinsulated Stator Coils for Machines Rated 6900 V and Below
 - 9. ANSI/IEEE 286-2000, IEEE Recommended Practice for Measurement of Power Factor Tip-Up of Electric Machinery Stator Coil Insulation
 - 10. ANSI/IEEE 429-1994, IEEE Recommended Practice for Thermal Evaluation of Sealed Insulation Systems for AC Electric Machinery Employing Form-Wound Preinsulated Stator Coils for Machines Rated 6900V and Below
 - 11. ANSI/IEEE 522-1992 (R1998), IEEE Guide for Testing Turn-to-Turn Insulation on Form-Wound Stator Coils for Alternating-Current Rotating Electric Machines
 - 12. ANSI/IEEE 1107-1996, IEEE Recommended Practice for Thermal Evaluation of Sealed Insulation Systems for AC Electric Machinery Employing Random Wound Stator Coils
 - 13. ANSI/IEEE 1434-2000, IEEE Trial-Use Guide to the Measurement of Partial Discharges in Rotating Machinery

14. NEMA ICS 6, Industrial Control and Systems Enclosures
15. NEMA MG 1, Motors and Generators
16. UL 50, Safety Enclosures for Electrical Equipment
17. UL 489, Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
18. UL 508, Industrial Control Equipment
19. UL 1066, Standard for Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures
20. NFPA 37, Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines
21. NFPA 101, Life Safety Code
22. NFPA 110, Standard for Emergency and Standby Power Systems - requirements for Level 2 EPSS

1.5 ENVIRONMENTAL CONDITIONS

- A. Engine-generator set shall withstand the environmental ranges specified in the Division 26 Section "Electrical" without mechanical or electrical damage or degradation of performance capability.

1.6 SUBMITTALS

- A. Preconstruction Submittals
 1. Qualification data for Testing Firm and Testing Firm's field supervisor.
 2. Qualification data for equipment manufacturer(s), including quality certification.
- B. Compliance Statement
 1. Compliance statement in accordance with the Division 26 Section "Electrical".
- C. Shop Drawings
 1. Detail plan and elevation drawings for equipment assemblies indicating dimensions, weights, structural design recommendations for dynamic loading, required clearances for maintenance and operations, method of field assembly, components, and location and size of each field connection.
 2. Anchorage provisions and locations.
 3. Wiring Diagrams: Power, signal, and control wiring. Show factory wiring and field wiring, phase rotation and grounding connections.
- D. Product Data
 1. Manufacturer's technical data including details, ratings, performance and characteristics of the major components and accessories.
- E. Design Data
 1. Generator electrical ratings including voltage, KW, KVA, starting KW capability and starting KVA capability.
 2. Time-current characteristic curves for generator overcurrent protective device with trip settings.

F. Test Reports

1. Certified prototype-unit test report.
2. Factory test reports, including sound measurement and exhaust emission test reports.
3. Acceptance test reports.

G. Certificates

1. Certification of Torsional Vibration Compatibility: Comply with NFPA 110.
2. Manufacturer Seismic Qualification Certification
 - a. Submit certification that engine-generator set, enclosure, batteries, battery racks, and other specified components will withstand seismic forces as follows:
 - 1) Seismic Design Category: B
 - 2) Spectral Response Coefficients
 - a) SDS: 0.305
 - b) SD1: 0.098
 - 3) Site Class: D
 - 4) Seismic Importance Factor: 1.10
 - 5) Mapped Spectral Response Accelerations
 - a) SS: 0.292
 - b) S1: 0.061
 - b. Indicate whether withstand certification is based on actual test of assembled components or based on calculation.
 - 1) The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

H. Manufacturer's Instructions

1. Unloading, hoisting, rigging, short term storage, long term storage, and installation instructions.
2. Method of field assembly, and location and size of each field connection.
3. Battery filling, initial charging, battery charger settings.
4. Generator set installation, testing, and commissioning instructions with checklists.

I. Manufacturer's Field Reports

1. Inspection of equipment installation (prior to energization and startup).
2. Acceptance test report.
3. Maintenance service.

J. Operation and Maintenance Data

1. Operation and Maintenance Manuals for engine, generator, major components and accessories.

K. Closeout Submittals

1. Training course materials.
2. Callback and follow-up service reports.
- L. Warranty
 1. Special warranty specified in this Section.

1.7 QUALITY ASSURANCE

- A. Source Limitations: Obtain generator sets and components from a single Supplier.
- B. Engine Exhaust Emissions: Comply with applicable state and local government regulations in effect at the project location.
- C. Noise Emissions: Comply with the specified sound requirements or applicable state and local government requirements (whichever is more stringent) applicable to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

1.8 COORDINATION

- A. Coordinate size, location, conduit stub-ups, anchor bolts and grounding electrode conductor routing. Install anchor bolts for vibration isolators in accordance with approved shop drawings.
- B. Coordinate equipment platform dimensions with dimensions of approved generator. Provide re-design of platform as necessary to accommodate the approved generator including space needed for 90 degree swing of access doors, for maintenance in accordance with generator manufacturer requirements and for NEC live part clearances. Submit proposed re-design for approval with calculations and other details as requested.

1.9 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months full maintenance by factory-trained employees of manufacturer's designated service organization. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Maintenance agreements shall include parts and supplies as used in the manufacture and installation of original equipment. Replace any spare parts taken from Owner's inventory.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 1. Cummins, Inc.
 2. Caterpillar, Inc.
 3. Equal.

2.2 ENGINE-GENERATOR SET

- A. Generator set shall be a coordinated assembly of compatible components.

- B. Minimum Power Output: 600 kW/750 kVA standby rating to operate as a unit as evidenced by records of prototype testing. Generator rating may be increased as necessary to meet the requirements of the article "Generator Set Performance".
- C. Output Voltage: 480/277 volt, 3 phase, 4 wire, 60 Hertz.
- D. Standby Power Available: 10 seconds maximum.
- E. Safety Standard: Comply with ASME B15.1.
- F. Nameplates: Each major system component shall be equipped with a nameplate to identify manufacturer's name and address, and model and serial number of component.
- G. Fabricate engine and generator mounting frame and attachment of components to resist generator set movement during the type of seismic event described in Part 1 of this Section when generator set mounting frame is anchored to the equipment pad.
- H. Mounting Frame: Adequate strength and rigidity to maintain alignment of mounted components without depending on concrete foundation. Mounting frame shall be free from sharp edges and corners.

2.3 GENERATOR SET PERFORMANCE

- A. Steady-State Voltage Operational Bandwidth: 2 percent of rated output voltage from no load to full load.
- B. Steady-State Voltage Modulation Frequency: Less than 1 Hz.
- C. Transient Voltage Performance: Not more than 10 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within 0.5 seconds.
- D. Steady-State Frequency Operational Bandwidth: Plus or minus 0.25 percent of rated frequency from no load to full load.
- E. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
- F. Transient Frequency Performance: Less than 2 Hertz variation for a 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within three seconds.
- G. Output Waveform: At no load, harmonic content measured line to neutral shall not exceed 2 percent total with no slot ripple. The telephone influence factor, determined in accordance with NEMA MG 1, shall not exceed 50 percent.
- H. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, the system shall supply a minimum of 300 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
- I. Excitation System: Performance shall be unaffected by voltage distortion caused by nonlinear loads.
- J. Generator shall have capability to start the largest load (250 HP Main Sewage Pump) with all other facility loads operating (approximately 306 KW/383 KVA). Review loads, methods of starting and other information as necessary to meet this requirement.

2.4 ENGINE

- A. Type: Turbocharged diesel.
- B. Fuel: No. 2 diesel to ASTM D975.
- C. Rated Engine Speed: 1800 rpm maximum.
- D. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm.
- E. Lubrication System:
 - 1. Positive displacement, mechanical, lubrication oil pump.
 - 2. Lube oil filter rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow. Provide automatic bypass.
 - 3. Thermostatic flow control valve to maintain optimum oil temperature. Unit shall be capable of full flow and be designed to be fail-safe.
 - 4. Crankcase drain arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.
- F. Engine Fuel System:
 - 1. Main fuel pump mounted on engine. Pump shall provide adequate primary fuel flow under starting and load conditions.
 - 2. Relief-bypass valve to automatically regulate pressure in fuel line and return excess fuel to source.
- G. Block Heater: Electric-immersion type, thermostatically controlled, factory installed in coolant jacket system. Heater shall operate at 480 VAC, single phase.
- H. Governor: Adjustable isochronous, with speed sensing.
- I. Over-speed protection: Separate over-speed protection device, independent from governor, designed for fail-safe operation in the event of loss of engine speed sensing and circuit faults.

2.5 ENGINE COOLING SYSTEM

- A. Description: Closed loop, liquid cooled, with integral radiator, factory mounted on engine-generator set mounting frame and integral engine-driven coolant pump. System shall be rated for full load operation at 122 degrees F (50 degrees C) ambient as measured at the generator air inlet.
- B. Radiator: Rated for specified coolant, cooled by engine-driven fan.
- C. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
- D. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
- E. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.
 - 1. Working pressure suitable for application, and non-collapsible under vacuum.
 - 2. End fittings shall be flanges or steel pipe nipples with clamps to suit piping and equipment connections.

2.6 ENGINE EXHAUST SYSTEM

- A. Exhaust silencer: Critical type, sized as recommended by engine manufacturer.
- B. Condensate Drain for Silencer: Schedule 40, black steel pipe connected to silencer drain outlet through a full port ball valve.
- C. Connection from Engine to Exhaust System: Flexible section of corrugated stainless-steel pipe.
- D. Exhaust Silencer Discharge Piping: ASTM A53, Schedule 40, welded, black steel, with welded joints and fittings. Provide rain cap.

2.7 COMBUSTION-AIR INTAKE

- A. Air filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element.

2.8 STARTING SYSTEM

- A. Description: 24 V DC from battery, with negative ground.
 - 1. Starting system components shall be sized for reliable operation during two sequential engine-cranking cycles with ambient temperature at maximum.
 - 2. Cranking motor shall be heavy-duty with solenoid engagement and mechanical release from engine flywheel.
 - 3. Four 15 second cranking cycles separated by 15 seconds off.
 - 4. Battery sized to provide power for the specified cranking cycle at least twice without recharging.
 - 5. Battery cables size as recommended by engine manufacturer. Include required interconnecting conductors and connection accessories.
 - 6. Battery-charging alternator shall be factory mounted on engine with solid-state voltage regulation and 35 amp minimum continuous rating.
 - 7. Battery Charger
 - a. Current-limiting, automatic equalizing and float-charging type. Unit shall comply with UL 1236.
 - b. Equalizing charge rate of 10 amps shall be initiated automatically after battery has lost charge until an equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again. Equalizing and float voltages shall be adjustable.
 - c. Automatic temperature compensation shall adjust float and equalize voltages for variations in ambient temperature from minus 40 degrees C to plus 60 degrees C to prevent overcharging at high temperatures and undercharging at low temperatures. Provide integral or remote mounted and wired temperature sensor.
 - d. Automatic voltage regulation shall maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
 - e. Ammeter and voltmeter flush mounted on charger enclosure. Meters shall indicate charging rates.
 - f. Sense abnormally low battery voltage. Provide indication on charger and voltage-free contact for remote monitoring.

- g. Sense high battery voltage, loss of ac input and loss of DC output. Provide indication on charger.
- h. Enclosure shall be a wall-mounted cabinet.
- i. -4 degree F minimum operating temperature.
- j. 120 VAC input power.
- k. Manufacturer shall be La Marche ESCR Series or equal.

2.9 ENGINE-GENERATOR SET CONTROL PANEL

- A. Functional Description: When mode selector switch on the engine-generator set control panel is in the AUTOMATIC position, remote control contacts shall close to initiate starting of the generator set and open to initiate stopping. When the mode selector switch is positioned to ON, the generator set shall start. When the mode selector switch is positioned to OFF, the generator set shall stop. During generator set operation, abnormal conditions shall automatically stop the generator set and initiate alarms.
- B. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common engine-generator set control panel mounted on the engine-generator set. Mounting method shall isolate the control panel from generator set vibration.
- C. Protection
 - 1. The generator set shall automatically shut down for any of the following causes:
 - a. Low lube oil pressure
 - b. High coolant temperature
 - c. Engine over-speed
 - d. Over-crank
 - 2. Generator shall not restart after an automatic shutdown until rest on the control panel.
 - 3. Generator shall be capable of shutdown by a manual remote emergency stop.
- D. Indicating Lights, Auxiliary Relays and Meters
 - 1. Malfunction or status indicating lights shall be provided for each of the following:
 - a. Low oil pressure pre-shutdown alarm
 - b. High coolant temperature pre-shutdown alarm
 - c. Low coolant temperature alarm
 - d. Low coolant level alarm
 - e. Low oil pressure shutdown
 - f. High coolant temperature shutdown
 - g. Engine overspend shutdown
 - h. Over-crank shutdown
 - i. Control switch not in remote
 - j. Low fuel
 - k. Fuel leak
 - l. Generator running

2. A common auxiliary relay with voltage-free fail contact shall be provided for malfunction and status items a. through i. above.
3. Voltage-free contacts for low fuel and fuel leak shall be provided.
4. A voltage-free contact for generator run shall be provided.
5. Meters shall be provided for the following:
 - a. AC and DC volts
 - b. AC amperes
 - c. Frequency
 - d. Power factor
 - e. Kilowatts
 - f. Oil pressure
 - g. Coolant temperature
 - h. Run time
- E. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.
- F. A control panel heater shall be provided for the prevention of condensation. Heater shall operate at 120 VAC and shall be thermostatically controlled.

2.10 GENERATOR OVERCURRENT AND FAULT PROTECTION

- A. Generator Circuit Breakers: Insulated case type, electronic-trip type, 100 percent rated, complying with UL 489.
 1. Frame size and trip rating as shown on Contract Drawings with adjustable long-time, short-time, instantaneous and ground fault settings.
 2. Trip settings shall be coordinated with generator thermal damage curve.
 3. Breaker shall include an arc energy reduction feature. Feature shall provide a temporary instantaneous trip setting to be used during maintenance activities. Feature shall be enabled by a switch mounted on the front of the circuit breaker enclosure and shall include an indicating light showing enabled-disabled status.
 4. Mount circuit breaker adjacent to generator terminal box.

2.11 GENERATOR, EXCITER AND VOLTAGE REGULATOR

- A. Comply with NEMA MG 1 and specified performance requirements.
- B. Drive Coupling: Generator shaft shall be connected to engine flywheel by means of a flexible steel coupling. Exciter shall be mounted on the generator rotor.
- C. Windings: 2/3 winding pitch stator with one slot skew to eliminate slot harmonics, and fully linked amortisseur winding.
 1. Windings shall be provided with an integral heater for the prevention of condensation. Heater shall operate at 120 VAC and shall be thermostatically controlled.
- D. Temperature Rise: 105 degrees C maximum at 40 degrees C ambient.
- E. Generator Insulation: Class H.

- F. Excitation: Brushless rotating exciter. Sustain generator output performance under short-circuit conditions as specified.
- G. Exciter DC power supply: permanent magnet DC generator in-line coupled to generator shaft.
- H. Stator-Winding Leads: For multiple voltage units, bring out both ends to terminal box to permit future reconnection for other voltages. Generator leads shall be terminated at insulated copper busbars with NEMA standard drilling for units rated over 300 amps.
- I. Over-speed: Generator construction shall prevent mechanical, electrical, and thermal damage up to 125 percent of base speed.
- J. Enclosure: Open drip-proof, fully guarded, with stainless steel insect screens.
- K. Instrument Transformers: Mounted within generator enclosure.
- L. Voltage Regulator: Solid-state type, voltage sensing, providing specified performance.
 - 1. Adjusting rheostat (or potentiometer) on engine generator set control panel shall provide plus or minus 5 percent adjustment of output voltage operating band.

2.12 SOUND ATTENUATING ENCLOSURE

- A. Description: Prefabricated weatherproof, non-walk-in, sound attenuating enclosure provided by generator set supplier with the following features:
 - 1. Construction: Metal-clad, integral structural-steel-framed enclosure anchored to concrete foundation.
 - 2. Structural Design and Anchorage:
 - a. Wind load: up to 120 mph.
 - b. Seismic requirements: as specified in Part 1 of this Section.
 - c. Roof load: 40 lbs/sf.
 - d. Distributed floor load: 200 lbs/sf.
 - 3. Rain test: no water intrusion at 4 inches/hour.
 - 4. Engine Cooling and Combustion Airflow through Enclosure: Maintain temperature rise of system components within required limits when generator operates at 110 percent of rated load for 2 hours with ambient temperature at maximum specified exterior temperature. Provide the necessary louvered openings, screens, filters and other features to meet this requirement.
 - 5. The enclosure shall consist of a roof, two sidewalls and two end walls, with welded and bolted steel frame construction. Enclosure shall incorporate the base mounted fuel tank specified herein.
 - 6. Shell: 12-gauge minimum galvanized steel, degreased, primed and painted inside and outside with color as selected by the Owner.
 - 7. Roof: one piece, welded
 - 8. Sound attenuating insulation shall be a non-hydroscopic material applied to interior wall and roof surfaces.
 - 9. Doors: quantity and locations to facilitate maintenance, operation and inspection. Doors shall have continuous hinges, 180 degrees swing and be pad lockable.

10. Lift rings shall be provided at the perimeter for lifting the complete enclosure with installed generator set into place. The lift rings shall be fabricated of 1.25-inch thick (nominal) steel plate and welded into the assembly perimeter at 4 locations.
11. Provide the necessary means to internally or externally mount the specified engine exhaust silencer.

2.13 FUEL TANK

- A. Base-Mounted Fuel Tank: Factory installed and piped, complying with UL 142 fuel oil tank. Features include the following:
 1. Tank level indicator.
 2. Capacity: 1,000 gallons
 3. Fill cap shall be located within generator enclosure or behind a lockable access cover.
 4. Containment Provisions: Provide double wall containment construction with leak detection. Containment shall comply with requirements of the authority having jurisdiction.

2.14 SOURCE QUALITY CONTROL

- A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
 1. Tests: Comply with NFPA 110, Level 1 energy converters in Paragraphs 3.2.1, 3.2.1.1, and 3.2.1.2.
 2. Generator Tests: Comply with IEEE 115.
 3. Components and Accessories: Items furnished with installed unit that are not identical to those on tested prototype shall have been factory tested to demonstrate compatibility and reliability.
- B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:
 1. Full load run.
 2. Maximum power.
 3. Voltage regulation.
 4. Transient and steady-state governing.
 5. Single-step load pickup.
 6. Safety shutdown.
 7. Observation of Factory Tests: Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.
- C. Report factory test results within 10 days of completion of test.

2.15 SPARE PARTS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses: One for every 10 of each type and rating, but not less than six of each.
 - 2. Indicator Lamps: Not less than ten of each type.
 - 3. Filters: Two sets each of lubricating oil, fuel, and combustion-air filters.
 - 4. Touchup Paint: One quart of color to match the finish of the sound attenuating enclosure.

2.16 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of generator sets and associated auxiliary components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Equipment platform installation shall be complete prior to commencing installation of the generator set.
- B. Examine area for compliance with requirements for installation and other conditions affecting generator set performance.
- C. Examine roughing-in electrical connections. Verify actual locations of connections before generator set installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle generator sets and accessories in accordance with manufacturer's instructions and the Division 26 Section "Electrical".

3.3 INSTALLATION

- A. Comply with generator set manufacturers' written installation and alignment instructions and with NFPA 110.
- B. Install generator set level on equipment platform.
 - 1. Place and secure anchorage devices in accordance with manufacturer's setting drawings, templates, diagrams and instructions.
 - 2. Vibration Isolation: Mount generator on restrained spring isolators.
- C. Install engine generator to provide access for periodic maintenance without removing connections or accessories.
- D. Provide all coolant and lubricants necessary for a complete installation.
- E. Provide all fuel necessary for testing.

- F. Provide fuel to fill fuel tank at completion of construction.
- G. Provide adjustment of circuit breaker trip parameters in accordance with the results of the study specified in the Division 26 Section "Overcurrent Protective Device Coordination Study".

3.4 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems".
- B. Connect wiring according to Division 26 Section "Low Voltage Electrical Power Conductors and Cables".
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 MANUFACTURER'S FIELD SERVICES

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in acceptance testing. Report results in writing.
- B. Engage a factory-authorized service representative to perform startup service.

3.6 ACCEPTANCE TESTING

- A. Engage a qualified testing firm to perform the following field tests and inspections and prepare test reports:
 - 1. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specifications INSPECTION AND TEST PROCEDURES 7.15.2 and 7.22.1 (except for vibration baseline test). Certify compliance with test parameters.
 - 2. Perform tests recommended by manufacturer.
 - 3. Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to single-step full-load pickup test.
 - 4. Perform battery tests. Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
 - a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
 - b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
 - c. Verify acceptance of charge for each element of the battery after discharge.
 - d. Verify that measurements are within manufacturer's specifications.
 - 5. Perform battery-charger tests. Verify correct battery rates of charge for both equalizing and float-charging conditions.
 - 6. Perform system integrity tests. Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.

7. Perform exhaust emissions test. Comply with applicable government test criteria.
 8. Perform voltage and frequency transient stability tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
 9. Perform noise level tests: Measure A-weighted level of noise emanating from generator set installation, including engine exhaust and cooling-air intake and discharge, at four equally spaced locations around the generator set perimeter and compare measured levels with required values.
- B. Coordinate tests with tests for transfer switches and run them concurrently.
 - C. Test instruments shall have been calibrated within the last 12 months, traceable to standards of the National Institute for Standards and Technology, and adequate for making positive observation of test results. Make calibration records available for examination on request.
 - D. Leak Test: After installation of fluids, test for leaks. Repair leaks and retest until no leaks exist.
 - E. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - F. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - G. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.
 - H. Report results of tests and inspections in writing. Record settings of all adjustable parameters.

3.7 STARTUP SERVICE

- A. Follow instructions of the factory-authorized service representative during startup.
- B. Inspect field-assembled components and equipment installation, including piping, and electrical connections. Report results in writing.
- C. Complete installation and startup checks according to manufacturer's written instructions.

3.8 IDENTIFICATION

- A. Provide warning signs according to Division 26 Section "Identification for Electrical Systems."

3.9 TRAINING

- A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain generator set.
 1. Coordinate this training with training for automatic transfer switch.

- B. Submit a proposed training course schedule and a complete description of training to Owner and Engineer at least 30 days in advance of proposed training date. Review manufacturer's instructions and recommendations for maintenance, troubleshooting, and parts replacement during the training course.

END OF SECTION

SECTION 26 41 13
LIGHTNING PROTECTION FOR STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide a U.L. master-labeled lightning protection system as specified herein for the rehabilitated Crotonville Pumping Station.

1.2 REFERENCE STANDARDS

- A. Comply with the following standards:
 - 1. National Fire Protection Association (NFPA) Lightning Protection Systems NFPA 780.
 - 2. Underwriter's Laboratories (UL) Standard 96A.
 - 3. Lightning Protection Institute (LPI) Code LPI-175.

1.3 QUALITY ASSURANCE

- A. Installation shall bear the Master Label of the Underwriters' Laboratory Incorporated.
 - 1. If a specific building or portion of the project cannot be Master Labeled due to its use, then the Master Label requirement will apply only to those portions of the project eligible for labeling.
- B. The lightning protection system shall be the standard product of a manufacturer regularly engaged in the production of lightning protection systems, and shall be the manufacturer's latest approved design. The equipment manufacturer shall also be a U.L. certified manufacturer, and a certified member in good standing of the Lightning Protection Institute.

1.4 SUBMITTALS

- A. Qualifications and experience proposal for the lightning protection system manufacturer and installer.
- B. Shop Drawings
 - 1. Layout drawings of all work showing the location of air terminals, conductors, ground rods, and all fittings, connectors, and equipment to be protected.
 - 2. Submittals shall contain a complete material list with manufacturer catalog data marked to show the proposed components, describing the material, and demonstrating conformance to the Specification, associated standards, and test requirements.
- C. Product Data: For each type of product specified herein, including catalog data, technical specifications, evidence of UL listing.
- D. Samples
 - 1. Samples of any lightning protection material shall be submitted upon Engineer's request.
- E. Tests and Test Reports
 - 1. Continuity test results.
 - 2. Ground resistance test results.

- F. Operation and maintenance data is not required, however, approved shop drawing submittals are required to be included for the record in the Operation and Maintenance Manuals, as described in Division 26 Section "Electrical".

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain all wire and cable of a particular type through one source from a single qualified manufacturer.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Equipment and materials shall be U.L. listed and labeled.
- B. Equipment and materials shall be new, the product of a manufacturer as outlined above, and in conformance with the referenced standards.

2.2 MATERIALS

- A. Lightning protection system materials shall be aluminum in exposed locations, and copper where concealed or buried unless otherwise specified.
- B. Horizontal and down conductors shall be solid or woven construction.
- C. Air terminals shall be solid, round aluminum bar of 1/2-inch minimum diameter and shall project 10 inch minimum above the object to be protected. Locate and space according to L.P.I. and U.L. requirements.
- D. Bases for air terminal shall be aluminum construction with bolted pressure cable connections. Means of base attachment shall be compatible with the surface to which the base is to be mounted and shall provide a secure installation.
- E. Ground rods shall be a minimum of 3/4 inch diameter steel core, copper coated and 10 feet long. They shall be connected to the system with a two-bolt cast bronze clamp, having a minimum length of 1 1/2 inch.
- F. Cable fasteners shall be substantial in construction, electrolytically compatible with the conductor and mounting surface and shall be spaced according to L.P.I. and U.L. Code requirements.
- G. Bonding devices, cable splicers and miscellaneous connectors shall be of cast bronze or aluminum with bolt pressure connections to cable. Cast or stamped crimp fittings are not acceptable.
- H. Equipment on stacks and vents shall be protected from corrosion and sized in accordance with L.P.I. and U.L. requirements.
- I. All miscellaneous bolts, nuts, and screws shall be brass, bronze or stainless steel corrosion-resistant fasteners compatible with the materials being fastened, and the substrate.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The installation shall be accomplished by an experienced installer listed with Underwriter's Laboratories as qualified and who is also a Certified Master Installer of the L.P.I. or working

under the direct supervision of an L.P.I. manufacturer.

- B. All equipment shall be installed in a neat workmanlike manner in the most inconspicuous manner possible. The system shall consist of a complete cable network on the roof including all air terminals, splices, and bonds with down conductors routed exposed on the building exterior.

3.2 COORDINATION

- A. The lightning protection installer shall work with other trades to insure a correct, neat and unobtrusive installation.
- B. Coordinate with all trades to determine features to be protected including antennas, HVAC equipment, plumbing vents and other items.
- C. Coordinate attachment of lightning protection system materials and method of any needed penetrations with the proposed roof type to ensure compatibility and to maintain the roof warranty.
- D. It shall be the responsibility of the lightning protection installer to assure a sound bond to ground and to assure interconnection with other ground systems.

3.3 MATERIALS

- A. Air Terminals
 - 1. Air terminals shall not project more than 24 inches nor less than 10 inches above the protected object.
 - 2. Ridges, dormers, perimeter, center of roof, equipment with metal less than 3/16 inch in thickness shall be protected by suitable air terminals. Other structural parts which are likely to receive and be damaged by a stroke of lightning shall be provided with air terminals.
 - 3. Both metallic and non-metallic stacks and vents shall be provided with air terminals unless they are within a zone of protection.
- B. Conductor Routing
 - 1. All main conductors shall maintain a downward or horizontal course, free from "U" or "V" pockets.
 - 2. Conductors shall not form an angle of less than 90° nor less than an 8-inch radius bend.
 - 3. Fasteners shall be spaced not more than 3 feet horizontally or vertically and shall be the same material as the conductor.
 - 4. Bimetallic fittings shall be used for all connections between dissimilar metals.
- C. Roof Conductors
 - 5. Roof conductors shall interconnect and provide a two-way path from all air terminals.
 - 6. Roof conductors shall bond together all air terminals and shall be installed exposed except that where connections are made to equipment located under roof.
 - 7. Conductors on perimeters of flat roofs shall form closed loops
 - 8. Dead end air terminals shall not be permitted.
 - 9. All interconnecting cables from air terminals to roof conductors or metal roof decks shall be similar to roof conductor.

D. Down Conductors

1. Down conductors shall follow the most direct path possible between roof conductors and ground terminals. Deep re-entrant loops shall not be permitted.
2. Buildings with a ground perimeter less than 250 feet shall have a minimum of two down conductors installed at the diagonally opposite corners of the building.
3. Buildings with a ground perimeter in excess of 250 feet shall have down conductors installed such that the distance between the conductors does not exceed 100 feet.
4. Down conductors shall be installed on the exterior walls of structures. Provide PVC conduit enclosures where subject to mechanical damage.

E. Grounding System

1. Ground rods shall be provided at each down conductor and they shall be installed a minimum of 2 feet away from the foundation walls.
2. The ground rods shall be in addition to the ground rods provided for the ground ring.
3. Connectors used to connect ground rods to the down conductors shall make contact with the ground rod for a distance of 1-1/2 inch measured parallel to the ground rod. In addition, ground terminals shall be interconnected with the ground ring.
4. Bonding of down conductors to the ground ring and splicing of conductors in concealed work shall be made by a welding process similar to Cadweld, Thermoweld or equal.
5. Where conductors are bonded to structural steel or metal roof decks, a bolted-on bonding plate shall be used. All other bonding of the lightning protection system shall be made with pressure clamps.
6. An accurate record of the type and location of each ground terminal shall be made and a copy submitted to the Engineer.

3.4 TESTING**A. General**

1. The Lightning Protection System shall be tested for continuity of all conductors and air terminals.
2. Maximum resistance of system shall not exceed five ohms unless otherwise specified or scheduled.
3. Contractor shall submit test results to the Engineer for review.

B. Indicators

1. Stamped metal tags shall be attached to, or adjacent to, each down conductor indicating in feet the exact vertical depth in the ground of each ground terminal.
 - a. Tags shall be of a corrosion resistant metal and shall be placed at a height of 5 feet above finish grade.

3.5 INSPECTION**A. General**

1. Each building installation shall be inspected and checked by a UL field inspector.

2. Any corrections which are required shall be made within 15 days of notification and re-inspected by UL field inspection at no cost to the Owner.

END OF SECTION

SECTION 26 43 00 SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide transient voltage surge suppression devices (SPDs) for protection of low-voltage building electric and electronic systems from the effects of line and induced transient voltage surges and coupled lightning discharged transients.

1.2 REFERENCES

- A. Materials and installation shall be in conformance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. Underwriters Laboratories, Inc. (UL) 1449 - Standard for Safety for Transient Voltage Surge Suppressors.
 - 2. National Electrical Code (NEC)
 - 3. The Institute of Electrical and Electronic Engineers (IEEE) ANSI/IEEE C62.41, recommended Practice for Surge Voltages in Low Voltage AC Power Circuits.

1.3 SUBMITTALS

- A. Submit manufacturer's catalog data for each product, clearly marked to show which items are proposed for this project. Cross out non-applicable information.
- B. Submittals shall include UL 1449 Listing documentation verifying:
 - 1. Short Circuit Current Rating (SCCR)
 - 2. Voltage Protection Ratings (VPRs) for all modes
 - 3. Maximum Continuous Operating Voltage rating (MCOV)
 - 4. Nominal current rating (I-n)
 - 5. Type 1 Device Listing
- C. Submit acceptance test report.

1.4 QUALITY ASSURANCE

- A. The surge protective device shall have a minimum of 10 years warranty.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Manufacturers
 - 1. Subject to compliance with requirements, provide products by one of the following:
 - a. Advanced Protection Technologies, Inc.

- a. Cutler-Hammer, Inc.
- b. Leviton Manufacturing Co. Inc.
- c. Liebert Corp.
- d. Siemens Energy Automation.
- e. Square D Co.
- f. Or approved equal.

2.2 MOTOR CONTROL CENTER AND PANELBOARD SURGE PROTECTION APPLICATIONS

- A. Surge protective devices shall be of the fast-acting Metal Oxide Varistor (MOV) design.
- B. Provide the following features and accessories:
 - 1. Integrally mounted in MCC or panelboard enclosure.
 - 2. Integral disconnect switch or branch circuit breaker disconnect in MCC or panelboard.
 - 3. UL labeled as Type 1 intended for use without the need of external or supplemental overcurrent protection. Suppression components of each mode, including N-G, shall be protected by internal overcurrent and thermal over-temperature controls. SPDs relying upon external or supplementary installed safety disconnects shall not be acceptable.
 - 4. UL labeled with 200 kA Short Circuit Current Rating (SCCR). Fuse ratings shall not be considered in lieu of demonstrated withstand testing of SPD, per NEC 285.6.
 - 5. UL labeled with 20 kA I nominal (I-n) in compliance with UL 96A Lightning Protection Master Label and NFPA 780.
 - 6. Suppression components shall be heavy duty large block MOVs, each exceeding 30 mm diameter. Include redundant suppression circuits. Internal connections shall be by bolted compression lugs.
 - 7. Terminals for wiring external to the SPD shall be suitable for the conductor size, quantity and type as necessary for the application.
 - 8. Red and green LED indicator lights for power and protection status. Each MOV shall be individually monitored, including N-G. Units merely indicating "power on" shall not be acceptable.
 - 9. Audible alarm, with silencing switch, to indicate when protection has failed.
 - 10. One set of voltage-free contacts rated 5 amps, 250 VAC, for remote monitoring of protection status.
 - 11. Surge-event operations counter.
 - 12. Peak Single-Impulse Surge Current Rating: 320 kA per phase.
 - 13. Protection modes and UL 1449 Voltage Protection Ratings for grounded wye circuits on 480Y/277 volts, 3-phase, 4-wire systems shall be as follows:
 - a. Line to Line: 2000 volts
 - b. Line to Neutral: 1200 volts
 - c. Line to Ground: 1200 volts
 - d. Neutral to Ground: 1200 volts
 - 14. Protection modes and UL 1449 Voltage Protection Ratings for grounded wye circuits on 208Y/120 volts, 3-phase, 4-wire systems shall be as follows:

- a. Line to Line: 1200 volts
- b. Line to Neutral: 700 volts
- c. Line to Ground: 700 volts
- d. Neutral to Ground: 700 volts

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide installation in accordance with the manufacturer's installation recommendations.
- B. Install with conductors between suppressor and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

3.2 FIELD QUALITY CONTROL

- A. Verify installation complies with manufacturer's requirements.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Perform visual and mechanical inspection and electrical tests in conformance with NETA Acceptance Testing Specification Inspection and Test Procedure 7.19.1 "Surge Arrestors, Low Voltage".
 - 2. Certify compliance with test parameters.
 - 3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

END OF SECTION

**SECTION 26 50 00
LIGHTING**

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide lighting fixtures with lamps, controls, hangers, options, and accessories required for a complete lighting system installation, as shown on the Contract Drawings and specified herein.

1.2 REFERENCES

- A. Materials and installation shall be in accordance with latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American National Standard Institute (ANSI)
 - 2. National Electric Code (NEC)
 - 3. National Electrical Manufacturers Association (NEMA)
 - 4. Underwriters Laboratories, Inc. (UL)

1.3 COORDINATION REQUIREMENTS

- A. Coordinate layout and installation of lighting fixtures with proposed and existing systems and building features.

1.4 SUBMITTALS

- A. Submit the following;
 - 1. Product Data: manufacturers' catalog data sheets for lighting fixtures, lamps, hangers, controls, and accessories, with sufficient information to demonstrate conformance to specified requirements. Include coefficient of utilization data and photometric data for each fixture type.
 - 2. Samples: submit upon Engineer's request.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver lighting fixtures in original sealed factory cartons.
- B. Store lighting fixtures in clean dry indoor rooms with a temporary dehumidifier and electric heating to maintain the storeroom between 5 and 40 deg. C with humidity less than 90%. Comply with manufacturer's additional written instructions for storing and periodic inspection and testing.
- C. Handle lighting fixtures according to manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers and catalog numbers are specified to establish a basis of design, and to establish the quality of materials of construction. Equivalent lighting fixtures using equal materials and with equivalent performance, appearance and features may be submitted, and shall be acceptable if approved by the Engineer.

2.2 LIGHTING FIXTURES

- A. Lighting fixture types shall be as scheduled on the Drawings.
- B. Unpainted fixture parts shall be corrosion-resistant, constructed of high-purity aluminum, stainless steel, or equivalent corrosion-resistant materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- B. Examine areas for suitable conditions for installation and that all overhead and ceiling work of other trades is complete.
- C. Verify that ground connections are in place.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. All lighting equipment shall have enclosures, hangers and supports, fittings and outlet boxes suitable for the location.
- B. Lighting fixture locations shown on the Drawings are approximate. Exact locations shall be coordinated with piping, ductwork and structural components to avoid interferences. Advise the Engineer of any necessary relocations and proceed with relocations after approval.
- C. Fixtures shall be mounted to provide a minimum of shading from pipes, ducts, beams and other obstructions.
- D. Reflectors, reflector cones and visible trim of all lighting fixtures shall not be installed until completion of general cleanup. Handle carefully to avoid scratching.
- E. Provide all necessary aiming and adjustments as directed by the Engineer.

3.3 FIELD QUALITY CONTROL

- A. Prepare for lighting fixture circuit energization as follows:
 - 1. Test continuity and insulation resistance for each power supply circuit.
 - 2. After installing equipment but before power supply is energized, verify that grounding system is completed.
 - 3. Verify that equipment is installed and connected according to the Contract Documents.

3.4 CLEANING

- A. On completion of installation, inspect interior and exterior of lighting fixtures. Remove dust, dirt, paint splatters and other spots from exterior and wipe down with damp cotton cloth. Touch-up exposed surfaces to match original finish. Vacuum interior surfaces removing all dirt and debris while taking care to protect static-sensitive and fragile parts from damage. Do not use compressed air to assist in cleaning.
- B. Lighting fixtures shall be left in clean, operational condition, free of dirt and cosmetic defects.

3.5 PROTECTION

- A. Protect installed fixtures from damage through Substantial Completion.

END OF SECTION

SECTION 27 00 00 COMMUNICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide modifications to existing telephone system as indicated on the Drawings and specified herein.
- B. Modifications shall include telephone outlets and wiring to connect existing/relocated telephones to existing/relocated telephone equipment.

1.2 REFERENCES

- A. Comply with the following standards:
 - 1. ANSI/TIA/EIA-568-A Commercial Wiring Standards
 - 2. ANSI/TIA/EIA-606-A-2002 Administration Standard for Commercial Telecommunications Infrastructure
 - 3. NFPA 70 National Electrical Code
 - 4. ANSI C2 National Electrical Safety Code
 - 5. Applicable Federal Communications Commission (FCC) regulations.
 - 6. Applicable telephone service provider's requirements

1.3 COORDINATION REQUIREMENTS

- A. Coordinate with service provider to ensure compliance with the service providers' requirements.
- B. Field verify existing system hardware, wiring and other features as necessary to permit connection of new components.
- C. Coordinate with the Owner regarding removal and reinstallation of existing telephone equipment.
- D. Coordinate with the Owner regarding removal and reinstallation of existing telephones.

1.4 SUBMITTALS

- A. Product Data Sheets
 - 1. Technical data sheets for outlets, cables and accessories marked to show products selected for this project.
- B. Test Reports
 - 1. Acceptance test reports.

1.5 QUALITY ASSURANCE

- A. Electrical Components: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Existing telephone system provides off-site voice and data communications using a telephone service, telephone panel, telephone outlets, telephones, devices and premises wiring.
- B. The existing telephone system shall be modified and used to serve existing WTP spaces and the spaces improved by this project. System modifications shall include the following:
 - 1. Disconnect and remove existing telephones.
 - 2. Disconnect and remove existing telephone outlets and associated wiring.
 - 3. Disconnect and remove existing data communications equipment and associated wiring.
 - 4. Remove and reinstall existing telephone service cable and existing telephone panel from their present locations to locations as indicated on the Drawings.
 - 5. Provide new telephone outlets with connections to existing/relocated telephone panel.
 - 6. Reinstall existing telephones and reconnect to new telephone outlets.
 - 7. Provide auto dialer and connect to new telephone outlet.

2.2 TELEPHONE OUTLET CABLES

- A. Cables from telephone panel to telephone outlets shall be compatible with existing telephone equipment and existing telephones.
- B. Unless otherwise required for compatibility, cables shall be Category 6, 24 gauge, four pair, UTP, 550 MHz and shall be terminated on an eight pin modular jack provided at each outlet. Cable shall be UL Listed Type CMP. Individual conductors shall have fluorinated ethylene propylene (Teflon) insulation. Cable shall meet the requirements of UL 910 and NFPA 262-1985. Color of jacket shall be gray.
- C. Cable labeling system shall be Panduit Mark PRO LS 3E or equal.

2.3 TELEPHONE OUTLETS

- A. Unless otherwise required for compatibility, outlets shall be non-keyed RJ45, 8 pin, 8-conductor, Category 6 modular jacks with compatible faceplate. Pin assignments shall be in accordance with TIA/EIA-T568B. Outlets shall be suitable for use with the specified outlet cable. Provide cover caps to protect terminations of the UTP cable. Modular jack colors shall be gray for telephone and blue for data. Outlets shall be Leviton eXtreme 6+ CAT 6 connectors or equal.
- B. Faceplates shall be provided with two (2) ports. Jacks shall be installed through ports flush with faceplates. Unused ports shall be filled with blanks matching the faceplate finish.
 - 1. Faceplates shall be stainless steel with identification window for insertion of labeling. Faceplates shall be Leviton QuickPort or equal.

2.4 TELEPHONES

- A. System shall use existing telephones.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and verify conditions are suitable for component installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Equipment and materials shall be installed in accordance with manufacturer's requirements.
- B. Outlet Wiring: All cabling shall be installed in conduits sized in accordance with the NEC unless otherwise shown or specified.
- C. Outlet Wiring Terminations: Provide termination of all installed cables. Terminations on existing/relocated telephone equipment shall be in accordance with existing telephone equipment requirements.
- D. Outlets: Install wall mounted outlets 60 inches to the centerline of the device box above finished floor unless otherwise noted.

3.3 IDENTIFICATION AND LABELING

- A. Identify cables and outlets.
 - 1. Cables shall be labeled at each end, 1" from end of the sheath. The cable or its label shall be marked with its identifier.
 - 2. Cables shall be labeled consistent with existing facility practices.
 - 3. Outlet faceplates shall be provided with a unique identifier indicating its connection location on the existing/relocated telephone equipment. Follow existing labeling practices.

3.4 TESTING

- A. Test all cables prior to system energization. The cables shall be tested for conformance to the specifications of TIA/EIA 568A Category 6.
 - 1. Cables shall be tested from source to outlet.
 - 2. All conductor pairs shall be tested for opens, shorts crosses, polarity reversals, transposition, grounded pairs and presence of AC voltage.
- B. Outlets: All outlets shall be tested to demonstrate functionality.
- C. Confirm all specified telephone system features are functional and off-site communications is operational.
 - 1. Correct all nonconformities and retest at no additional cost to the Owner.

END OF SECTION

SECTION 31 01 01 EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes excavation and backfilling including the loosening, removing, refilling, transporting, storage and disposal of all materials classified as "earth" necessary to be removed for the construction and completion of all work under the Contract, and as shown on the Contract Drawings, specified or directed.
- B. Where certain features related to Earthwork are shown on the Contract Drawings, the Contractor shall be entirely responsible for final sequencing, scheduling, coordinating and planning the actual areas and their implementation in accordance with all laws and property ownership. These may include storage and staging areas, temporary stock pile areas, vehicle parking areas, temporary haul roads for construction ingress and egress, and other similar zones and land uses.

1.2 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. ASTM International
 - a. A328 - Specification for Steel Sheet Piling
 - b. D698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³)
 - c. D1556 - Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
 - d. D1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2,700 kN-m/m³)
 - e. D1760 - Specification for Pressure Treatment of Timber Products
 - f. D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

1.3 DEFINITIONS

- A. Excavation (including trenching)
 - 1. Clearing, grubbing, stripping, removing, storing and re-handling of all materials of every name and nature necessary to be removed for all purposes incidental to the construction and completion of all the work under construction.
 - 2. All sheeting, sheet piling, bracing and shoring, and the placing, driving, cutting off and removing of the same.
 - 3. All diking, ditching, fluming, coffer-damming, pumping, bailing, draining, well pointing, or otherwise disposing of water.
 - 4. Removing and disposing of all surplus materials from the excavations in the manner specified.

5. Maintenance, accommodation and protection of traffic and pedestrian travel and the temporary paving of highways, roads and driveways.
 6. Supporting and protecting of all buildings, curbs, sidewalks, pavements, overhead wires, poles, trees, vines, shrubbery, pipes, sewers, conduits or other structures or property in the vicinity of the work, whether over or underground or which appear within or adjacent to the excavations, and the restoration of the same in case of settlement or other injury.
 7. All temporary bridging and fencing and the removing of same.
- B. Earth
1. All materials such as sand, gravel, clay, loam, ashes, cinders, pavements, muck, roots or pieces of timber, soft or disintegrated rock, not requiring blasting, barring, or wedging from their original beds, and specifically excluding all ledge or bedrock and individual boulders or masonry larger than one-half cubic yard in volume.
- C. Backfill
1. Refilling of excavation and trenches to the line of filling indicated on the Contract Drawings or as directed using materials suitable for refilling of excavations and trenches; and the compacting of all materials used in filling or refilling by rolling, ramming, watering, puddling, etc., as may be required.
- D. Spoil
1. Surplus excavated materials not required or not suitable for backfills or embankments.
- E. Embankments
1. Fills constructed above the original surface of the ground or such other elevation as specified or directed.
- F. Limiting Subgrade
1. The underside of the pipe barrel for pipelines
 2. The underside of footing lines for structures
- G. Excavation Below Subgrade
1. Excavation below the limiting subgrades of structures or pipelines.
 2. Where materials encountered at the limiting subgrades are not suitable for proper support of structures or pipelines, the Contractor shall excavate to such new lines and grades as required.

1.4 SUBMITTALS

- A. Submit the following in accordance with the General Conditions/General Requirements.
- B. Sheeting and bracing drawings stamped and signed by a licensed Professional Engineer in the State of the project, if sheeting and bracing is required.
- C. A written Control of Water Management Plan if removal of water is required.
- D. A representative list of satisfactory similar operations, including contact names and telephone numbers, if well point dewatering is required.

PART 2 - PRODUCTS

2.1 WOOD SHEETING AND BRACING

- A. Wood sheeting and bracing shall be sound and straight; free from cracks, shakes and large or loose knots; and shall have dressed edges where directed.
- B. It shall conform to National Design Specifications for Stress Grade Lumber having a minimum fiber stress of 1200 pounds per square inch.
- C. Sheeting and bracing to be left in place shall be pressure treated in accordance with ASTM D1760 for the type of lumber used and with a preservative approved by the Engineer.

2.2 STEEL SHEETING AND BRACING

- A. Steel sheeting and bracing shall be sound.
- B. It shall conform to ASTM A328 with a minimum thickness of 3/8 inch.

2.3 GEOTEXTILE MATERIALS

- A. Geotextile for Silt Fence: Woven geotextile fabric, manufactured for silt fence complying with the following measurements per test methods referenced:
 - 1. Grab Tensile Strength: 247 lbf; ASTM D4632
 - 2. Sewn Seam Strength: 222 lbf; ASTM D4632
 - 3. Tear Strength: 90 lbf; ASTM D4533
 - 4. Puncture Strength: 90 lbf; ASTM 4833
 - 5. Apparent Opening Size: No. 60 sieve, maximum; ASTM 4751
 - 6. Permittivity: 0.02 per second, minimum; ASTM D4491
 - 7. UV Stability: 50 percent after 500 hours' exposure; ASTM D4355
 - 8. Product shall be Mirafi 100X, Mirafi Envirofence, or equal.
- B. Geotextile for Structural Subgrade Reinforcement: Shall be an integrally formed, Tensar Triaxial TX140 geogrid or equal.
- C. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polypropylene fibers; with elongation greater than 50 percent; complying with AASHTO M 288-06 Class 2 and the following, measure per test methods referenced:
 - 1. Grab Tensile Strength: 160 lbf MD (Machine Direction, 160 lbf CD (Cross Direction); ASTM D 4632
 - 2. Grab Tensile Elongation: 50% MD and CD, ASTM D4632
 - 3. Trapezoid Tear Strength: 60 lbs, MD and CD; ASTM D 4533
 - 4. CBR Puncture Strength: 410 lbs. ASTM D6241
 - 5. Apparent Opening Size: No. 70 sieve, maximum; ASTM D 4751
 - 6. Permittivity: 1.5 sec-1, minimum; ASTM D 4491
 - 7. Product shall be Mirafi 160N, or equal

- D. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from high-tenacity polypropylene yarns; with elongation less than 50 percent; complying with AASHTO M 288 and the following measured per test methods referenced:
 - 1. Grab Tensile Strength; 200 lbs. MD and CD; ASTM D4632
 - 2. Grab Tensile Elongation; 15% MD and CD; ASTM D463
 - 3. Trapezoid Tear Strength: 75 lbs; MD and CD ASTM D 4533
 - 4. CBR Puncture Strength: 700 lbs.; ASTM D 6241
 - 5. Apparent Opening Size: No.40 sieve, maximum; ASTM D 4751
 - 6. Permittivity: 0.05 sec-1, minimum; ASTM D 4491
 - 7. Flow Rate: 4 gal/min/ft²; ASTM D4491
 - 8. UV Stability: 70 percent after 500 hours exposure; ASTM D 4355
 - 9. Product shall be Mirafi 500X, or equal.
- E. Erosion Control Mat: Wooden fiber mat covered with netting top and bottom, manufactured for erosion control applications, made from curled wood excelsior with 80 percent 6-inch fibers of greater length; complying with the following blanket performance requirements:
 - 1. C factor: 0.022
 - 2. Shear Stress: 2.3 lb/sf
 - 3. Velocity: 10.0 fps
 - 4. Reported functional longevity: 24-6 months
 - 5. Thickness: 0.58 in., ASTM D 6525
 - 6. MD Tensile Strength: 217.2 lbf; ASTM D 6818
 - 7. Product shall be North American Green P300, or equal.

PART 3 - EXECUTION

3.1 UNAUTHORIZED EXCAVATION

- A. Whenever excavations are carried beyond or below the lines and grades shown on the Contract Drawings, or as given or directed by the Engineer, all such excavated space shall be refilled with select fill, controlled low strength material, concrete or other materials as the Engineer may direct. All backfilling and compacting of unauthorized excavations shall be at the Contractor's expense.
- B. All material which slides, falls or caves into the established limits of excavations due to any cause whatsoever, shall be removed and disposed of at the Contractor's expense and no extra compensation will be paid to the Contractor for refilling of the void areas left by the slide, fall or cave-in, including any materials or select fill required.

3.2 CONTROL OF WATER

- A. General
 - 1. Contractor shall at all times provide and maintain proper and satisfactory means and devices for the control and removal of all water entering the excavations, and shall remove all such water as fast as it may collect, in such manner as shall not interfere with the prosecution of the work or the proper placing of pipes, structures, or other work.

2. Unless otherwise specified, all excavations which extend down to or below the static groundwater elevations shall be de-watered by lowering and maintaining the groundwater beneath such excavations at all times when work thereon is in progress, during subgrade preparation and the placing of the structure or pipe thereon.
 3. Water shall not be allowed to rise over or come in contact with any masonry, concrete or mortar, until at least 24 hours after placement, and no stream of water shall be allowed to flow over such work until such time as the Engineer may permit.
 4. Where the presence of fine grained subsurface materials and a high groundwater table may cause the upward flow of water into the excavation with a resulting quick or unstable condition, the Contractor shall install and operate a well point system to prevent the upward flow of water during construction.
 5. Water pumped or drained from excavations, or any sewers, drains or water courses encountered in the work, shall be handled in accordance with the Contractor's Construction Water Management Plan as approved by the Engineer.
 6. Any damage caused by or resulting from dewatering operations shall be the sole responsibility of the Contractor.
- B. Work Included
1. Preparation and submittal of a written Control of Water Management Plan to manage and control dewatering activities.
 2. Construction and removal of cofferdams, sheeting and bracing, and the furnishing of materials and labor necessary thereof.
 3. Excavation and maintenance of ditches and sluiceways.
 4. Furnishing and operation of pumps, well points, and appliances needed to maintain control of water related to the work in a satisfactory manner.
 5. Installation and removal of temporary sediment and discharge control devices.
- C. Well Point Dewatering Systems
1. Installation
 - a. Well point system shall be designed and installed by or under the supervision of an organization whose principal business is well pointing and which has at least five consecutive years of similar experience and can furnish a representative list of satisfactory similar operations, including contact names and telephone numbers.
 - b. Well point headers, points and other pertinent equipment shall not be placed within the limits of the excavation in such a manner or location as to interfere with the laying of pipe or trenching operations or with the excavation and construction of other structures.
 - c. Detached observation wells of similar construction to the well points shall be installed at intervals of not less than 50 feet along the opposite side of the excavation from the header pipe and line of well points, to a depth of at least 5 feet below the proposed excavation. In addition, one well point in every 50 feet shall be fitted with a tee, plug and valve so that the well point can be converted for use as an observation well. Observation wells shall be not less than 1 inches in diameter.
 - d. Standby gasoline or diesel powered equipment shall be provided so that in the event of failure of the operating equipment, the standby equipment can be readily connected to the system. The standby equipment shall be maintained in good order and actuated regularly not less than twice a week.

2. Operation

- a. Where well points are used, the groundwater shall be lowered and maintained continuously (day and night) at a level not less than 2 feet below the bottom of the excavation. Excavation will not be permitted at a level lower than 2 feet above the water level as indicated by the observation wells.
- b. Effluent pumped from the well points shall be examined periodically by qualified personnel to determine if the system is operating satisfactorily without the removal of fines.
- c. Water level shall not be permitted to rise until construction in the immediate area is completed and the excavation backfilled.

3.3 STORAGE OF MATERIALS

A. Sod

1. Any sod cut during excavation shall be removed and stored during construction so as to preserve the grass growth. Sod damaged while in storage shall be replaced in like kind at the sole expense of the Contractor.

B. Topsoil

1. Topsoil suitable for final grading shall be removed and stored separately from other excavated material.
2. Control erosion run-off from stockpiles by installing silt fencing. Maintain silt fence during construction and remove upon completion of work.

C. Excavated Materials

1. All excavated materials shall be stored in locations so as not to endanger the work, and so that easy access may be had at all times to all parts of the excavation. Stored materials shall be kept neatly piled and trimmed, so as to mitigate impact to public travel and to adjoining property owners.
2. Special precautions shall be taken to permit access at all times to fire hydrants, fire alarm boxes, police and fire department driveways, and other points where access may involve the safety and welfare of the general public.

3.4 DISPOSAL OF MATERIALS

A. Spoil Material

1. All spoil materials shall be disposed of in accordance with local and state regulations.
2. The surface of all spoil areas shall be graded and dressed and no unsightly mounds or heaps shall be left on completion of the work. On site disposal areas, if permitted, shall be permanently restored with turf establishment or as otherwise specified.

3.5 SHEETING AND BRACING

A. Installation

1. Contractor shall furnish, place and maintain such sheeting, bracing and shoring as may be required to support the sides and ends of excavations in such manner as to prevent any movement which could, in any way, injure the pipe, structures, or other work; diminish the width necessary for construction; otherwise damage or delay the work of

the Contract; endanger existing structures, pipes or pavements; or cause the excavation limits to exceed the right-of-way limits.

2. In no case will bracing be permitted against pipes or structures in trenches or other excavations.
3. Sheeting shall be driven as the excavation progresses, and in such manner as to maintain pressure against the original ground at all times. The sheeting shall be driven vertically with the edges tight together, and all bracing shall be of such design and strength as to maintain the sheeting in its proper position. Seepage that carries fines through the sheeting shall be plugged to retain the fines.
4. Where breast boards are used between soldier piles, the boards shall be back packed with soil to maintain support.
5. Contractor shall be solely responsible for the adequacy of all sheeting and bracing.

B. Removal

1. In general, all sheeting and bracing, whether of steel, wood or other material, used to support the sides of trenches or other open excavations, shall be withdrawn as the trenches or other open excavations are being refilled. That portion of the sheeting extending below the top of a pipe or structural foundation shall not be withdrawn, unless otherwise directed, before more than 6 inches of earth is placed above the top of the pipe or structural foundation and before any bracing is removed. The voids left by the sheeting shall be carefully refilled with selected material and rammed tight with tools especially adapted for the purpose or otherwise as may be approved.
2. Contractor shall not remove sheeting and bracing until the work has attained the necessary strength to permit placing of backfill.

C. Left in Place

1. If, to serve any purpose of his own, the Contractor files a written request for permission to leave sheeting or bracing in the trench or excavation, the Engineer may grant such permission, in writing, on condition that the cost of such sheeting and bracing be assumed and paid by the Contractor.
2. Contractor shall leave in place all sheeting, shoring and bracing which are shown on the Contract Drawings or specified to be left in place or which the Engineer may order, in writing, to be left in place. All shoring, sheeting and bracing shown or ordered to be left in place will be paid for under the appropriate item of the Contract. No payment allowance will be made for wasted ends or for portions above the proposed cutoff level, which are driven down instead of cut-off.
3. In case sheeting is left in place, it shall be cut off or driven down as directed so that no portion of the same shall remain within 12 inches of the street subgrade or finished ground surface.

3.6 BACKFILLING

A. General

1. All excavations shall be backfilled to the original surface of the ground or to such other grades as may be shown, specified or directed.
2. Backfilling shall be done with suitable excavated materials that can be satisfactorily compacted during refilling of the excavation. In the event the excavated materials are not suitable, Select Fill as specified or ordered by the Engineer shall be used for backfilling.

3. Any settlement occurring in the backfilled excavations shall be refilled and compacted.
- B. Unsuitable Materials
1. Stones and pieces of rock greater than six inches in any single dimension shall not be used in any portion of the backfill.
 2. All stones and pieces of rock shall be distributed through the backfill and alternated with earth backfill in such a manner that all interstices between them shall be filled with earth.
 3. Stone and pieces of rock greater than 1.5-inches in any single dimension shall not be used in the initial backfill (centerline of pipe to 12-inches above the top of pipe).
 4. Pieces of pavement, frozen earth, or other miscellaneous debris shall not be allowed in any part of the backfill.
- C. Compaction and Density Control
1. Compaction shall be as specified for the type of earthwork, i.e., structural, trenching or embankment.
 - a. Compaction specified shall be the percent of maximum dry density.
 - b. Compaction equipment shall be suitable for the material encountered.
 2. Where required, to assure adequate compaction, in-place density test, at the expense of the Contractor, shall be made by an approved testing laboratory.
 - a. Moisture-density relationship of the backfill material shall be determined by ASTM D698, Method D.
 - 1) Compaction curves for the full range of materials used shall be developed.
 - b. In-place density shall be determined by the methods of ASTM D1556 or ASTM D2922 and shall be expressed as a percentage of maximum dry density.
 3. Where required, to obtain the optimum moisture content, the Contractor shall add, at its expense, sufficient water during compaction to assure the specified maximum density of the backfill. If, due to rain or other causes, the material exceeds the optimum moisture content, it shall be allowed to dry, assisted if necessary, before resuming compaction or filling efforts.
 4. Contractor shall be responsible for all damage or injury done to pipes, structures, property or persons due to improper placing or compacting of backfill.

3.7 OTHER REQUIREMENTS

- A. Drainage
1. All material deposited in roadway ditches or other water courses shall be removed immediately after backfilling is completed and the section, grades and contours of such ditches or water courses restored to their original condition, in order that surface drainage will be obstructed no longer than necessary.
- B. Unfinished Work
1. When, for any reason, the work is to be left unfinished, all trenches and excavations shall be filled and all roadways, sidewalks and watercourses left unobstructed with their surfaces in a safe and satisfactory condition. The surface of all roadways and sidewalks shall have a temporary pavement.

C. Hauling Material over Public Roads and Streets

1. When it is necessary to haul material over public streets or pavements, the Contractor shall provide suitable, tight vehicles so as to prevent deposits on the streets or pavements. In all cases where any materials are dropped from the vehicles, the Contractor shall clean up the same as often as required to keep the crosswalks, streets and pavements clean and free from dirt, mud, stone and other hauled material.

D. Dust Control

1. It shall be the sole responsibility of the Contractor to control the dust created by any and all of his operations to such a degree that it will not endanger the safety and welfare of the general public.
2. Calcium chloride and petroleum products shall not to be used for dust control.

E. Test Pits

1. For the purpose of obtaining detail locations of under-ground obstructions, the Contractor shall make excavations in advance of the work. Payment for the excavations ordered by the Engineer will be made under an appropriate item of the Contract and shall include sheeting, bracing, pumping, excavation and backfilling.

END OF SECTION

SECTION 31 05 14 SELECT FILL

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes select fill materials used in either embedment or special backfill, as specified or as directed by the Engineer.

1.2 REFERENCES

- A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards, and specifications, except where more stringent requirements have been specified herein:
 - 1. American Society for Testing and Materials (ASTM)
 - a. D422 - Method for Particle-Size Analysis of Soil

1.3 SUBMITTALS

- A. In addition to those submittals identified in the General Clauses/General Requirements, the following items shall be submitted:
 - 1. Name and location of the source of the material
 - 2. Samples and test reports of the material

1.4 DEFINITIONS

- A. Embedment or Lining
 - 1. Any type granular material specified or directed placed below an imaginary line drawn one foot above the inside diameter of the pipe and within the trench limits.
- B. Special Backfill
 - 1. Pipelines
 - a. Any select fill material specified or directed placed above an imaginary line drawn one foot above the inside diameter of the pipe and within the trench limits.
 - 2. Structures
 - a. Any select fill material specified or directed placed within the excavation limits, either in, under or adjacent to the structure.
- C. Special Granular Material
 - 1. Special granular material shall mean any of the granular materials listed below or other materials ordered by the Engineer.

PART 2 - PRODUCTS**2.1 MATERIALS****A. Type E Select Fill****1. Run-of-Bank Gravel**

- a. Run-of-bank gravel or other acceptable granular material free from organic matter with the following gradation by weight:

<u>% Passing</u>	<u>Sieve</u>
100	1 ½-inch
30 – 65	¼-inch
0 – 10	No. 200

B. Type F Select Fill**1. Run-of-crusher Stone**

- a. Run-of-crusher hard durable limestone or approved equal having the following gradation by weight:

<u>% Passing</u>	<u>Sieve</u>
100	1½- inch
95 – 100	1
65 – 80	½
40 – 60	¼
0 – 10	#200 Sieve

C. AASHTO #57 Coarse Aggregate

1. Thoroughly washed clean, sound, tough, hard crushed limestone or approved equal free from coatings. Gradation for coarse aggregate shall have the following gradation by weight:

<u>% Passing</u>	<u>Sieve</u>
100	1½- inch
95 – 100	1
25 – 60	½
0 – 10	No. 4
0-5	No. 8
0 – 2	#200 Sieve

D. NYSDOT 733-01 Flowable Fill

1. Flowable fill shall be in accordance with NYS DOT 733-01 and payment item 204.02 Controlled Low Strength Material (CLSM) (No Fly Ash). Installation shall be in accordance with NYSDOT Section 204-3.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Place material for pipeline embedment as shown on the Contract Drawings, as specified or as directed by the Engineer.

3.2 DISPOSAL OF DISPLACED MATERIALS

- A. Materials displaced through the use of Select Fill shall be wasted or disposed of by the Contractor.
- B. Cost of disposal of displaced materials shall be included in the price bid.

3.3 SETTLEMENTS

- A. Repair any settlements in the finished work.

END OF SECTION

SECTION 31 23 33

TRENCH EXCAVATION AND BACKFILL

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes excavation and backfill as required for pipe installation or other trench construction.

PART 2 - PRODUCT – NOT USED

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Trench excavation shall be located as shown on the Contract Drawings or as specified. Under ordinary conditions, excavation shall be by open cut from the ground surface. Where the depth of trench and soil conditions permit, tunneling may be required beneath cross walks, curbs, gutters, pavements, trees, driveways, railroad tracks and other surface structures. No additional compensation will be allowed for such tunneling over the price bid for open cut excavation of equivalent depths below the ground surface unless such tunnel excavation is specifically provided for in the Contract Documents.
- B. Trenches shall be excavated to maintain the depths as shown on the Contract Drawings or as specified for the type of pipe to be installed.
- C. Alignment and depth shall be determined and maintained by the use of a string line installed on batter boards above the trench, a double string line installed along side of the trench or a laser beam system.
- D. The minimum width of trench excavation shall be 6 inches on each side of the pipe hub for 21-inch diameter pipe and smaller and 12 inches on each side of the pipe hub for 24-inch diameter pipe and larger.
- E. Trenches shall not be opened for more than 300 feet in advance of pipe installation nor left unfilled for more than 100 feet in the rear of the installed pipe when work is in progress without the consent of the Engineer. Open trenches shall be protected and barricaded as required.
- F. Bridging across open trenches shall be constructed and maintained where required.

3.2 SUBGRADE PREPARATION FOR PIPE

- A. Where pipe is to be laid on undisturbed bottom of excavated trench, mechanical excavation shall not extend lower than the finished subgrade elevation at any point.
- B. Where pipe is to be laid on special granular material the excavation below subgrade shall be to the depth specified or directed. The excavation below subgrade shall be refilled with special granular material as specified or directed, shall be deposited in layers not to exceed 6 inches and shall be thoroughly compacted prior to the preparation of pipe subgrade.
- C. Subgrade shall be prepared by shaping with hand tools to the contour of the pipe barrel to allow for uniform and continuous bearing and support on solid undisturbed ground or embedment for the entire length of the pipe.

- D. Pipe subgrade preparation shall be performed immediately prior to installing the pipe in the trench. Where bell holes are required they shall be made after the subgrade preparation is complete and shall be only of sufficient length to prevent any part of the bell from becoming in contact with the trench bottom and allowing space for joint assembly.

3.3 STORAGE OF MATERIALS

- A. Traffic shall be maintained at all times in accordance with the applicable Highway Permits. Where no Highway Permit is required at least one-half of the street must be kept open for traffic.
- B. Where conditions do not permit storage of materials adjacent to the trench, the material excavated from a length as may be required, shall be removed by the Contractor, at his cost and expense, as soon as excavated. Material subsequently excavated shall be used to refill the trench where the pipe had been built, provided it be of suitable character. Excess material shall be removed to locations selected and obtained by the Contractor.
 - 1. Contractor shall, at his cost and expense, bring back adequate amounts of satisfactory excavated materials as may be required to properly refill the trenches.
- C. If directed by the Engineer, Contractor shall refill trenches with select fill or other suitable materials and excess excavated materials shall be disposed of as spoil.

3.4 REMOVAL OF WATER AND DRAINAGE

- A. Contractor shall at all times provide and maintain proper and satisfactory means and devices for the removal of all water entering the trench, and shall remove all such water as fast as it may collect, in such manner as shall not interfere with the prosecution of the work.
- B. Removal of water shall be in accordance with the Section entitled Earthwork.

3.5 PIPE EMBEDMENT

- A. All pipe shall be protected from lateral displacement and possible damage resulting from superimposed backfill loads, impact or unbalanced loading during backfilling operations by being adequately embedded in suitable pipe embedment material. To ensure adequate lateral and vertical stability of the installed pipe during pipe jointing and embedment operations, a sufficient amount of the pipe embedment material to hold the pipe in rigid alignment shall be uniformly deposited and thoroughly compacted on each side, and back of the bell, of each pipe as laid.
- B. Concrete cradle and encasement of the class specified shall be installed where and as shown on the Contract Drawings or ordered by the Engineer. Before any concrete is placed, the pipe shall be securely blocked and braced to prevent movement or flotation. The concrete cradle or encasement shall extend the full width of the trench as excavated unless otherwise authorized by the Engineer. Where concrete is to be placed in a sheeted trench it shall be poured directly against sheeting to be left in place or against a bond-breaker if the sheeting is to be removed.
- C. Embedment materials placed above the centerline of the pipe or above the concrete cradle to a depth of 12 inches above the top of the pipe barrel shall be deposited in such manner as to not damage the pipe. Compaction shall be as required for the type of embedment being installed.

3.6 BACKFILL ABOVE EMBEDMENT

- A. The remaining portion of the pipe trench above the embedment shall be refilled with suitable materials compacted as specified.
 - 1. Where trenches are within the ditch-to-ditch limits of any street or road or within a driveway or sidewalk, or shall be under a structure, the trench shall be refilled in horizontal layers not more than 8 inches in thickness, and compacted to obtain 95% maximum density, and determined as set forth in the Section entitled "Earthwork".
 - 2. Where trenches are in open fields or unimproved areas outside of the ditch limits of roads, the trench shall be refilled in horizontal layers not more than 8 inches in thickness, and compacted to obtain 90% maximum density, and determined as set forth in the Section entitled "Earthwork".
 - 3. Hand tamping shall be required around buried utility lines or other subsurface features that could be damaged by mechanical compaction equipment.
 - 4. In place density compaction testing as set forth in the Section entitled "Earthwork," shall be completed as directed by Engineer. Testing shall occur at minimum every 250-feet with at least one in each trench below roadways.
- B. Backfilling of trenches beneath, across or adjacent to drainage ditches and water courses shall be done in such a manner that water will not accumulate in unfilled or partially filled trenches and the backfill shall be protected from surface erosion by adequate means.
 - 1. Where trenches cross waterways, the backfill surface exposed on the bottom and slopes thereof shall be protected by means of stone or concrete rip-rap or pavement.
- C. All settlement of the backfill shall be refilled and compacted as it occurs.
- D. Restore surfaces in accordance with the Section entitled "Restoration of Surfaces".

END OF SECTION

SECTION 32 01 00 RESTORATION OF SURFACES

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes restoration and maintenance of all types of surfaces, sidewalks, curbs, gutters, culverts and other features disturbed, damaged or destroyed during the performance of the work under or as a result of the operations of the Contract.
- B. The quality of materials and the performance of work used in the restoration shall produce a surface or feature equal to the condition of each before the work began.

1.2 REFERENCES

- A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American Society for Testing and Materials (ASTM)
 - a. D698 – Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³)
 - b. D1557 – Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2,700 kN-m/m³)
 - c. New York State Department of Transportation

1.3 SUBMITTALS

- A. Submit the following in accordance with the General Conditions/General Requirements.
 - 1. A schedule of restoration operations. After an accepted schedule has been agreed upon it shall be adhered to unless otherwise revised with the approval of the Engineer.

PART 2 - PRODUCT (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

- A. In general, permanent restoration of paved surfaces will not be permitted until one months' time has elapsed after excavations have been completely backfilled as specified. A greater length of time, but not more than nine months may be allowed to elapse before permanent restoration of street surfaces is undertaken, if additional time is required for shrinkage and settlement of the backfill.
- B. Replacement of surfaces at any time, as scheduled or as directed, shall not relieve the Contractor of responsibility to repair damages by settlement or other failures.

3.2 TEMPORARY PAVEMENT

- A. Immediately upon completion of refilling of the trench or excavation, Contractor shall place a temporary pavement over all disturbed areas of streets, driveways, sidewalks, and other traveled places where the original surface has been disturbed as a result of his operations.
- B. Unless otherwise specified or directed the temporary pavement shall consist of compacted run-of-crusher limestone to such a depth as required to withstand the traffic to which it will be subjected.
- C. Where concrete pavements are removed, the temporary pavement shall be surfaced with "cold patch". The surface of the temporary pavement shall conform to the slope and grade of the area being restored.
- D. Control of dust shall be the Contractor's responsibility. All surfaces shall be treated as frequently as may be required in the opinion of Engineer.
- E. Temporary pavement shall be maintained by the Contractor in a safe and satisfactory condition until such time as the permanent paving is completed. Contractor shall immediately remove and restore all pavement that is deemed unsatisfactory by the Engineer.

3.3 PERMANENT PAVEMENT REPLACEMENT

- A. Permanent and final repaving of all streets, driveways and similar surfaces where pavement has been removed, disturbed, settled or damaged by or as a result of performance of the Contract shall be repaired and replaced by the Contractor, by a new and similar pavement.
 - 1. Top surface shall conform with the grade of existing adjacent pavement and the entire replacement shall meet the current specifications of the local community for the particular types of pavement.
 - 2. Where the local community has no specification for the type of pavement, the work shall be done in conformity with the New York State Department of Transportation Standard which conforms the closest to the type of surfacing being replaced, as determined by Engineer.

3.4 PREPARATION FOR PERMANENT PAVEMENT

- A. When scheduled and within the time specified, the temporary pavement shall be removed and a base prepared, at the depth required by the local community or Highway Permit, to receive the permanent pavement.
 - 1. The base shall be brought to the required grade and cross-section and thoroughly compacted before placing the permanent pavement.
 - 2. Any base material which has become unstable for any reason shall be removed and replaced with compacted base materials.
- B. Prior to placing the permanent pavement all service boxes, manhole frames and covers and similar structures within the area shall be adjusted to the established grade and cross-section.
- C. Edges of existing asphalt pavement shall be cut a minimum of 1 foot beyond the excavation or disturbed base whichever is greater.
 - 1. All cuts shall be parallel or perpendicular to the centerline of the street.

3.5 ASPHALT PAVEMENT

- A. Permanent asphalt pavement replacement for streets, driveways and parking area surfaces shall be replaced with bituminous materials of the same depth and kind as the existing unless otherwise specified.
- B. Prior to placing of any bituminous pavement a sealer shall be applied to the edges of the existing pavement and other features.
- C. Furnishing, handling and compaction of all bituminous materials shall be in accordance with the State Department of Transportation Standards.

3.6 CONCRETE PAVEMENT AND PAVEMENT BASE

- A. Concrete pavements and concrete bases for asphalt, brick or other pavement surfaces shall be replaced with 4,000 psi concrete, air-entrained.
- B. Paving slabs or concrete bases shall be constructed to extend 1 foot beyond each side of the trench and be supported on undisturbed soil. Where such extension of the pavement will leave less than 2 feet of original pavement slab or base, the repair of the pavement slab or base shall be extended to replace the slab to the original edge of the pavement or base unless otherwise indicated on the Contract Drawings.
- C. Where the edge of the pavement slab or concrete base slab falls within the excavation, the excavation shall be backfilled with Special Backfill compacted to 95% maximum dry density as determined by ASTM D 698 up to the base of the concrete.
- D. The new concrete shall be of the same thickness as the slab being replaced and shall contain reinforcement equal to the old pavement.
 - 1. New concrete shall be placed and cured in accordance with the applicable provisions of the New York State Department of Transportation Standards.

3.7 STONE OR GRAVEL PAVEMENT

- A. All pavement and other areas surfaced with stone or gravel shall be replaced with material to match the existing surface unless otherwise specified.
 - 1. The depth of the stone or gravel shall be at least equal to the existing.
 - 2. After compaction the surface shall conform to the slope and grade of the area being replaced.

3.8 CONCRETE WALKS, CURBS AND GUTTER REPLACEMENT

- A. Concrete walks, curbs and gutters removed or damaged in connection with or as a result of the construction operations shall be replaced with new construction.
 - 1. The minimum replacement will be a flag or block of sidewalk and 5 feet of curb or gutter.
- B. Walks shall be constructed of 4,000 psi concrete, air-entrained with NYSDOT #1 stone aggregate on a 4-inch base of compacted gravel or stone.
 - 1. The walk shall be not less than 4 inches in thickness or the thickness of the replaced walk where greater than 4 inches, shall have construction joints spaced not more than 25 feet apart, shall have expansion joints spaced not more than 50 feet apart and shall be sloped at right angles to the longitudinal centerline approximately inch per foot of width.

- C. One 1-inch expansion joint material shall be placed around all objects within the sidewalk area as well as objects to which the new concrete will abut, such as valve boxes, manhole frames, curbs, buildings and others.
- D. Walks shall be hand-floated and broom-finished, edged and grooved at construction joints and at intermediate intervals matching those intervals of the walk being replaced.
 - 1. The intermediate grooves shall be scored a minimum of 1/4 of the depth of the walk.
 - 2. The lengths of blocks formed by the grooving tool, and distances between construction and expansion joints shall be uniform throughout the length of the walk in any one location.
- E. The minimum length of curb or gutter to be left in place or replaced shall be 5 feet. Where a full section is not being replaced, the existing curb or gutter shall be saw cut to provide a true edge.
 - 1. The restored curb or gutter shall be the same shape, thickness and finish as being replaced and shall be built of the same concrete and have construction and expansion joints as stated above for sidewalks.
- F. All concrete shall be placed and cured as specified in the Section for concrete.

3.9 LAWNS AND IMPROVED AREAS

- A. The area to receive topsoil shall be graded to a depth of not less than 4 inches or as specified, below the proposed finished surface.
 - 1. If the depth of existing topsoil prior to construction was greater than 4 inches, topsoil shall be replaced to that depth.
- B. The furnishing and placing of topsoil, seed and mulch shall be in accordance with the Section entitled "Topsoil and Seeding".
- C. When required to obtain germination, the seeded areas shall be watered in such a manner as to prevent washing out of the seed.
- D. Any washout or damage which occurs shall be regraded and reseeded until a good sod is established.
- E. Maintain the newly seeded areas, including regrading, reseeding, watering and mowing, in good condition.

3.10 OTHER TYPES OF RESTORATION

- A. Trees, shrubs and landscape items damaged or destroyed as a result of the construction operations shall be replaced in like species and size.
 - 1. All planting and care thereof shall meet the standards of the American Nursery and Landscaper Association.
- B. Water courses shall be reshaped to the original grade and cross-section and all debris removed. Where required to prevent erosion, the bottom and sides of the water course shall be protected.
- C. Storm sewers and culverts damaged or removed as a result of the construction operations shall be replaced in like size and material and shall be replaced at the original location and grade. When there is minor damage to a culvert and with the consent of the Engineer, a repair may be undertaken, if satisfactory results can be obtained.

3.11 MAINTENANCE

1. The finished products of restoration shall be maintained in an acceptable condition until the project close out.

END OF SECTION

SECTION 32 12 16 ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes construction of two or three course bituminous concrete pavement on a prepared base laid to the required grade, thickness and cross-section as shown on the Contract Drawings or as specified in this Section.
- B. The quality of materials and performance of the work shall be in accordance with the Standards of the New York State Department of Transportation unless otherwise specified in this Section.

1.2 REFERENCES

- A. Materials and installation shall comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. New York State Department of Transportation

1.3 SUBMITTALS

- A. Submit the following in accordance with the General Conditions/General Requirements.
 - 1. Product Data: Specification sheets marked to specifically indicate the materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.
 - 2. Shop Drawings: Indicating the soil stabilization material.
 - 3. Certificates: Certification that the material will be furnished by a State certified facility.
 - 4. Test and Evaluation Reports:
 - a. Testing and control of asphalt shall be as required by the New York State Department of Transportation.

PART 2 - PRODUCTS

2.1 MATERIALS AND CONSTRUCTION

- A. Soil Stabilization Fabric
 - 1. Tencate, Mirafi 600X
 - 2. Carthage Mills, FX-66
 - 3. Or equal
- B. Bituminous Concrete Products
 - 1. Binder course shall be NYSDOT Type 3, Item 403.13
 - 2. Top course shall be NYSDOT Type 6F, Item 403.17

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install finished pavement to the grades and cross-sections as shown on the Contract Drawings and in accordance with State Department of Transportation placement requirements.
- B. Subgrade Preparation
 - 1. Subgrade shall be shaped to line and grade and compacted with self-propelled rollers.
 - 2. All depressions which develop under rolling shall be filled with acceptable material and the area re-rolled.
 - 3. Soft areas shall be removed and filled with acceptable materials and the area re-rolled.
 - 4. Should the subgrade become rutted or displaced prior to the placing of the subbase, it shall be reworked to bring to line and grade.
- C. Geotextile Material Placement
 - 1. Geotextile material shall be placed on the sub-grade prior to the depositing of the subbase.
 - a. Geotextile material shall be installed the full width of the subgrade and shall extend up the sides the depth of the subbase.
 - b. Geotextile material shall be lapped and secured in accordance with manufacturer's recommendations.
- D. Subbase Material Placement
 - 1. Unless otherwise shown on the Contract Drawings, the subbase shall consist of 9 inches of Type F selected fill placed in 3-inch layers. Each layer shall be compacted by rolling with self-propelled rollers.
 - a. (Note: The loose lift thickness shall be a minimum of 1.5 times the maximum particle size with a minimum of 6 inches.)
 - 2. Rolling shall begin at the sides and continue toward the center and shall continue until there is no movement ahead of the roller.
 - 3. After completion of the subbase rolling there shall be no hauling over the subbase other than the delivery of material for the top course.
- E. Bituminous Material
 - 1. The bituminous binder course shall be placed to the compacted depth shown on the Contract Drawings.
 - 2. The bituminous top course shall be placed to the compacted depth shown on the Contract Drawings.
 - 3. Prior to placing of any bituminous pavement a sealer shall be applied to the edges of existing pavement, curbing, gutters, manholes and other structures.

3.2 FIELD QUALITY CONTROL

- A. Perform tests in accordance with the following standards:
 - 1. The surface tolerance shall not exceed 1/4 inch in 10 feet.
 - 2. There shall be no depressions which will retain standing water.
 - 3. Variations exceeding 1/4-inch or depressions shall be corrected by the Contractor to the satisfaction of the Engineer.

END OF SECTION

SECTION 32 31 13

CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes all labor, materials and equipment to properly install fence framework, fabric, and gates as shown on the Contract Drawings, complete with accessories.

1.2 REFERENCES

- A. Materials and installation shall comply with the following codes, standards and specifications, except where more stringent requirements have been specified herein or shown on the Contract Drawings:
 - 1. American Society for Testing and Materials (ASTM)
 - a. A90 - Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles
 - b. A121 - Specification for Zinc-Coated (Galvanized) Steel Barbed Wire
 - c. A392 - Specification for Zinc-Coated Steel Chain-Link Fence Fabric
 - d. A428 - Test Method for Weight of Coating on Aluminum-Coated Iron or Steel Articles
 - e. A491 - Specification for Aluminum-Coated Steel Chain-Link Fence Fabric
 - f. A585 - Specification for Aluminum-Coated Steel Barbed Wire
 - g. A817 - Specification for Metallic-Coated Steel Wire for Chain-Link Fence Fabric
 - h. A824 - Specification for Metallic-Coated Steel Marcellled Tension Wire for Use with Chain-Link Fence
 - i. A1011 - Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High Strength Low-Alloy and High Strength Low-Alloy with Improved Formability
 - j. B117 - Method of Salt Spray (Fog) Testing
 - k. C94 - Ready-Mixed Concrete
 - l. F567 - Standard Practice for Installation of Chain-Link Fence
 - m. F626 - Specification for Fence Fittings
 - n. F1043 - Specification for Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework
 - o. F1083 - Standard Specification for Pipe, Steel and Hot Dipped Zinc Coated, (Galvanized) Welded, for Fence Structures

1.3 SUBMITTALS

- A. Product Data: Indicating details of fence and gate construction, fence height, post spacing, dimensions and unit weights of framework, accessories, hardware, and concrete footing details marked to specifically indicate materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.

1.4 PROJECT CONDITIONS

- A. Verify layout information for chain link fences and gates shown on the Contract Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The following manufacturers are named to establish a standard of quality necessary for the Project:
1. Allied Tube & Conduit Corp.
 2. Anchor Fence, Inc.
 3. Page Aluminized Steel Corp.
 4. Or equal

2.2 GENERAL

- A. Framework:
1. Schedule 40 steel pipe with 1.8 ounces of zinc coating per square foot of surface area conforming to ASTM F 1083.
 2. Pipe shall be straight, true to section and conform to the following weights:

Pipe Size Outside Diameter	Weight lbs./ft.
1- 5/8"	2.27
1- 7/8"	2.72
2-3/8"	3.65
2-7/8"	5.80
3-1/2"	7.58
4"	9.12
6-5/8"	18.99

- B. Fabric: Aluminum-Coated Steel.
1. Aluminum-coated steel fabric manufactured in accordance with ASTM A 491 and coated before weaving with a minimum of 0.40 ounces of aluminum per square foot of surface area. Steel wire and coating shall conform to ASTM A 817.
- C. Fittings:
1. Pressed steel or cast iron, galvanized with a minimum of 1.2 ounces of zinc per square foot of surface area, or cast aluminum alloy, all conforming to ASTM F 626.

2.3 CONCRETE MIX

- A. ASTM C 94 Portland Cement concrete with maximum 3/4-inch aggregate having a minimum compressive strength of 2,500 psi at 28 days.

2.4 MATERIALS AND CONSTRUCTION

A. Fence Posts

1. Line posts shall be sized as follows:
 - a. For fabric height less than 6-feet: 1-7/8-inches outside diameter
 - b. For fabric height 6-feet to 9-feet: 2-3/8-inches outside diameter
 - c. For fabric heat 9-feet to 12-feet: 2-7/8-inches outside diameter
2. Terminal posts shall be sized as follows:
 - a. For fabric height less than 6-feet: 2-7/8-inches outside diameter
 - b. For fabric height 6-feet to 9-feet: 2-7/8-inches outside diameter
 - c. For fabric heat 9-feet to 12-feet: 4-inches outside diameter

B. Gate Posts

1. Gate posts shall be sized as follows:
 - a. For single gates up to 6-feet wide and double gates up to 12-feet wide: 2-7/8-inches outside diameter
 - b. For single gates 7-feet to 12-feet wide and double gates 13-feet to 25-feet wide: 4-inches outside diameter
 - c. For single gates 13-feet to 18-feet wide and double gates 25-feet to 36-feet wide: 6-5/8-inches outside diameter

C. Rails and Braces

1. Rails and braces shall be 1-5/8-inches outside diameter.

D. Fabric

1. Fabric shall be aluminum-coated steel wire, 9-gage, woven in a 1-inch diamond mesh with top selvage twisted and barbed and bottom selvage knuckled. Fence heights up to 12 feet shall be one-piece widths.

E. Gates

1. Gates shall have frame assembly of 1-7/8-inch outside diameter schedule 40 steel pipe with welded joints, galvanized in accordance with ASTM F 1083. Weld areas repaired with zinc-rich coating applied per manufacturer's directions. Fabric shall match fence. Gate accessories, hinges, latches, center stops, keepers and necessary hardware shall be of quality required for industrial and commercial application. Latches shall permit padlocking of gate. Barbed wire shall be installed at top of gates.

F. Fittings

1. Post caps shall be pressed steel, cast iron or cast aluminum alloy designed to fit snugly over posts to exclude moisture. Supply cone type caps for terminal posts and loop type for line posts.
2. Rail and brace ends shall be pressed steel, cast iron or cast aluminum alloy, cup-shaped to receive rail and brace ends.
3. Top rail sleeves shall be tubular steel, 0.051 thickness by 7-inches long, expansion type.

4. Tension bars shall be steel strip, 5/8-inch wide by 3/16-inch thick.
 5. Tension bands shall be pressed steel, 14-gage thickness by 3/4-inch wide.
 6. Brace bands shall be pressed steel, 12-gage thickness by 3/4-inch wide.
 7. Truss rods shall be steel rod, 3/8-inch diameter merchant quality with turnbuckle.
 8. Barbed wire arms shall be pressed steel, cast iron or cast aluminum alloy fitted with clips or slots for attaching three strands of barbed wire. Arms shall be set on a 45-degree angle and shall be capable of supporting a 250-pound load at outer barbed wire connecting point without causing permanent deflection. Provide single slant or V-shaped arms as indicated on the Contract Drawings.
- G. Tension Wire
1. Tension wire shall be marcelled 7-gage steel wire with minimum coating of 0.80 ounces of zinc or 0.40 ounces of aluminum per square foot of wire surface and conforming to ASTM A824.
- H. Barbed Wire
1. Barbed wire shall be commercial quality steel, 12-gage, two strand twisted line wire with 4-point barbs at 5-inch spacing. Coating shall consist of a minimum of 0.80 ounces of zinc per square foot of wire surface conforming to ASTM A 121 or a minimum of 0.30 ounces of aluminum per square foot of wire surface conforming of ASTM A 585.
- I. Tie Wires
1. Tie wires shall be aluminum 9-gage, alloy 1100-H4, A58 self-locking fabric bands or equal.
- J. Hog Rings
1. Hog rings shall be steel wire, 11-gage with a minimum zinc coating of 0.80 ounces per square foot of wire surface.

PART 3 - EXECUTION

3.1 GENERAL

- A. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install fence and gate as shown on the Contract Drawings and in accordance with the manufacturer's installation instructions.
- B. Fence installation shall conform to requirements of ASTM F 567.
- C. Provide fence heights as shown on Contract Drawings.
- D. Space line posts at intervals not exceeding ten feet.
- E. Set terminal, gate and line posts plumb in concrete footings as shown on Contract Drawings. Top of footing shall be 2 inches above grade and sloped to direct water away from posts.
- F. Brace gate and terminal posts back to adjacent line posts with horizontal brace rails and diagonal truss rods.
- G. Install top rail through line post loop caps connecting sections with sleeves to form a continuous rail between terminal posts. Fasten top rail to terminal posts.

- H. Stretch bottom tension wire between terminal posts 6 inches above grade and fasten to outside of line posts with tie wires.
- I. Pull fabric taut to provide a smooth uniform appearance, free from sag, with bottom selvage 2-inches above grade. Fasten to terminal posts with tension bars threaded through mesh and secured with tension bands at maximum 15-inch intervals. Tie to line posts and top rails with tie wires spaced at maximum 12-inches on posts and 24-inches on rails. Attach to bottom tension wire with hog rings at maximum 24-inch intervals.
- J. Anchor barbed wire to terminal extension arms, pull taut to remove all sags and firmly install in slots of line post extension arms.
- K. Install gates plumb, level and secure for full opening without interference. Anchor center stops and keepers in concrete. Adjust and lubricate hardware for smooth operation.
- L. Install nuts for fittings, bands and hardware bolts on inside of fence. Peen ends of bolts or score threads to prevent removal.

END OF SECTION

SECTION 32 93 13 TOPSOIL AND SEEDING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes topsoil, fertilizer, seed, mulch anchorage, and associated work.

1.2 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. "Standard Specifications, Construction and Materials, New York Department of Transportation, Office of Engineering" (NYS DOT Specification).

1.3 COORDINATION REQUIREMENTS

- A. Coordinate topsoil and seeding with both project requirements and the Stormwater Pollution Prevention Plan (SWPPP) requirements, as appropriate.

1.4 SUBMITTALS

- A. Submit the following in accordance with the General Conditions/General Requirements.
 - 1. Location of source and data for off-site topsoil.
 - 2. Analysis of the seed.
 - 3. Certification that each container complies with the provisions of New York State Agriculture and Markets' Law.
 - 4. Hydroseeder data including material and application rates, if applicable.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Topsoil
 - 1. Topsoil shall be unfrozen, friable clayey loam free from clay lumps, stones, roots, sticks, stumps, brush or foreign objects.
 - 2. All topsoil incorporated into the completed contract, whether originating on-site or off-site, shall be screened.
 - 3. All stones and rocks larger than 1/4-inch diameter shall be removed from topsoil prior to placement.
- B. Fertilizer
 - 1. Fertilizer shall be a standard quality commercial carrier of available plant food elements. A complete prepared and packaged material containing a minimum of 10 percent nitrogen, 10 percent phosphoric acid and 10 percent potash.
 - 2. Each bag of fertilizer shall bear the manufacturer's guaranteed statement of analysis.

C. Seed Mixtures

1. Seed mixtures shall be of commercial stock of the current season's crop and shall be delivered in unopened containers bearing the guaranteed analysis of the mix.
2. All seed shall meet the State standards of germination and purity.

<u>Specie</u>	<u>Lawn Area (*)</u>	<u>Un-Maintained (*) Areas</u>
Kentucky Bluegrass	50	20
Creeping Red Fescue	30	20
Manhattan or Pennfine Ryegrass	20	60

3. (*) % by Weight

- D. Mulch shall be stalks of oats, wheat, rye or other approved crops which are free from noxious weeds.

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. The area to receive topsoil shall be graded to a depth of not less than 4 inches or as specified, below the proposed finished surface. If the depth of topsoil existing prior to construction was greater than 4 inches, the topsoil shall be replaced not less than the greater depth.
 1. All debris and inorganic material shall be removed and the surface loosened for a depth of 2 inches prior to the placing of the topsoil.
 2. The topsoil shall not be placed until the subgrade is in suitable condition and shall be free of excessive moisture and frost.
- B. Satisfactory topsoil removed from the excavations shall be placed on the prepared subgrade to the depth required.
 1. In the event the topsoil removed during excavation is unsatisfactory or inadequate to obtain the required finish grades, the Contractor shall furnish the required quantity of satisfactory topsoil from approved sources off site.
 2. All topsoil shall be screened and be free from stones, roots, sticks and other foreign substances and shall not be placed in a frozen or muddy condition.
 3. The finished surface shall conform to the lines and grades of the area before disturbed or as shown on the Contract Drawings. Any irregularities shall be corrected before the placement of fertilizer and seed.
- C. The fertilizer shall be applied uniformly at the rate of 20 pounds per 1000 square feet.
 1. Following the application of the fertilizer and prior to application of the seed, the topsoil shall be scarified to a depth of at least 2 inches with a disc or other suitable method traveling across the slope if possible.
- D. When the topsoil surface has been fine graded, the seed mixture shall be uniformly applied upon the prepared surface with a mechanical spreader at a rate of not less than 10 pounds per 1000 square feet.
 1. The seed shall be raked lightly into the surface and rolled with a light hand lawn roller. Seeding and mulching shall not be done during windy weather.

- E. The mulch shall be hand or machine spread to form a continuous blanket over the seed bed, approximately 2 inches uniform thickness at loose measurement. Excessive amounts or bunching of mulch will not be permitted.
 - 1. Mulch shall be anchored by an acceptable method.
 - 2. Unless otherwise specified, mulch shall be left in place and allowed to decay.
 - 3. Any anchorage or mulch that has not decayed at time of first mowing, shall be removed. Anchors may be removed or driven flush with ground surface.
- F. Seeded areas shall be watered as often as required to obtain germination and to obtain and maintain a satisfactory sod growth. Watering shall be in such a manner as to prevent washing out of seed.
- G. Hydroseeding may be accepted as an alternative method of applying fertilizer, seed and mulch. Contractor shall submit all data regarding materials and application rates to the Engineer for review.

3.2 MAINTENANCE

- A. All lawn areas shall be mowed by the Contractor before the new grass reaches a height of 4 inches.
- B. Contractor shall maintain the newly seeded areas in good condition until acceptance, including regular mowing to a height of 2 inches

END OF SECTION

SECTION 33 29 60
WASTEWATER TEMPORARY BYPASS PUMPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all plans, labor, equipment, materials, accessories and consumables necessary to implement a temporary bypass pumping system for purpose of diverting wastewater flow around the existing Crotonville Pumping Station during construction activities.
- B. Contractor is responsible for design, installation, operation and maintenance of bypass pumping system.
- C. Bypass pumping system shall include bypass pump(s), automated valves, flow meters, suction and discharge piping, and appurtenances as required.

1.2 PERFORMANCE REQUIREMENTS

- A. Extended duration bypass pumping of Crotonville Pumping Station during construction:
 - 1. Duration: As required to substantially complete construction and renovations of Crotonville Pumping Station and place new pumping equipment into reliable service.
 - 2. Design peak capacity: 3,300 gal/min) at 203 feet TDH (based on 2012 historical data)
 - 3. Average flow: 530 gal/min (based on 2012 historical data)
- B. Provide spare pumping capacity equal to the capacity of the largest single bypass pump, available on-site for use in event of equipment failure.
- C. Size suction and discharge piping to achieve velocity no higher than 12 feet/second at specified design peak pumping capacity.

1.3 GENERAL

- A. Bypass pumping system shall utilize existing Influent Sewer Chamber, 24" force main, and new bypass sewer connection piping, as shown on the Contract Drawings.
- B. Primary bypass pumps shall be electric, self-priming type (Godwin Dri-Prime®, or equal), operated automatically by liquid level controls. Bypass pumping system shall meet performance requirements specified herein.
- C. Additional redundant bypass pump(s) shall be critically silenced diesel engine-driven, self-priming type (Godwin Dri-Prime®, or equal), operated automatically by liquid level controls. Bypass pumping system shall meet performance requirements specified herein. Diesel-engine driven pump(s) shall serve as backup in the event of an electrical power failure.
- D. Influent sluice gate shall be closed and bypass pumping system shall draw suction from existing Influent Sewer Chamber as shown on the Contract Drawings.
- E. Bypass pumping system shall discharge to new bypass sewer connection on existing force main as shown on the Contract Drawings.
- F. Contractor may propose an alternative bypass pumping system for review by the Engineer. Alternative bypass pumping facilities shall meet the performance requirements specified

and shall meet or exceed the level of reliability specified and shown on the Contract Drawings, in the judgement of Engineer and Owner.

1.4 SUBMITTALS

- A. Bypass Pumping Plan: Prepare and submit a Bypass Pumping Plan for review by Engineer and Owner prior to mobilization of any bypass pumping equipment. Bypass Pumping Plan shall be stamped and signed by a Professional Engineer licensed in the State of New York.
- B. Plan shall include but not limited to the following:
 - 1. Schedules, locations, elevations, capacities of equipment and material
 - 2. Plans showing staging areas for pumps and bypass piping
 - 3. Sewer flow diversion method
 - 4. Size and location of manholes or access points for suction and discharge hose or piping
 - 5. Quantity, size, material, location and method of installation of suction piping
 - 6. Quantity, size, material, location and method of installation of discharge piping
 - 7. Bypass pump sizes, capacities, performance curve, and number of each size to be provided onsite including spare pumping units
 - 8. Thrust and restraint block sizes and locations
 - 9. Details to demonstrate the integrity of all suction and discharge piping including piping and fittings associated with all primary and secondary pumping units.
 - 10. Sections showing suction and discharge pipe depth, embedment, select fill and special backfill
 - 11. Method of noise control for each pump and any additional equipment.
 - 12. Any temporary pipe supports and anchoring requirements
 - 13. Schedule for installation and maintenance of bypass pumping lines
- C. Bypass pumping monitoring person's qualifications.

1.5 NOISE EMISSIONS

- A. Comply with applicable state and local government requirements applicable to sound emitted by pump including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.
- B. Sound Attenuation Enclosure: 50 dB(A) at 50 feet, free field, including exhaust silencer.

PART 2 - PRODUCTS

- A. NOT USED

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Field verify existing conditions prior to preparation of Bypass Pumping Plan.

3.2 TESTING

- A. Perform leakage and pressure tests of bypass pumping system discharge piping using clean water prior to actual operations.
- B. Pressure and leakage test shall be conducted at 100 psig for a period of two (2) hours. No leakage is permitted.
- C. Demonstrate that pumping system is in good working order and is sufficiently sized to successfully handle design flows by performing test run for a period of 24 hours prior to beginning the Work.
- D. Provide 48 hours notice prior to testing.

3.3 OPERATIONS

- A. Include provisions to maintain vehicular and pedestrian access, avoid damage to public and private property, prevent leakage from hoses and minimizing noise from pumps.
- B. Immediately remove and dispose of all wastewater offensive matter spilled during bypass pumping at Contractor's expense.
- C. Pay any fines imposed as a result of spills or overflows that occur as a result of bypass pumping operations.
- D. Repair any damage to public or private property caused by bypass pumping operations.
- E. Repair any damage to manholes or sewer piping resulting from bypass pumping operations, to satisfaction of Engineer.
- F. Immediately notify Engineer and Owner if a sanitary sewer overflow or spill occurs and take necessary action to clean up and disinfect spillage to satisfaction of Engineer and Owner and/or other governmental agencies.
- G. Contractor shall not be permitted to overflow, bypass, pump or otherwise convey drainage to any land, street, storm drain or water course.
- H. Provide on-site manual oversight of all bypass pumping operations 24 hours per day, 7 days per week when bypass pumping system is in operation.
 - 1. Alternatively, Contractor may provide electronic supervision of bypass pumping operations during non-working hours, provided the following measures are incorporated to Owner's satisfaction:
 - a. Manual checks at no less than 8-hour frequency, documented.
 - b. Alarms transmitted immediately to Contractor's supervisory personnel, via reliable telephone, cellular or radio communications.
 - c. Alarms also transmitted to designated representative of Owner.
 - d. Demonstrated ability to respond to system trouble or failure immediately and arrive on-site within 30 minutes of alarm.
 - e. Electronic supervision will be permitted at Owner's discretion, based on Contractor's ability to document and demonstrate system reliability and compliance with above requirements.
- I. Cease bypass pumping operations and return flows to normal configuration when directed by Engineer.
- J. When bypass operations are complete, flush bypass piping with fresh water and drain into Owner's wastewater system prior to disassembly.

3.4 MONITORING

- A. Provide continuous monitoring of bypass pumping operation.
- B. Provide lubricants and fuel as required to maintain bypass pumping equipment in reliable working condition. Take care to prevent and contain spills.
- C. Monitoring staff shall be properly trained, experienced, and mechanically qualified to quickly and effectively address potential emergency and non-emergency situations associated with pumps and bypass pumping system that must remain in operation for an extended period.

END OF SECTION

SECTION 40 05 07
HANGERS AND SUPPORTS FOR PROCESS PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes hangers, supports, and restraints for process piping systems as shown on the Contract Drawings.
- B. Pipe hangers and supports inside pumping stations shall be Type 316 stainless steel, including hardware and accessories.

1.2 REFERENCES

- A. Comply with the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American Society for Testing and Materials (ASTM)
 - a. ASTM A167 – Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - b. ASTM A480 – Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
 - c. ASTM A653 – Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process.
 - d. ASTM A924 – Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot Dip Process.
 - e. ASTM B209 – Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - f. ASTM C1107 – Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
 - 2. American Society of Mechanical Engineers (ASME)
 - a. ASME B31.1 – Power Piping Code
 - b. ASME B31.9 – Building Services Piping
 - c. ASME Boiler and Pressure Vessel Code
 - 3. Manufacturer's Standardization Society (MSS)
 - a. MSS SP-58 Materials and Design of Pipe Supports
 - b. MSS SP-69 Selection and Application of Pipe Supports
 - c. MSS SP-89 Fabrication and Installation of Pipe Supports
 - 4. American Welding Society (AWS)

1.3 SUBMITTALS

- A. Submit the following in accordance with the General Conditions/General Requirements.
- B. Product Data: For each type of pipe hanger, channel support system component provide "Catalog cuts" and spec sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.

C. Shop Drawings**1. Submit the following for approval:**

- a. Detailed shop drawings including plans, elevations and laying schedules for piping supports, hangers and restraints for process piping systems. Include design calculations, size, materials of construction, and fabrication details.
- b. Details of intermediate structural steel members required to span main structural steel for support of piping.
- c. Details of methods for attachment of hangers and supports to building construction for equipment and piping 4 inches and larger.
- d. Details of guide and anchor installations.
- e. Details of trapeze hangers.

2. Include design calculations and indicate size and characteristics of components and fabrication details.**D. Certificates:**

1. Manufacturer's certification that all materials furnished are in compliance with the applicable requirements of the referenced standards and this Specification.
2. Copies of welding certificates for welding procedures and operators.

E. Design Data: Indicate load carrying capacity of trapeze, unistrut, multiple pipe, and riser support hangers.**F. Manufacturer's Installation Instructions: Indicate special procedures and assembly of components.****1.4 QUALITY ASSURANCE****A. Qualifications:**

1. Welding: Qualify welding processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

PART 2 - PRODUCTS**2.1 MANUFACTURERS****A. The following manufacturers are named to establish a standard of quality necessary for the Project:**

1. Anvil (previously Grinnell Company)
2. Empire Industries
3. Or equal

B. Unless stated otherwise, the catalog figure numbers in this Section refer to the products manufactured by Anvil. Equivalent products by other acceptable manufacturers will be considered.**2.2 GENERAL****A. All hangers and supports shall be manufactured or fabricated from materials suitable for the particular area in which they are to be installed.**

- B. Hangers and supports shall be adequate to maintain the supported load in proper position under all operating conditions.
- C. Factor of Safety
 - 1. Hangers and supporting devices shall be designed to provide a minimum working safety factor of 3.5.
 - 2. The safety factor for pipe hangers and supports shall be based on supporting the pipe completely full with the liquid being conveyed.

2.3 MATERIALS AND CONSTRUCTION

- A. Stainless Steel: For the purpose of this Section, all stainless steel (S.S.) shall be Type 316.
- B. Hangers and supports for wet, humid and/or corrosive environments (Wet Wells, Influent Channels, other hazardous areas, vaults, pipe trenches, and similar spaces).
 - 1. Hangers, supports, struts and accessories located in humid and/or corrosive environments shall be Type 316 stainless steel with Type 316 stainless steel hardware.
- C. Hangers and Supports for Exterior Locations
 - 1. Hangers, supports, struts and accessories located in exterior locations shall be Type 316 stainless steel with Type 316 stainless steel hardware.
- D. Hangers, supports, struts and accessories located in other locations shall be hot-dip galvanized with Type 316 stainless steel hardware.
- E. General Requirements
 - 1. Piping used for supports shall be in accordance with the following standards:
 - a. Steel Pipe - ASTM Des: A 53 Schedule 40
 - b. Cast Iron Pipe - ASA Des: 21.6 and 21.8, Thickness Class 22
 - 2. Structural steel, wrought metals and metal castings used for hangers and supports shall meet the requirements of the applicable Sections.
- F. Hangers
 - 1. Overhead hangers for pipes eight inches in diameter and smaller shall be supported by threaded hanger rods and shall be adjustable Split Ring Type. Construction shall be malleable iron, black finish, Underwriters Laboratory (UL) listed and Factory Mutual (FM) approved.
 - 2. Overhead hangers for pipes 10 inches in diameter and larger, and for smaller pipes where shown or specified on the Contract Drawings, shall be adjustable clevis or single roll and socket type.
 - 3. Ceiling flanges shall be utilized for pipes 8 inches in diameter or less. Concrete rod attachment plates shall be utilized for pipes larger than 8 inches in diameter.
- G. Supports
 - 1. Brackets for supporting piping from walls or columns shall be furnished with back plates where required to prevent the safe bearing capacity of the wall from being exceeded.
 - 2. Clamps for supporting piping (sizes 3/8" to 4" only) from walls shall be malleable iron.
 - 3. Saddle stands shall be of the adjustable type, with floor flanges for bolting to floors or foundations.

4. Where piping is installed on structural steel supports, blocking or pipe rolls shall be provided to prevent lateral pipe movement.
 5. Beam and channel clamps shall be constructed of malleable iron and be Underwriters Laboratories (UL) listed and Factory Mutual (FM) approved.
 6. Channel sections shall be complete with clamping nuts and fittings. Channel sections for piping supports systems shall be PS-200 Power Strut or approved equal. Finish for channel sections and fittings shall be hot dipped galvanized conforming to ASTM A153. All exposed channel ends shall be provided with end caps.
 7. Concrete pier supports shall be constructed of 4000 psi concrete. 60 durometer rubber shall be installed between concrete pier supports and piping.
 8. Riser clamps shall be constructed of carbon steel.
- H. Inserts
1. Concrete inserts shall be hot dipped galvanized and shall be installed in concrete structures where required and where shown on the Contract Drawings.
 2. Continuous inserts shall be PS-349 by Power-Strut or approved equal.
 3. Spot inserts shall be Power Strut PS-152 or approved equal.
 4. All concrete inserts shall have plastic coated filler to prevent concrete seepage.
- I. Hanger Rods
1. Hanger rods for installation in humid environments shall be continuously threaded, Type 316 stainless steel. Hanger rods for installation in other areas shall be continuously threaded, hot dip galvanized steel unless otherwise indicated.
 2. The minimum acceptable size hanger rod for each installation shall be determined from the following table:

Diameter of Pipe (inches)	Diameter of Rod (inches)
Up to 2	3/8
2-1/2 to 3-1/2	1/2
4 to 5	5/8
6 to 8	3/4
10 to 12	7/8
14 to 16	1
18 to 30	1-1/4
36 to 42	1-1/2
42 to 48	1-3/4

3. Hanger rods shall be provided with two removable nuts on each end, of like material (Type 316 stainless steel or hot dip galvanized as required), for positioning and locking rod in place.

J. Anchor Bolts

1. Provide stainless steel anchor bolts, nuts and washers, Type 316, meeting requirements of the Section entitled "Metal Fabrications" and as indicated on the Drawings. Unless otherwise indicated, size anchor bolts to the largest diameter that will pass through the bolt holes of the equipment base. Length of the bolts shall be long enough to permit a minimum of one inch of grout beneath the base plate and a minimum of three inches anchorage into the structural concrete.
- K. Provide anchor bolts, nuts and washers together with template or setting drawing sufficiently in advance to permit anchor bolts to be set either prior to or during structural concrete placement.

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. Hang, support, and restrain mechanical work from structural work. Do not hang, support, or restrain mechanical work from electrical work or from other mechanical work. Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Installation shall be performed as recommended by the manufacturer and shall be such that the centerline elevations of supported piping are maintained in an orderly manner.
- C. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.
- D. Pipe Hangers and Supports
 1. Horizontal metal pipe shall be supported in accordance with the following schedule, except as otherwise specified or noted on the Contract Drawings.

Diameter of Pipe	Maximum Support Spacing
1/2 to 1-1/4 inch	6'-0"
1-1/2 to 2 inch	10'-0"
2-1/2 to 3 inch	10'-0"
4 to 6 inch	15'-0"
Over 6 inch	17'-0"

2. Horizontal plastic pipe shall be supported in accordance with the following schedule, except as otherwise specified or noted on the Contract Drawings.

Diameter of Pipe	Maximum Support Spacing
1/2 to 1-1/4 inch	4'-0"
1-1/2 to 2 inch	5'-0"
2-1/2 to 3 inch	6'-0"
Over 4 inch	6'-0"

3. Support spacings listed do not apply where concentrated loads are placed between supports. Concentrated loads include flanges, valves and specialties.
 4. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.
 5. Use hangers with 1-1/2-inch minimum vertical adjustment.
 6. For Directional Changes: Install a hanger or support within 12" of a directional change for all pipe runs in either a horizontal or vertical plane.
 7. For Concentrated Loads: Install additional hangers or supports, spaced as required and directed by the Engineer at locations where concentrated loads such as in-line pumps, valves, fittings or accessories occur, to support concentrated loads.
 8. For Branch Piping Runs and Runouts over 5 feet in Length: Install a minimum of one hanger, and additional hangers if required by the hanger spacing schedules.
 9. Parallel Piping Runs: Where several pipe lines run parallel in the same place and in close proximity to each other, trapeze hangers may be submitted for approval. Base hanger spacing for trapeze type hangers on the smallest size of pipe being supported. Design the entire hanger assembly based on a safety factor of five, for the ultimate strength of the material being used.
 10. Vertical Piping:
 - a. Support vertical risers of piping systems by means of heavy duty hangers installed close to base of pipe risers, and by riser clamps with extension arms at intermediate floors, with the distance between clamps not to exceed 25 feet, unless otherwise specified. Support pipe risers in vertical shafts equivalent to the aforementioned. Riser piping shall be supported independently of connected horizontal piping. Install riser clamps above floor slabs, with the extension arms resting on floor slabs or pipe sleeves. Provide adequate clearances for risers that are subject to appreciable expansion and contraction caused by operating temperature ranges.
 11. Hangers and supports shall be installed such that piping live and dead loads and stresses from movement do not transmit to connected equipment.
- E. Inserts
1. Inserts shall be provided for suspending hanger rods and hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 2. Where concrete slabs form a finished ceiling, inserts shall be provided flush with slab surface.
- F. Upper Hanger Attachments
1. Upper hanger attachments shall be made to structural steel wherever possible.
 2. Power driven pins shall not be used.

3. Expansion nails shall not be used.
 4. Powder driven fasteners shall not be used in pre-cast concrete.
 5. Loads in excess of 250 pounds shall not be supported from a single welded or powder-driven stud.
- G. Steel Frame Construction
1. Provide intermediate structural steel members where required.
 2. Secure upper hanger attachments to steel bar joists at panel points.
 3. Holes shall not be drilled in structural steel members.
 4. Friction clamps shall not be used.

3.2 PAINTING

- A. With the exception of those parts and components customarily furnished unpainted, all metal surfaces shall be shop prepared and coated with rust-inhibitive shop paint. Shop paint shall be fully compatible with the field paint specified. Machined surfaces shall be protected against damage and corrosion by other means.
- B. Perform field painting in accordance with the Section entitled "Field Painting".

END OF SECTION

SECTION 40 05 13 PROCESS PIPING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes, but is not limited to, the following:
1. All types and sizes of piping, except those specified under other Sections or other contracts.
 2. Piping embedded in concrete within a structure or foundation will be considered as exposed and is included herein.
 3. Supports, restraints, thrust blocks and other anchors.
 4. Work on or affecting existing piping
 5. Pressure and leakage testing
 6. Installation of jointing and gasketing materials, specials, flexible couplings, mechanical couplings, harnessed and flanged adapters, sleeves, tie rods, and all other Work required to complete exposed piping installation.
 7. Incorporation of valves, meters and special items shown or specified into piping systems as required and as specified.
 8. All pipe joint hardware (bolts, nuts, etc.) located inside pumping station shall be stainless steel.

1.2 REFERENCES

- A. Comply with the following codes, standards and specifications, except where more stringent requirements have been specified herein:
1. American Society for Testing and Materials (ASTM)
 - a. A48 – Gray Iron Castings
 - b. A74 – Cast Iron Soil Pipe and Fittings
 - c. A307 – Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
 - d. A354 – Specification for Quenched and Tempered Alloy Steel Bolts, Studs and Other Externally Threaded Fasteners
 - e. A563 – Specification for Carbon and Alloy Steel Nuts
 - f. D1784 – Rigid PVC Compounds and CPVC Compounds
 - g. D1785 – PVC Plastic Pipe, Schedules 40, 80 and 120
 - h. D2241 – Standard Specification for Polyvinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series)
 - i. D2464 – Threaded PVC Plastic Pipe Fittings, Schedule 80
 - j. D2466 – PVC Plastic Pipe Fittings, Schedule 40
 - k. D2467 – PVC Plastic Pipe Fittings, Schedule 80
 - l. D2749 – Dimensions of Plastic Pipe Fittings

- m. D2837 – Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials
 - n. D2855 – Practice for Making Solvent-Cemented Joints with PVC Pipe and Fittings
 - o. F1970 – Special Engineered Fittings or Appurtenances for use in PVC or CPVC Systems
2. American National Standards Institute (ANSI)
- a. A21.5 – Polyethylene Encasement for Ductile-Iron Pipe Systems
 - b. A21.10 – Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm Through 1200 mm), for Water and Other Liquids
 - c. A21.11 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
 - d. A21.15 – Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges
 - e. A21.50 – Thickness Design for Ductile-Iron Pipe
 - f. A21.51 – Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
 - g. A21.53 – Ductile-Iron Compact Fittings, 3 In. Through 24 In. (76 mm through 610 mm) and
 - h. B16.1 – Cast Iron Pipe Flanges and Flanged Fittings
 - i. B16.5 – Pipe Flanges and Flanged Fittings
 - j. B16.42 – Ductile Iron Pipe Flanges and Flanged Fittings, Classes 150 and 300
 - k. B18.2.1 – Square and Hex Bolts and Screws Inch Series
 - l. B18.2.2 – Square and Hex Bolts (Inch Series)
3. American Society of Mechanical Engineers (ASME)
- a. Section IX AWS B2.1
4. American Water Works Association (AWWA)
- a. C104/A21.4 – Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
 - b. C105/A21.5 – Polyethylene Encasement for Ductile-Iron Pipe Systems
 - c. C110/A21.10 – Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm Through 1200 mm), for Water and Other Liquids
 - d. C111/A21.11 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
 - e. C115/A21.15 – Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges
 - f. C116, Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile Iron and Gray Iron Fittings for Water Service.
 - g. C150/A21.50 – Thickness Design for Ductile-Iron Pipe
 - h. C151/A21.51 – Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
 - i. C200 – Steel Water Pipe-6 In. (150 mm) and Larger
 - j. C203 – Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
 - k. C205 – Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 In. and Larger - Shop Applied

- l. C206 – Field Welding of Steel Water Pipe
- m. C207 – Steel Pipe Flanges for Waterworks Service - Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm)
- n. C208 – Dimensions for Fabricated Steel Water Pipe Fittings
- 5. American Welding Society (AWS)

1.3 SUBMITTALS

- A. Submit the following in accordance with the General Conditions/General Requirements:
 - 1. Shop Drawings: Submit for approval the following:
 - a. Detailed drawings in plan and profile, and laying schedules.
 - b. Details of piping, supports, accessories, specials, joints, harnessing, and connections to existing pipes and structures.
 - 2. Tests: Submit description of proposed testing methods, procedures and apparatus. Submit copies of test report for each test.
 - 3. Record Drawings:
 - a. Submit record drawings prior to time of Substantial Completion.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to site to insure uninterrupted progress of the Work.
- B. Handle all pipe, fittings and accessories carefully with approved handling devices. Do not drop or roll pipe off trucks. Do not otherwise drop, roll or skid piping.
- C. Store pipes and fittings on heavy wood blocking or platforms so they are not in contact with ground.
- D. Unload pipe, fittings and specials opposite to or as close to place where they are to be installed as is practical to avoid unnecessary handling. Keep pipe interiors completely free from dirt and foreign matter.
- E. Inspect delivered pipe for cracked, gouged, chipped, dented or other damaged material and immediately remove from site.

PART 2 - PRODUCTS

2.1 MATERIALS AND CONSTRUCTION

- A. Required pipe materials are listed in Piping Schedule. Refer to applicable Sections for material specifications.
- B. Polyvinyl Chloride (PVC) Pipe
 - 1. Material: Unless otherwise shown or specified, PVC pipe shall be:
 - a. Type, Grade: Type 1, Grade 1
 - b. Wall Thickness:
 - 1) Schedule 80 conforming to ASTM D1785 and US Product Service PS 21-70 (supersedes US Commercial Standard CS 207-60) as having the same OD dimension as iron pipe

- c. Temperature Rating: Maximum temperature rating shall be 140 degrees F.
 - d. Color: Gray
 - 2. Fittings: Type, grade, schedule, and color of fitting shall match pipe.
 - a. Solvent Weld: Solvent welded fittings shall conform to ASTM D2467 for socket type.
 - b. Flanged: Provide flanged fittings with Viton-A gaskets.
 - 3. Joints:
 - a. Solvent: Use primer and solvent cement as recommended by PVC pipe manufacturer. Primer shall be in accordance with ASTM F656. Solvent cement shall be in accordance with ASTM D2564.
 - b. Threaded: Polytetrafluoroethylene (Teflon) (PTFE) tape required for threaded fittings. Pipe shall not be threaded.
 - c. Flanged: Provide with back-up flange of minimum 1/8-inch thickness. Back-up flanges and connecting bolts shall be of Type 304 stainless steel.
 - d. Push-on: Provide gasketed push-on joints in accordance with ASTM D3139 and ASTM F477.
 - 4. Manufacturer:
 - a. Ipex Pipe Valves & Fittings, Inc.
 - b. Spears Manufacturing Company.
 - c. Or equal
- C. Ductile Iron Pipe and Fittings
- 1. Flanged Pipe: Fabricate in accordance with ANSI A21.15.
 - a. Thickness Class: As specified in piping schedule. If not otherwise specified, use Class 53.
 - 2. Non-Flanged Pipe: Conform to ANSI A21.51 for material, pressure, dimensions, tolerances, tests, markings, and other requirements.
 - a. Pressure Class: As specified in piping schedule. If not otherwise specified, use Thickness Class 53.
 - 3. Joints:
 - a. Flanged Joints: Conform to ANSI A21.10 and ANSI A21.11 capable of meeting the pressure class or special thickness class, and test pressure specified in piping schedule.
 - 1) Gaskets: Unless otherwise specified, gaskets shall be at least 1/8-inch thick, ring or full-face as required for pipe, of a synthetic rubber compound containing not less than 50 percent by volume nitrile or neoprene, and shall be free from factice, reclaimed rubber, and other deleterious substances. Gaskets shall be suitable for service conditions specified, specifically designed for use with ductile iron pipe and fittings.
 - a) Gasket Sealing Compounds: Provide high temperature resistant sealing compound (Loctite PST 592 or equivalent) with Dimethacrylate-ester base, and Teflon.
 - 2) Bolts: Conform to ANSI B18.2.1.
 - a) ASTM A 193, Grade B8M, Class 2, Heavy hex, Type 316 stainless steel.

- 1) Nuts: Conform to ANSI B18.2.2.
 - a) ASTM A 194, Grade B8M, Heavy hex, Type 316 stainless steel.
- b. Mechanical Joints: Conform to ANSI A21.10 and ANSI A21.11, capable of meeting pressure class or special thickness class, and test pressure specified in piping schedule
 - 1) Glands: Ductile iron
 - 2) Gaskets: Plain tip
 - 3) Bolts and Nuts: High strength, low alloy steel.
 - 4) Manufacturers: Provide products of one of the following:
 - a) Clow Water Systems, a Division of McWane, Inc.
 - b) American Cast Iron Pipe Co.
 - c) U.S. Pipe and Foundry Co.
 - d) Or equal.
- c. Flanged Fittings: Conform to ANSI A21.10 and ANSI A21.15.
 - 1) Pressure Rating: As specified above for flanged joints
 - 2) Material: Ductile iron
 - 3) Gaskets: As specified above for flanged joints
 - 4) Bolts and Nuts: As specified above for flanged joints
- d. Mechanical Joint Fittings: Conform to ANSI A21.10.
 - 1) Pressure Rating: As specified above for mechanical joints
 - 2) Material: Ductile iron
 - 3) Glands: Ductile iron
 - 4) Gaskets: As specified above for mechanical joints
 - 5) Bolts and Nuts: As specified above for mechanical joints
 - 6) Mechanical joint fittings shall be equipped with restraining type follower glands, MEGALUG® Series 1100 by EBAA Iron, Inc., or equal.
- e. Specials:
 - 1) Transition Pieces:
 - a) Furnish suitable transition pieces (adapters) for connecting to existing piping.
 - b) Unless otherwise shown or specified, expose existing piping to determine material, dimensions, and other data required for transition pieces.
 - 2) Taps:
 - a) Provide taps where shown or required for small-diameter pipe connections.
 - b) Provide corporation stops where shown or required.
 - c) Where pipe wall thickness or tap diameter is inadequate to provide required minimum number of threads, provide a tapping saddle.

- d) For flanged connections on tapping saddle outlet branch, counterbore flange per MSS SP-60 dimensions. Inside diameter of the outlet shall be 1/4-inch greater than nominal diameter.

4. Coatings and Linings

- a. Pipe and fittings shall be delivered to the application facility without asphalt, cement lining, or other lining on the interior surface.
- b. Coatings and linings shall be as scheduled.
- c. Ceramic epoxy lining shall be an amine cured novalec epoxy containing at least 20% by volume of ceramic quartz pigment.
- d. Ceramic epoxy lining shall have a permeability rating of 0.00 when tested per Method A of ASTM E96 with a test duration of 30 days.
- e. Abrasion resistance:
 - 1) Less than 3 mils loss after one million cycles on a 22.5° sliding aggregate slurry abrasion tester.
- f. Applicator:
 - 1) The lining shall be shop applied by a certified firm with a successful history of applying lining to the interior of ductile iron pipe and fittings.
- g. Surface preparation:
 - 1) The interior surface of the pipe must be clean and dry. Surface preparation shall be in accordance with the manufacturer's recommendations.
- h. Lining:
 - 1) The interior of the pipe shall receive 40 mils nominal DFT.
 - 2) Lining shall not be applied when the substrate or ambient temperature is below 40 deg. F.
 - 3) Lining shall not be used on the face of a flange.
 - 4) The number of coats and thickness per coat of lining shall be as recommended by the lining manufacturer.
 - 5) Curing and re-application time shall be as recommended by the lining manufacturer.
- i. Inspection
 - 1) Ductile iron pipe and fitting linings shall be checked for thickness using a magnetic film thickness gauge. The thickness testing shall be done using the method outlined in SSPC PA-2.
 - 2) The interior lining of the pipe and fittings shall be tested for pinholes with a non-destructive 2,500-volt test. Any defects found shall be repaired prior to shipment.
 - 3) Each pipe joint and fitting shall be marked with the date of application of the lining system along with its numerical sequence of application on that date and records maintained by the applicator of his work.
- j. Certification
 - 1) The pipe or fitting manufacturer shall supply a certificate attesting that the lining was applied per this specification.

- k. Handling
 - 1) Ceramic lined pipe and fittings shall be handled from the outside only in accordance with the lining manufacturer's recommendations.
 - 2) Field repairs shall be done in accordance with the lining manufacturer's recommendations.
- l. Manufacturer:
 - 1) Induron Protective Coatings (Protecto 401™)
 - 2) Tnemec (Series 431 Perma-Shield PL)
 - 3) Or approved equal

2.2 ACCESSORIES

A. Wall Castings and Sleeves

- 1. Wall castings shall be cast or ductile iron and shall be of the configuration as shown on the Contract Drawings.
- 2. Sleeves shall be solid cast or ductile iron castings or fabricated from Schedule 40 steel pipe.
- 3. Fabricated wall pipes and sleeves of ductile or cast iron pipe may be used in lieu of wall castings and cast sleeves with prior acceptance of the Engineer.
 - a. Fabrication shall be by a manufacturer regularly engaged in the field.
- 4. Wall castings and sleeves shall be provided with waterstops when installed in poured concrete foundations, walls, slabs, and elsewhere as shown.
 - a. Waterstops for fabricated sleeves shall be at least the same thickness as the sleeve and a minimum of 2 inches in width.
 - 1) Attached by continuous fillet weld both sides around the sleeve.
 - a) MIG weld shall be used on cast or ductile iron.
 - b) One waterstop for lengths up to and including 12 inches.
 - c) Two waterstops for lengths over 12 inches.
- 5. Waterstops for castings shall be the manufacturer's standard.

B. Link Seals

- 1. Provide link type mechanical seals suitable for working pressure, as scheduled, corrosive service and accessible from one side, with glass reinforced nylon pressure plates and stainless steel bolts and nuts.
- 2. Product and Manufacturer: Link-Seal, as manufactured by GPT Industries, or equal.

C. Bolted Sleeve Type Couplings

- 1. Sleeve type couplings shall be designed to fit the outside diameter of the pipe they connect.
- 2. Sleeves shall be shop finished with an epoxy coating.
- 3. Unless otherwise specified or shown, the middle ring shall be furnished without a pipe stop and shall have the following minimum dimensions:

Pipe Diameter	Thickness	Length
6-inch to 24-inch	3/8-inch	7-inches
30-inch and larger	1/2-inch	10-inches

4. All flanges, bolts, nuts, and washers used shall be isolated from dissimilar metals by using dielectric insulating sleeves and washers.
 5. Pressure and Service: Same as connecting piping.
 6. Sleeve and Follower: Carbon steel with fusion bonded epoxy coating, for exposed service.
 7. Gaskets: Nitrile (Buna N) rubber.
 8. Bolts and Nuts: Stainless steel, Type 316.
 9. Product and Manufacturer: Style 38 by Dresser Industries, Type 411 by Smith-Blair, or equal.
 10. Harness rods and nuts shall be of heat treated steel with the following properties:
 - a. Minimum yield strength: 70,000 psi
 - b. Minimum ultimate strength: 110,000 psi
 - c. American standard coarse threads
 - d. Galvanized or cadmium plated unless otherwise schedule or shown
- D. Flanged Coupling Adapters
1. One end of adapter shall be flanged and other end shall have a bolted sleeve type coupling.
 2. Pressure and Service: Same as connecting piping.
 3. Body and Follower: Cast or ductile iron, with fusion bonded epoxy coating.
 4. Gaskets: Nitrile (Buna N) rubber.
 5. Bolts and Nuts: Stainless steel, Type 316.
 6. Product and Manufacturer: Type 912 by Smith-Blair, Style FC400 by Romac Industries, Inc., or equal.
- E. Restrained Flanged Adapters
1. Restrained flanged adapters shall be used where specifically indicated on the Contract Drawings.
 2. The flange adapter shall be capable of deflection during assembly, or permit lengths of pipe to be field cut allowing a minimum of 0.6" gap between the end of the pipe and the mating flange without affecting the integrity of the seal.
 3. Restrained flange adapter shall be a Series 2100 MEGAFLANGE adapter as manufactured by EBAA Iron Inc., or equal.
 4. Restrained flange adapters shall be made of ductile iron conforming to ASTM A536 and have flange bolt circles that are compatible with ANSI/AWWA C110/A21.10.
 5. Restraint for the flange adapter shall consist of multiple individual actuated gripping wedges to maximize restraint capability

6. Torque limiting actuating screws shall be used to insure proper initial set of gripping wedges.
 7. Sealing gaskets shall be natural or synthetic rubber suitable for the intended service.
 8. Bolts and nuts shall be Type 316 stainless steel for non-submerged service.
 9. Restrained flange adapters shall be designed to resist of minimum of 150 psi working pressure.
 10. Restrained flange adapters shall be shop finished with an epoxy coating.
- F. Anchor Pipe
1. Cast Ring Anchor Pipe
 - a. Sizes 6" x 13", 18", 24", and 36"; 8" x 13" and 12" x 13"
 - b. Wall Thickness:
 - 1) 6" – 0.37"
 - 2) 8" – 0.39"
 - c. Cement Lined: ANSI A21.4
 - d. Joints: ANSI A21.10, rubber gasket, mechanical joint, solid gland cast integrally with pipe by swivel gland.
 - 1) Glands: Ductile Iron
 - e. Ring: Solid anchor ring cast integrally with pipe.
 - f. Manufacturers:
 - 1) Tyler/Union Product: Swivel by solid adapter and swivel by swivel adapter
 - 2) Griffin Product: Swivel x solid anchoring coupling
 2. Welded Ring Anchor Pipe
 - a. Sizes: 6" x lengths over 36", 8" x lengths over 13".
 - b. Wall Thickness: Class 54 minimum.
 - c. Cement Lined: ANSI A21.4
 - d. Joints: ANSI A21.10, rubber gasket, mechanical joint, solid gland by swivel gland or swivel gland by swivel gland.
 - 1) Glands: Ductile Iron
 - e. Ring: 1/2" x 1/2" solid anchor ring welded onto pipe on joint side of ring.
 - 1) Material: Ductile Iron, ASTM A-536.
 - 2) Weld:
 - a) Fusion weld, continuous short arc.
 - b) AWS 5.15 ENiFeMN-CI Electrode (NI ROD 44)
 - f. Manufacturers: Higgins Engineering, Inc. (must specifically request Class 54 pipe).
- G. Accessories
1. Steel rods, bolts, lugs, and brackets:
 - a. Comply with ASTM A36 or ASTM A307
 - b. Grade A carbon steel

- c. Sleeve type couplings shall be harnessed where shown and with the number and size of rods indicated.
- 2. Protective coating: Bituminous

PART 3 - EXECUTION

3.1 INSTALLATION

A. General

- 1. Install piping as shown on the Contract Drawings and in accordance with the manufacturer's installation instructions.
- 2. If there is a conflict between manufacturer's recommendations and Contract Drawings or Specifications request instructions from Engineer before proceeding.

B. Exposed Piping Installation:

- 1. Install straight runs true to line and elevation.
- 2. Install vertical pipe truly plumb in all directions.
- 3. Install piping parallel or perpendicular to building walls. Piping at angles and 45 degree runs across corners will not be accepted unless specifically shown or approved.
- 4. Install small diameter piping generally as shown when specific locations and elevations are not indicated. Locate such piping as required to avoid ducts, equipment, beams, and other obstructions.
- 5. Install piping so as to leave all corridors, walkways, work areas, and like spaces unobstructed. Unless otherwise approved, provide minimum headroom clearance under all piping of 7 feet 6 inches.
- 6. Protect and keep clean water pipe interiors, fittings and valves.
- 7. Provide temporary caps or plugs over all pipe openings at the end of each day's work, and when otherwise required or directed by Engineer.
- 8. Cutting: Cut pipe from measurements taken at site, not from Contract Drawings.
- 9. Install dielectric unions wherever dissimilar metals are connected except for bronze or brass valves in ferrous piping.
- 10. Provide a union downstream of each valve with screwed connections.
- 11. Provide screwed or flanged unions at each piece of equipment, where shown, and where necessary to install or dismantle piping.

C. Buried Piping Installation:

- 1. General:
 - a. Install pipelines, fittings, specials, and accessories in accordance with the configuration shown on the Contract Drawings.
 - b. Excavation and backfilling shall be in accordance with the applicable provisions of the Section entitled "Trench Excavation and Backfill".
 - c. Blocking will not be permitted under pipe, except where the pipe is to be laid with concrete cradle or encasement.

- d. No pipe shall be laid upon a foundation in which frost exists; nor at any time when there is danger of the formation of ice or the penetration of frost at the bottom of the excavation.
 - e. Temporary bulkheads shall be placed in all open ends of pipe whenever pipe laying is not actively in process. The bulkheads shall be designed to prevent the entrance of dirt, debris or water.
 - f. Precautions shall be taken to prevent the flotation of the pipe in the event of water entering the trench.
2. Location and Grade:
- a. Pipelines and appurtenances shall be located as shown on the Contract Drawings or as directed and as established from the control survey in accordance with Division 1 specifications.
 - b. Alignment and grades shall be determined and maintained by a method acceptable to the Engineer.
3. Subgrade:
- a. Subgrade for pipelines shall be earth or special embedment as specified or directed and shall be prepared in accordance with the Section entitled "Trench Excavation and Backfill".
4. Joints:
- a. Joints shall be assembled using gaskets, lubricants and solvents as furnished by the pipe manufacturer and in accordance with the manufacturer's recommendations.
5. Embedment:
- a. Embedment shall be deposited and compacted in accordance with the Section entitled "Trench Excavation and Backfill".
 - b. Embedment shall be native material excavated from the trench, which is acceptable to the Engineer, containing no stones larger than 1-1/2 inches in size or debris.
 - c. Embedment material shall be deposited and tamped in 6-inch layers to the centerline of the pipe.
 - d. Native material placed above the centerline of the pipe to a depth of 12 inches above the pipe shall be deposited in such manner as to not damage the pipe.
 - e. When specified or directed, Select Fill material shall be used in lieu of the native material for b or d above.
6. Thrust Restraints:
- a. Pressure pipelines shall have thrust restraints in the form of thrust blocks, tie rods, or anchors of the size and type specified or as required by the pressure and stability of the supporting surface.
 - 1) Thrust restraints shall be installed at all changes in direction, changes in size, dead ends or other locations where shown.
 - 2) Thrust restraints shall be in place, and when of concrete (3,000 psi) shall have developed the required strength, prior to testing of the pipeline.
 - 3) Tie rods and nuts for thrust restraints shall be of high tensile steel and shall have a minimum yield strength of 70,000 psi.
 - a) Tie rods and nuts installed underground shall be coated with two coats of coal tar pitch preservative coating after installation.

D. Joints

1. General:

- a. Make joints in accordance with pipe manufacturer's recommendations and requirements below.
- b. Cut piping accurately and squarely and install without forcing or springing.
- c. Ream out all pipes and tubing to full inside diameter after cutting. Remove all sharp edges on end cuts.
- d. Remove all cuttings and foreign matter from inside of pipe and tubing before installation. Thoroughly clean all pipe, fittings, valves, specials, and accessories before installing.

2. Flanged Joints:

- a. Assemble flanged joints using 1/8-inch ring-type gaskets for raised face flanges. Use full face gaskets for flat face flanges unless otherwise approved by Engineer. Gaskets shall be suitable for service intended in accordance with manufacturer's ratings and instructions. Gaskets shall be properly centered.
- b. Bolts shall be tightened in a sequence which will insure equal distribution of bolt loads.
- c. Length of bolts shall be uniform, and shall not project beyond nut more than 1/4-inch or fall short of nut when fully taken up. Ends of bolts shall be machine cut so as to be neatly rounded. No washers shall be used.
- d. Bolt threads and gasket faces for flanged joints shall be lubricated prior to assembly.
- e. Alternately tighten bolts 180 degrees apart to compress gasket evenly.

3. Thermoplastic Pipe Joints:

a. Solvent Cement Joints:

- 1) Bevel pipe ends and remove all burrs before making joints. Clean both pipe and fittings thoroughly. Do not attempt to make solvent cement joints if temperature is below 40°F nor in wet conditions.
- 2) Use solvent cement supplied or recommended by the pipe manufacturer.
- 3) Apply joint primer and solvent cement and assemble joints in strict accordance with the recommendations and instructions of the manufacturer of the joint materials and the pipe manufacturer.
- 4) Observe safety precautions with the use of joint primers and solvent cements. Allow air to circulate freely through pipelines to permit solvent vapors to escape. Slowly admit water when flushing or filling pipelines to prevent compression of gases within pipes.

E. Installing Valves and Accessories

1. Provide supports for large valves, flow meters and other heavy items as shown or required.
2. Install floor stands as shown and as recommended by manufacturer.
3. Provide lateral restraints for extension bonnets and extension stems as shown and as recommended by manufacturer.
4. Provide steel sleeves where operating stems pass through floor. Extend sleeves 2 inches above floor.

5. Position valve operators as shown. When position is not shown, install valve so that it can be conveniently operated and as approved by Engineer. Avoid placing operators at angles to floors or walls, unless shown on Contract Drawings.
 6. Position flow measuring devices in pipe lines so that they have amount of straight upstream and downstream runs recommended by manufacturer, unless specific location dimensions are shown. Position swing check valves so that they do not conflict with discs of butterfly valves.
- F. Unions
1. Install dielectric unions wherever dissimilar metals are connected except for bronze or brass valves in ferrous piping.
 2. Provide a union downstream of each valve with screwed connections.
 3. Provide screwed or flanged unions at each piece of equipment, where shown, and where necessary to install or dismantle piping.
- G. Eccentric Reducers
1. Use eccentric reducers where shown and where air or water pockets would otherwise occur in mains because of a reduction in pipe size.
- H. Transitions from One Type of Pipe to Another
1. Provide all necessary adapters, specials and connection pieces required when connecting different types and sizes of pipe or connecting pipe made by different manufacturers.
- I. Wall Castings and Sleeves
1. Install wall castings and sleeves at the locations and elevations as shown on layout drawings or Contract Drawings.
 - a. Verify location with the installer of the carrier pipe before concrete is poured.
 2. Castings and sleeves installed in walls and ceilings shall be flush with the finish surface, unless otherwise indicated.
 3. Sleeves in floors shall be fabricated from Schedule 40 steel pipe.
 - a. In areas not requiring escutcheons or plates the sleeve shall extend 4 inches above finished floor.
 4. Sleeves installed in exterior walls, finished areas and where water or gas tightness is required shall be sealed water and gas tight.
 5. Size
 - a. Wall castings shall be the size of the carrier pipe.
 - b. Sleeves for modular link type wall seals shall be sized in accordance with the manufacturer's recommendations. The number of links provided shall be in accordance with the manufacturer's recommendations.
 - c. Sleeves for caulking shall be a minimum of one size larger than the carrier pipe.
 6. Sealants shall be installed in accordance with the manufacturer's recommendations.

3.2 PAINTING

- A. Perform field painting in accordance with the Section "Field Painting".

3.3 IDENTIFICATION

- A. Identify piping as specified in Section "Identification for Process Piping".

3.4 TESTING

A. General

1. Test all piping as specified below unless otherwise authorized by Engineer.
2. Notify Engineer 48 hours in advance of testing.
3. Provide all testing apparatus including pumps, hoses, gages, and fittings.
4. Pipelines shall hold specified test pressure for two hours.
5. Repair and retest pipelines which fail to hold specified test pressures or which exceed allowable leakage rate.
6. Test pressures required are at lowest elevation of pipeline section being tested, unless otherwise specified.
7. Conduct all tests in presence of Engineer. Repeat tests in presence of local authorities having jurisdiction, if required.

B. Schedule of Pipeline Tests

1. Test piping at test pressure indicated in Piping Schedule.
2. For piping not included in Piping Schedule, Engineer will notify Contractor in writing of test pressure to be utilized.

C. Pressure Test Procedure

1. Insure that all supports and restraint protection are securely in place.
2. Fill section to be tested slowly with water and expel all air. If necessary, install cocks to ensure removal of air.
3. Test only one section of pipe at a time.
4. Apply specified test pressure required for two hours and observe pressure gauge. Check carefully for leaks while test pressure is being maintained.

D. Leakage Testing

1. Conduct leakage test after satisfactory completion of pressure test.
2. Allowable Leakage Rates (gallons per hour per 1000 feet per inch diameter:
 - a. Copper, Steel, Ductile Iron, Thermo Plastic, and all Other Piping: 0.0
3. Leakage Test Procedure:
 - a. Examine exposed pipe, joints, fittings and valves. Repair visible leakage or replace defective pipe, fitting or valve.
 - b. Refill line under test to reach required test pressure.
 - c. Provide test container filled with known quantity of water at start of test. Attach test pump suction to test container.
 - d. Pump water from test container into line with test pump to hold specified test pressure for test period. Water remaining in container shall be measured and amount used during test shall be recorded on test report.

- e. Perform all repair, replacement, and retesting required because of failure to meet testing requirements.
- f. Leakage shall be less than rate specified above.

3.5 SCHEDULE

Location	Description	Size (inches)	Material	Wall Thickness or Class	Joints	Interior Lining	Exterior Coating	Test Pressure (psig)
Wet Well	Pump Suction	12	DI	Class 53	Flg./RJ	Cer. Epoxy	Pt.	100
	Pump Discharge	10, 12, 16	DI	Class 53	Flg./RJ	Cer. Epoxy	Pt.	100
	Surge Relief	8	DI	Class 53	Flg./RJ	Cer. Epoxy	Pt.	100

Legend:

DI	Ductile Iron	RJ	Restrained Joint
PVC	Polyvinyl Chloride	Flg.	Flanged
PC	Pressure Class	Cer. Epoxy	Ceramic Epoxy
TC	Thickness Class	Pt.	Paint

END OF SECTION

SECTION 40 05 25
MISCELLANEOUS VALVES AND APPURTENANCES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes process valves 3-inches and smaller to be installed in pressure pipelines, special valves, traps and accessories not specified elsewhere as shown on the Contract Drawings.

1.2 REFERENCES

- A. Comply with the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American Society for Testing and Materials (ASTM)
 - 2. American National Standards Institute (ANSI)
 - 3. American Society of Mechanical Engineers (ASME)
 - 4. American Water Works Association (AWWA)
 - 5. National Sanitation Foundation (NSF)

1.3 SUBMITTALS

- A. Submit the following in accordance with the General Conditions/General Requirements.
- B. Product Data: "Catalog cuts" and specification sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.
- C. Shop Drawings: Indicating dimensions, materials of construction, sizes, and mounting details.
- D. Certificates: Manufacturer's certification that all materials furnished are in compliance with the applicable requirements of the referenced standards and this Specification.

1.4 QUALITY ASSURANCE

- A. Component Supply and Compatibility
 - 1. Valves of like size, type and material shall be supplied by a single manufacturer who shall be responsible for the proper application, engineering, testing and operation of the valve as specified herein.
 - 2. All components of like size and type shall be the product of the same manufacturer for purposes of parts interchangeability.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Delivery of material including unloading, storage and handling of valves shall be in accordance with the manufacturer's recommendations.
- B. Materials shall be elevated above the ground and stored to avoid corrosion and deterioration.

- C. Shipping containers shall be clearly labeled.

1.6 WARRANTY

- A. Valves shall have a one year warranty against defects in workmanship and/or materials. Warranty period shall commence upon final acceptance and approval by Engineer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The manufacturers named in this Section establish a standard of quality necessary for the Project.

2.2 GENERAL

- A. All valves of like size, type and material shall be supplied as a complete package from a single manufacturer, who shall be responsible for proper operation of the coordinated system.
- B. All components of like size and type shall be the product of the same manufacturer for purposes of parts interchangeability.
- C. Unless otherwise specified, manually operated valves shall open by turning counterclockwise.
- D. Unless otherwise specified, valves shall be designed for 150 psi working pressure.
- E. Valves and traps shall have flanged, threaded, or soldered joints, as required for the type of pipe in which they are installed.
- F. Valve size shall be consistent with the adjoining pipe size, unless otherwise called out on the Contract Drawings.
- G. Each valve shall have the name of the manufacturer and the size of the valve cast on the body or bonnet in raised letters.
- H. Valves shall include operator, actuator, hand wheel, extension stem, stem guides, operating nut, wrench, and accessories as shown, specified or required to allow complete operation from the intended operating level. Size the operators and actuators to operate valve for the full range of pressures and velocities anticipated in the pipeline.
- I. Unless otherwise specified, the interior surfaces of metal valves in contact during the seating operation shall be either solid bronze or faced with bronze.
- J. For all valves with solvent welded connections, the Contractor shall ensure the compatibility of the solvent cement with the liquid being conveyed.

2.3 MATERIALS AND CONSTRUCTION

- A. Ball Valves
 - 1. Ball valves for water service shall be bronze body with Teflon seats and seals, solder or threaded ends, and be equipped with a plastic-covered steel handle.
 - 2. Valve shall be provided with a label identifying the direction of liquid flow.
 - 3. Ball valve models shall be identifiable by the color designation on the valve handle.
- B. Gate Valves (Smaller than 3-inches)

1. Gate valves for water service shall be bronze body except the 2-1/2-inch and 3-inch sizes which shall be cast iron.
 2. Gate valves shall be non-rising stem, threaded bonnet, solid bronze disc, tapered wedge type, rated for 200 psi non-shock working pressure, with lead-free materials and construction conforming to MSS SP-139 and NSF 61.
 3. Gate valves shall have handwheel operators and threaded rods.
 4. Gate valves shall be Nibco T-113, Apollo 102T, or approved equal.
- C. Air Release Valve
1. Air release valves shall be a full port size and designed to automatically exhaust small amounts of air which may collect at the high points in a pipeline or piping system during normal operation.
 2. Valve body and cover shall be constructed of cast iron conforming to ASTM A126, Class B.
 3. Floats and internal components shall be Type 316 stainless steel.
 4. Floats shall seal against replaceable, resilient seats and shall be guided into the seat to provide a tight seal.
 5. Air release valves shall be equipped with isolation valves furnished by the air valve manufacturer.
 6. Manufacturers:
 - a. Val-Matic Valve and Manufacturing Corp., Model 48A
 - b. GA Industries, Inc., Model 929
 - c. Or approved equal.
- D. Sump Pump
1. Provide a complete sump pump system for each sump pump application shown on the Contract Drawings.
 2. Sump pump system shall consist of one primary sump pump and associated valves, piping, and appurtenances consisting of the following:
 - a. Sump pump shall include:
 - 1) Vortex type impeller
 - 2) Corrosion resistant cast-iron motor shell, switch case and pump housing
 - 3) UL listed submersible oil filled motor, UL listed rubber power cord, 115 volt AC operation
 - 4) Float operated, submersible (NEMA 6) mechanical switch
 - 5) Completely submersible, hermetically sealed
 - 6) Auto reset thermal overload protection
 - b. Discharge piping shall be 1-1/2-inch Schedule 40 PVC pipe and fitting in accordance with ASTM D1785 and ASTM D2466 respectively.
 - c. Sump pump shall be provided with a 1-1/2-inch non-corrosive, PVC body check valve with neoprene gasket and flapper. Flapper shall be weighted with stainless steel metal backing plates and rivets. Check valves shall be rated for 10 feet static head backpressure (with flexible couplings). Each sump pump shall be provided with a union adapter and full port ball valve of matching size to the discharge piping.

3. Sump pump shall be capable of pumping 50 gpm at 20 feet of head minimum.
4. Manufacturers:
 - a. Goulds (Model ST 71)
 - b. Or approved equal
- E. Pressure Gauges
 1. Case: Liquid-filled type, aluminum, stainless steel or phenolic, 4-1/2-inch diameter. Finish shall be black except for stainless steel.
 2. Pressure-Element Assembly: Bourdon tube, bronze, unless otherwise noted.
 3. Pressure Connection: Brass, NPS 1/4, bottom-outlet type unless otherwise noted. Gages shall be stem mounted in an upright position.
 4. Movement: Brass or stainless steel, and shall be adjustable for recalibration.
 5. Dial: Satin-faced, non-reflective aluminum with permanently etched scale markings.
 6. Pointer: Red or other dark-color metal.
 7. Window: Glass
 8. Ring: Stainless steel or plastic.
 9. Scale: Midpoint shall be nominal system operating pressure.
 10. Accuracy:
 - a. Gages 4-1/2-inch and larger shall be 1% of full scale.
 11. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure. Gages shall be calibrated to read zero at atmospheric pressure.
 12. Range for Fluids under Pressure: Two times operating pressure. Gauge shall be capable of a pressure of 30% above its maximum span without requiring recalibration.
 13. 4-1/2-inch and larger gauges shall have flanges for wall or flush mounting.
 14. Accessories
 - a. Ball valves shall be provided in accordance with this Section.
 15. Diaphragm Seals
 - a. Each diaphragm seal shall have Type 316 stainless steel upper and lower housings.
 - b. Elements and diaphragm seals shall be by the same manufacturer and shall be shipped as complete units, factory filled with silicone fluid.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install miscellaneous valves, traps, and accessories as shown on the Contract Drawings and in accordance with the manufacturer's installation instructions.
- B. Support valves independently from the piping using supports acceptable to the Engineer.

3.2 PAINTING

- A. Perform field painting in accordance with the Section "Field Painting".

- B. With the exception of those parts and components customarily furnished unpainted, all metal surfaces shall be shop prepared and coated with rust inhibitive shop paint. Shop paint shall be fully compatible with the field paint specified. Machined surfaces shall be protected against damage and corrosion by other means.

END OF SECTION

SECTION 40 05 52
IDENTIFICATION FOR PROCESS PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes identification of process piping, valves, and equipment, as shown on the Contract Drawings.

1.2 REFERENCES

- A. Comply with the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American National Standards Institute (ANSI)

1.3 SUBMITTALS

- A. Submit the following in accordance with the General Conditions/General Requirements.
- B. Product Data: "Catalog cuts" and specification sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.
- C. Samples: Samples of symbols, abbreviations, letter size, and color. Provide a complete list of legend wording proposed for identification of process piping and equipment. Do not order or purchase identification materials until samples have been reviewed and approved by the Engineer.
- D. Certificates: Manufacturer's certification that all products are in compliance with the applicable requirements of the referenced standards and this Specification.
- E. Manufacturer Instructions: Manufacturer's installation instructions.
- F. Submit a valve service identification chart which shall include, at a minimum, the following:
 - 1. Valve Tag Number
 - 2. Valve Location
 - 3. Valve Function and Service
 - 4. Valve Manufacturer's Name and Model Number

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Provide identification of process piping, valves, and mechanical equipment using color bands, lettering, flow direction arrows, and related permanent identification devices as shown on the Contract Drawings, as specified, and/or directed by the Engineer.

2.2 MANUFACTURERS

- A. The following manufacturers are named to establish a standard of quality necessary for the Project:

1. Seton Identification Products
2. Brady Corporation
3. Marking Services Incorporated
4. Or equal

2.3 GENERAL

- A. All identification labels and markings shall be supplied as a complete package from the manufacturer, who shall be responsible for proper operation of the coordinated system.
- B. All components of like size and type shall be the product of the same manufacturer for purposes of interchangeability.
- C. Identifying labels and markings for process piping shall conform to ANSI standards regarding legend, color, visibility, and size of legend and letters.
- D. All tags or markers shall be oriented such that they are readily visible from all normal working locations.
- E. All equipment above lift-out ceilings or made accessibly by access doors shall be labeled in the same manner as that of exposed equipment.

2.4 MATERIALS AND CONSTRUCTION

- A. Pipe Identification Painting
 1. Type and color shall be as indicated in the Section entitled "Field Painting".
- B. Pipe Identification Markers
 1. Snap-On Type: Pre-coiled acrylic plastic marker with clear polyester coating, incorporating flow arrows, and legend printed in alternate directions.
 - a. Piping or insulation under 6 inch O.D.: One piece wrap around type with 3/4 inch adhesive strip on inside edge and 360 degree visibility.
 - b. Piping or insulation 6 inch O.D. and larger: Strip type with factory applied grommets, secure with Type 316 stainless steel spring fasteners.
 2. Stick-On Type: One piece pressure sensitive adhesive backed plastic marker with clear polyester coating, incorporating flow arrows, and legend printed in alternate directions.
 - a. Piping or insulation under 8 inch O.D.: Wrap around type with 360 degree visibility.
 - b. Piping or insulation 8 inch O.D. and larger: Strip type.
 3. Markers shall be color coded based on pipe contents. Color selection shall be according to the Pipe Identification Schedule in this Section.
- C. Pipe Banding Tape
 1. 1-1/2-inch width (minimum), pressure sensitive adhesive backed type, of same material as pipe identification marker, and of color to match background color of pipe identification marker.
- D. Pipe Identification Tags
 1. Type: Brass, 19 B&S gage, with 1/4 inch high pipe service abbreviated lettering over 2-inch high pipe size lettering. Lettering shall be deep stamped and black filled. Tag to have 3/16 inch diameter hole at top for fastening.
 2. Size: 2 inch square tag.

3. Fasteners: Brass "S" hook or brass jack chain, size as required for pipe to which tag is attached.
- E. Valve Identification Tags
1. Type: Brass, 19 B&S gage, with $\frac{1}{4}$ inch high valve service abbreviated lettering over $\frac{1}{2}$ inch high lettering indicating valve service chart number. Lettering shall be deep stamped and black filled. Tag to have $\frac{3}{16}$ inch diameter hole at top for fastening.
 2. Size: 1-1/2 inch square tag.
 3. Fasteners: Brass "S" hook or brass jack chain, size as required for valve stem or handle to which tag is attached.
 4. For chemical storage rooms, materials of construction for the valve tag and fastener shall be compatible with the chemical being stored within the room.
- F. Equipment Identification Letters and Numbers
1. Type: Stick-on type, made of all-purpose polyester, single character letters and numbers, specifically designed for intended use (i.e., outdoor, chemical, etc.).
 2. Color: Black letters on white background.
 3. Size: Letters and numbers shall be 1 inch or 3 inches in height, as specified.
- G. National Fire Protection Association Chemical Hazard Labels
1. Type: Stick-on type, self-adhesive vinyl.
 2. Color: Black letters on NFPA diamond background colors.
 3. Size: 15-inches x 15-inches minimum with 6-inch letters.

2.5 ACCESSORIES

- A. Valve Service Identification Chart Frames
1. Satin finished extruded aluminum frame of size to fit 8-1/2 x 11 inch valve chart and complete with rigid clear plastic glazing.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

- A. All markers shall be installed in accordance with the manufacturer's printed instructions and shall be neat and uniform in appearance.

3.3 PAINTING

- A. Perform field painting in accordance with the Section "Field Painting".
- B. Pipe Identification Painting
1. General:
 - a. Piping within areas designated below shall be painted with various colors to identify the contents.

- b. If the piping is insulated, then the insulation cover shall be painted and not the pipe.
EXCEPTION: Do not paint metal insulation jackets, regardless of location.
- 2. Areas for Pipe Identification Painting:
 - a. Piping within the following spaces or rooms shall be painted:
 - 1) Exposed piping in corridors or other interior spaces which does not have a metal insulation jacket.
- 3. Application of Paint:
 - a. Prepare and paint designated piping and/or insulation in accordance with the Section entitled "Field Painting."
 - b. Coverage of designated piping or insulation shall be complete and free of streaking or defects.
- 4. Cleaning:
 - a. Clean adjacent surfaces of paint spatters and drips resulting from the Work of this Section.
- 5. Pipe Identification Painting Color Schedule:
 - a. Refer to the Section entitled "Field Painting".

3.4 IDENTIFICATION

A. Pipe Identification Markers and Tags

- 1. General:
 - a. Piping shall be identified as to content and direction of flow by use of pipe identification markers or tags.
 - b. Identify all piping, bare or insulated, whose contents match those listed in the Process Pipe Schedule in Specification Section 40 05 13, with the following exceptions:
 - 1) Piping in furred spaces or above plastered ceilings, except at access panels where valves and piping shall be identified as specified for exposed piping.
 - 2) Piping in finished spaces such as offices, toilet rooms, locker rooms, etc.
 - c. Marker legend size, field color, and length of field shall be in accordance with ANSI A13.1.
 - d. Legend wording shall be developed by the Contractor and submitted to the Engineer for review. Whenever possible, standard terminology should be used. Identification by the combination of two or more standard labels (at each identification point) is acceptable.
- 2. Use of Markers or Tags:
 - a. Pipe or insulation with an outside diameter (O.D.) of 3/4 inch and less shall be identified by the use of Pipe Identification Tags, except in chemical storage rooms.
 - b. Pipe or insulation with an O.D. larger than 3/4 inch shall be identified by the use of Pipe Identification Markers. Pipe or insulation within chemical storage rooms shall be identified by the use of Pipe Identification Markers.
 - c. Snap-on or stick-on type pipe identification markers may be used in accordance with Article 2.02, Paragraph B; except that stick-on markers shall not be used in the following situations:

- 1) Areas where humid, wet, or dripping conditions are found or likely.
 - 2) Areas where chemical fumes are present or likely.
 - 3) Outdoor installations.
 - 4) On lines subject to 50 degree F temperature variations.
3. Location of Markers and Tags:
 - a. Pipe identification markers and tags shall be located so as to be readily visible from any reasonable point of observation.
 - b. Locate pipe identification markers and tags at all valves, branch or riser take-offs, and both sides of pipe passage through walls, floors, and ceilings.
 - c. On continuous pipe runs locate pipe identification markers and tags at 20 foot intervals, but not less than one marker or tag on any length of pipe 10 feet or greater.
 4. Preparation:
 - a. Insure that any painting is complete and the paint has thoroughly dried before applying pipe identification markers and tags.
 - b. Prepare surface in accordance with the manufacturer's instructions for the type of identification used and the type of surface to which it is applied.
 5. Installation:
 - a. Install pipe identification markers and tags in accordance with the manufacturer's instructions.
 - b. Secure both ends of stick-on type markers with pipe banding tape. Tape shall have a one inch lap on the pipe or insulation and be applied in 360 degrees.
- B. Valve Identification Tags:
1. General:
 - a. Valves shall be designated by distinguishing numbers and/or letters as scheduled and as shown on the Contract Drawings.
 2. Installation:
 - a. Fasten tags to valve stems or handles using brass "S" hooks or jack chain.
 - b. Fasten tags in a manner and location that will permit easy reading, but will not interfere with the operation of the valve.
- C. Equipment Identification
1. General:
 - a. Identify mechanical equipment, bare or insulated, in the following locations, by use of stick-on letters and numbers, unless otherwise indicated:
 - 1) Mechanical equipment rooms
 - 2) Pipe galleries
 - 3) Chemical storage rooms
 - 4) Suspended ceiling plenums
 - 5) Exterior locations
 2. Location and Content of Identification:

- a. Equipment shall be identified with a minimum of two sets of lettering. Center identification lettering, vertically and horizontally, on opposite vertical sides of the equipment.
 - b. Vertical sides selected shall have the longest dimension (i.e., label sides of equipment and not the ends), unless view is obstructed to those sides. If view is obstructed to sides of equipment, locate identification lettering on the two most visible vertical sides and/or ends.
 - c. Equipment identification numbers and letters shall match the designation found on the Contract Drawings.
3. Size of Lettering:
- a. Use the largest lettering size (3 inch or 1 inch height) that will easily fit the available surface space.
 - b. Use only one lettering height on any given piece of equipment (i.e., do not mix lettering sizes).
4. Installation:
- a. Prepare surface to which lettering is applied and install lettering in accordance with the manufacturer's instructions.
 - b. Apply lettering in a straight line along the axis of the equipment. Lettering edges should touch, but not overlap.

END OF SECTION

SECTION 40 05 53
PROCESS VALVES THREE INCH DIAMETER AND LARGER

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes process valves three inches and larger as shown on the Contract Drawings, complete with appurtenances.
- B. Process valves include the following:
 - 1. Check valves
 - 2. Gate valves
 - 3. Surge relief valves

1.2 REFERENCES

- A. Comply with the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American Society for Testing and Materials (ASTM)
 - 2. American National Standards Institute (ANSI)
 - 3. American Society of Mechanical Engineers (ASME)
 - 4. American Water Works Association (AWWA)
 - 5. National Sanitation Foundation (NSF)

1.3 SUBMITTALS

- A. Submit the following in accordance with the General Conditions/General Requirements.
- B. Product Data: "Catalog cuts" and spec sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.
- C. Shop Drawings:
 - 1. Drawings showing the layout of the valves, supports, and equipment
 - 2. Cross sections showing elevations of the valves, supports, and equipment. Information shall include the valve size, dimensions, type, material, schedule, and mounting details.
- D. Certificates:
 - 1. Manufacturer's certification that all materials furnished are in compliance with the applicable requirements of the referenced standards and this specification.
 - 2. Certified results of performance, leakage, and hydrostatic tests.

1.4 QUALITY ASSURANCE

- A. Component Supply and Compatibility

1. Valves of like size, type and material shall be supplied by a single manufacturer who shall be responsible for the proper application, engineering, testing and operation of the valve as specified herein.
 2. All components of like size and type shall be the product of the same manufacturer for purposes of parts interchangeability.
- B. Contractor shall verify all field dimensions for development and approval of Manufacturer's drawings.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver valves in shipping splits that can be moved past obstructions in the delivery path.
- B. Coordinate delivery of valves to allow movement into designated space.
- C. Materials and equipment shall be boxed, crated or otherwise completely enclosed and protected during shipment, handling and storage. Such boxes, crates or protection shall be clearly labeled with manufacturer's name, brand or model designation, type or grade, and color.
- D. Protect materials and equipment from exposure to the elements and keep dry at all times. Deliver, handle and store to prevent damage, deterioration, and loss, including theft and vandalism. Comply with the manufacturer's written instructions.
- E. Material and equipment damaged by handling and storage shall be repaired or replaced by the Contractor as directed by the Engineer, at no additional cost to the Owner.
- F. Valves shall be protected against corrosion during storage and prior to being placed in operation.

1.6 WARRANTY

- A. Valves shall have a one year warranty against defects in workmanship and/or materials. Warranty period shall commence upon final acceptance and approval by Engineer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The manufacturers named in this Section establish a standard of quality necessary for the Project.

2.2 GENERAL

- A. All valves shall be supplied as a complete package from the manufacturer, who shall be responsible for proper operation of the coordinated system.
- B. All components of like size and type shall be the product of the same manufacturer for purposes of parts interchangeability.
- C. Valves shall include operator, actuator, hand wheel, extension stem, stem guides, floor stand, operating nut, wrench, and accessories as shown, specified or required to allow complete operation from the intended operating level.
- D. Valve shall be suitable for the intended service. Renewable parts shall not be of a lower quality than specified.

- E. Valve size shall be consistent with the adjoining pipe size, unless otherwise called out on the Contract Drawings or in the Valve Schedule at the end of this section.
- F. Valve joints shall be as required for the type of pipe in which they are installed.
- G. Resilient seated valves shall have no leakage (drip-tight) in either direction at valve rated design pressure. All other valves shall have no leakage (drip-tight) in either direction at valve rated design pressure, unless otherwise indicated in this Section or approved by the Engineer.
- H. Size operators and actuators to operate the valve for the full range of pressures and velocities anticipated in the pipeline.
- I. Valve to open by turning counterclockwise.
- J. Factory mount operator, actuator, and accessories.
- K. Each valve shall have the name of the manufacturer and the size of the valve cast on the body or bonnet in raised letters.
- L. Unless otherwise specified, the interior surfaces of metal valves in contact during the seating operation shall be either solid bronze or faced with bronze.

2.3 MATERIALS AND CONSTRUCTION

- A. Check Valves
 - 1. The following manufacturers are named to establish a standard of quality necessary for the Project:
 - a. Val-Matic
 - b. Or approved equal.
 - 2. Check valve shall be a swing check valve of the full port design with a domed cover and only one moving part, the flexible disc.
 - 3. Valve body shall be ductile iron. Flanged end shall meet ANSI B16.1, Class 125.
 - 4. Seating surface shall be on a 45-degree angle to minimize disc travel.
 - 5. Access cover shall be domed in shape to provide a flushing action over the disc.
 - 6. Flexible disc shall be Buna-N and shall be replaceable without taking the valve out of service.
 - 7. Check valves shall be designed for installation in the horizontal or vertical position.
 - 8. The flexible disc shall be of one-piece construction, precision molded with an integral O-ring type sealing surface reinforced with alloy steel.
 - 9. Valve shall be equipped with a position indicator and back flush attachment.
- B. Gate Valves
 - 1. The following manufacturers are named to establish a standard of quality necessary for the Project.
 - a. Kennedy Valve
 - b. Mueller Co.
 - c. Or approved equal
 - 2. Gate valves shall be resilient seated gate valves in accordance with the requirements of AWWA C509.

3. Valve body, bonnet, stuffing box and disc shall be constructed of cast iron or ductile iron. Valves shall have a Buna-N or EPDM resilient seating surface.
4. Gate valves shall have non-rising stems and dual O-ring stem seals. Gate valves shall open in a counterclockwise direction.
5. Gearing shall be installed on all gate valves 12-inches and larger. Gearing shall have position indicators, unless otherwise indicated.
6. All hardware (nuts, bolts, etc.) shall be Type 316 stainless steel.
7. All valves shall have flanged ends that meet ANSI B16.1, Class 125.
8. Buried valves shall be designed to be installed with shaft in the horizontal and include bevel gear with 2-inch square operating nut.

C. Surge Relief Valve

1. The following manufacturers are named to establish a standard of quality necessary for the Project:
 - a. Ross Valve Manufacturing Company, Inc.
 - b. GA Industries, Inc.
 - c. Or approved equal.
2. The manufacturer shall have a minimum of five (5) years' experience in the manufacture of wastewater surge relief valves.
3. Valves shall be piston type, globe style with flanged connections. Flanged ends shall meet ANSI B16.1, Class 125.
4. Valves shall be installed with the axis of flow in the horizontal position and the valve piston in the vertical position.
5. The piston shall be cushioned and designed to resist slamming.
6. Valve body shall be of gray iron casting that conforms to ASTM Specification A-126 – Class B, Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
7. Piston, liner, and seat ring shall be of bronze, ASTM B62 or ASTM B505
8. Seals shall be of Buna-N.
9. All external controls and associated rigid brass piping and fittings necessary for proper operation shall be factory assembled and furnished with the valve.
10. Surge relief valve shall function as follows:
 - a. Valve shall be normally closed, and provide drop tight closure.
 - b. Valve shall protect the system from excessive pressure. Valve shall open quickly on a rise in inlet pressure and close slowly to prevent upstream surges.
 - c. Valve operation shall be purely hydraulic, requiring no electrical power.
 - d. One surge relief valve shall be installed as indicated on the Contract Drawings. If upstream pressure decreases below the spring settings, the valve shall close. Valve set point is based on a working pressure of 86 psig. The set point for the surge relief valve (SRV) shall be as follows:
 - 1) SRV – 100 psig (115% of working pressure)
 - e. Set point shall be established at the factory, but valve shall have appropriate mechanisms to allow for adjustment of set point in the field.
 - f. Valves shall be designed to relieve water to a drain at atmospheric pressure.

11. Speed control valves shall be furnished to provide adjustable control of the main valve closing speed.
12. Valve shall be furnished with a pressure setting indicator.
13. One set of any special tools needed for operation and maintenance shall be provided with the valve.

D. Manual Actuators

1. Manual actuators shall be fully compatible with the valve supplied and shall be furnished by the valve manufacturer.
2. Manual actuators shall be of the traveling nut, self-locking style, and shall be capable of withstanding 450 foot-pounds of input torque at the extreme operator positions. The traveling nut operators shall exhibit characteristic closure at extreme open/close positions to minimize water hammer.
3. Manual actuators for other than buried service shall have a position indicator to indicate valve position for all points between fully opened and fully closed.
4. All valves located less than 5-feet from the floor shall be equipped with hand wheel operators.
5. All valves located 5-feet or more from the floor shall be equipped with chain wheel operators.
6. Handwheels shall be a minimum of 12-inches in diameter for valves 14-inches and larger and shall be a minimum of 8-inches in diameter for valves less than 14-inches.
7. Manual actuators shall be designed to operate the valve with a full hydraulic imbalance as scheduled, and with a maximum 80 pounds of effort with both hands.

2.4 SOURCE QUALITY CONTROL

A. Factory Test

1. Provide Certified Hydrostatic Tests and Performance Reports documenting compliance with applicable standards.

2.5 SHOP FINISHES

- A. Valve interior and exterior surfaces, except for seating, bearing or finished surfaces, shall be provided with the manufacturer's standard coating unless otherwise specified. Manufacturer's standard coating shall be fully compatible with the field paint specified.
- B. Protect machined surfaces against damage and corrosion by other means.
- C. Valve interior coating shall be in accordance with AWWA C550.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install valves and actuators as shown on the Contract Drawings and in accordance with the manufacturer's installation instructions.
- B. Support valves independently from the piping using supports acceptable to the Engineer.

3.2 FIELD QUALITY CONTROL

- A. Conduct operating tests to adequately show that the valves have been properly installed and will function as specified. All tests shall be subject to the Engineer's review and approval.
- B. The piping in which valves are installed shall be filled with water and pressurized to the test pressure indicated in the piping schedule in the Division 33 and 40 piping Sections to demonstrate that the installed valves do not leak.
- C. Correct any deficiencies in the valves or the installation.

3.3 PAINTING

- A. Perform field painting in accordance with the Section "Field Painting".

3.4 IDENTIFICATION

- A. Identify valves as specified in Section "Identification for Process Piping".

3.5 SCHEDULE

- A. The valve schedule below provides a summary of new valves to be provided under the Project.

Valve No.	Type	Size (inch)	Ends	Min. Pressure Class	Actuator
GV-131	Pump No. 1 Gate Valve	12	FL	150	Manual – HW
GV-132	Pump No. 2 Gate Valve	12	FL	150	Manual – HW
GV-133	Pump No. 3 Gate Valve	12	FL	150	Manual – HW
CV-131	Pump No. 1 Check Valve	12	FL	150	N/A
CV-132	Pump No. 2 Check Valve	12	FL	150	N/A
CV-133	Pump No. 3 Check Valve	12	FL	150	N/A
GV-141	Pump No. 1 Gate Valve	12	FL	150	Manual – HW
GV-142	Pump No. 2 Gate Valve	12	FL	150	Manual – HW
GV-143	Pump No. 3 Gate Valve	12	FL	150	Manual – HW
GV-160	Forcemain Discharge Gate Valve	16	FL	150	Manual – BG
SRV-161	Surge Relief Valve	8	FL	150	N/A

Legend: BG – Bevel Gear FL – Flanged HW – Handwheel

END OF SECTION

SECTION 40 05 59 STAINLESS STEEL GATES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes stainless steel water control gates and appurtenances, complete with guides, brackets, anchor bolts, stems and stem guides, manual operators, complete with all necessary accessories as shown on the Contract Drawings.

1.2 REFERENCES

- A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American Society for Testing and Materials (ASTM)
 - 2. American Water Works Association (AWWA)
 - a. AWWA C561 – Fabricated Stainless Steel Slide Gates
 - 3. American National Standards Institute (ANSI)
 - 4. American Society of Mechanical Engineers (ASME)
 - 5. American Welding Society (AWS)

1.3 SUBMITTALS

- A. Submit the following in accordance with the General Conditions/General Requirements.
- B. Product Data: “Catalog cuts” and specification sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.
- C. Shop Drawings indicating the dimensions, materials of construction, size and weight of equipment and location of connections to other work. Catalog cuts are not acceptable for shop drawings.
- D. Certificates: Manufacturer’s certification, stating paragraph-by-paragraph that all gates and materials furnished are in compliance with the applicable requirements of the latest edition of the AWWA Standard and this Specification.
- E. Manufacturer’s data including catalog information, cut sheets, lubrication requirements, manufacturer’s specifications, and materials description.
- F. Requirements for handling, storage and protection prior to installation.
- G. Manufacturer’s installation recommendations.
- H. Submit a coordination list that identifies each gate. The coordination list shall include project specific information such as tag numbers, gate type, location, size, and application.
- I. Suggested spare parts list with current price information.
- J. Requirements for routine maintenance prior to equipment start-up.
- K. Closeout Submittals.

1. Operation and Maintenance Data: Provide copies of the Manufacturer's Operation and Maintenance manuals in accordance with the General Conditions/General Requirements.
2. Warranty Documentation: Provide a copy of the Manufacturer's warranty.
3. Provide a copy of the Manufacturer's certificate of proper installation.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer's Factory Qualifications: Manufacturer shall be regularly engaged in the manufacture of water control gates. Manufacturer shall assign a Project Manager with a minimum of ten years' experience in the design and production of substantially similar equipment and shall be able to show evidence of at least fifty (50) installations in satisfactory operation.
2. References and evidence of experience shall be provided if requested by the Engineer.
3. Any required welding shall be performed by welders with ASME Section IX certification.

B. Component Supply and Compatibility

1. All equipment in this Section shall be supplied by a single manufacturer who shall be responsible for the design, coordination and proper operation of the entire system. Equipment shall be fabricated, assembled, erected and placed in proper operating condition in full conformity with the drawings, specifications, engineering data, instructions and recommendations of the equipment manufacturer.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Care shall be used in the handling and storage of this equipment to prevent damage or distortion of the equipment prior to installation. Materials and equipment shall be protected from exposure to the elements and kept dry at all times. Materials and equipment shall be handled and stored in accordance with manufacturer's recommendations.
- B. Materials and equipment shall be boxed, crated or otherwise completely enclosed and protected during shipment, handling, and storage. Such boxes, crates or protection shall be clearly labeled with manufacturer's name and model designation.
- C. Material and equipment damaged by handling and storage shall be repaired or replaced by the Contractor as directed by the Engineer.

1.6 WARRANTY

- A. The gate manufacturer shall warrant the system being supplied to the Owner against defects in materials and workmanship for a period of five (5) years following acceptance of the gates by the Owner.
- B. The warranty shall be in published form and shall apply to all similar units.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The following manufacturers are named to establish a standard of quality necessary for the Project:

1. RW Gate Company
2. Whipps, Inc.
3. Or equal

2.2 SYSTEM DESCRIPTION

- A. Furnish and install stainless steel gates with frames and accessories suitable for high-humidity and highly corrosive conditions.
- B. Stainless steel gates shall be suitable for service in raw sewage.

2.3 GENERAL

- A. All parts shall have accurate mounting and bearing surfaces so that they can be assembled without fitting, chipping, or re-machining. All parts shall conform accurately to the design dimensions and shall be free of all defects in workmanship or material that shall impair their service. The gates shall be completely shop assembled to insure proper fit and adjustment of all parts.
- B. Stainless steel gates shall be non-self-contained with a rising stem unless otherwise indicated.
- C. Stainless steel gates shall be supplied as a complete package from the gate manufacturer, who shall be responsible for proper operation of the coordinated system.
- D. All components of like size and type shall be the product of the same manufacturer for purposes of parts interchangeability.
- E. Construction of stainless steel gates shall be in accordance with the latest edition of AWWA C561 – Fabricated Stainless Steel Slide Gates.
- F. All drilled holes shall be spot faced to insure ample bolt and nut bearing surfaces.
- G. Wherever the term “stainless steel” is used in this Specification, Type 316 stainless steel shall be provided unless otherwise noted. Welded components shall be Type 316L stainless steel.
- H. The minimum thickness of the gate, its reinforcing members and all structural components of the guide and frame shall be 1/4-inch.
- I. After fabrication, all welds and weld burn shall be passivated in accordance with ASTM A380. If bead blasting is utilized, the entire slide and frame shall be bead blasted for a uniform finish.

2.4 PERFORMANCE REQUIREMENTS

- A. Gates shall be designed for the indicated seating and unseating heads.
- B. Gates shall conform to the requirements of the latest revision of AWWA C561, applicable to discs and frames with a safety factor of 4 with regard to tensile, compressive and shear strength.
- C. Allowable leakage shall be half of the value specified in the latest revision of AWWA C561.

2.5 MATERIALS AND CONSTRUCTION

- A. Frames

1. Frames shall be Type 316L stainless steel.
2. Gate frames shall be of one-piece construction and constructed of structural members or formed plate welded to form a rigid one-piece frame having a minimum thickness of 1/4-inch.
3. The bottom frame shall be of the flush-bottom type and shall be grouted into the existing concrete to provide a level smooth surface along the bottom when the gate is open.
4. A rigid stainless steel member shall be provided across the invert of the opening on downward opening weir gates.
5. The side frame shall be surface mounted unless otherwise shown on the Contract Drawings. For locations where the gate is being replaced, the side mounting design shall be consistent with existing conditions. The Contractor shall field verify the side frame mounting configuration prior to submitting shop drawings.
6. The frame shall extend to accommodate the entire height of the slide when the slide is in the fully opened position on upward opening gates or downward opening weir gates.
7. The frame configuration shall allow for the replacement of all of the seats and seals without removal of the gate from the concrete.
8. All contact surfaces of the frame shall be machined.
9. The design stress shall not exceed the lesser of 50% of the yield strength or 25% of the ultimate strength of the materials for maximum load conditions.

B. Guides

1. The guides shall be constructed utilizing self-adjusting UHMWPE (ultra high molecular weight polyethylene) and shall be integral with the gate frame. Guides shall be designed to withstand the total thrusts due to water pressure in accordance with AWWA C561. Rubber J-seals or similar are not acceptable.
2. The guides shall be of such lengths as to retain the entire gate within the guide grooves when the gate is fully open.
3. Guides and bearings shall ensure no metal-to-metal contact between the frame and gate.

C. Slides

1. Slides shall be Type 316L stainless steel.
2. Slides shall be rectangular in shape, of one-piece construction.
3. Slides shall not deflect more than 1/720 of the gate span or 1/16-inch, whichever is less, in any direction under the design seating head or design unseating head.
4. Stainless steel slides shall have structural components not less than 1/4-inch thick, with horizontal and vertical strengthening ribs, integrally welded to the plate.
5. A resilient EPDM flush bottom seal shall be mechanically fastened to the invert member.
6. The design stress shall not exceed the lesser of 50% of the yield strength or 25% of the ultimate strength of the materials for maximum load conditions.

D. Stems

1. Stems and extensions shall be Type 316 stainless steel.
2. Stems shall be the rising type and unless otherwise shown, shall be provided with floor mounted manual geared crank operators unless otherwise shown on the Contract Drawings.

3. Stems shall have a minimum outside diameter of 1-1/2-inches.
 4. Stems shall be threaded with machine rolled, full depth Acme type threads and allow full travel of the gate.
 5. Stems shall be designed to transmit in compression a minimum of two times the rated output of the hoist at 40 pounds effort on the crank.
 6. Rising stems shall be provided with a clear polycarbonate or butyrate stem cover. The stem cover shall have a cap and condensation vents and a clear mylar position indicating tape. The tape shall be field applied to the stem cover after the gate has been installed and positioned.
- E. Stem Couplings
1. Stem couplings shall be constructed of stainless steel and shall be bored and pinned or solid bronze and shall be machine bored, and internally threaded with Acme threads to fit the threaded stem ends.
 2. Stem couplings shall be of greater strength than the stem.
 3. Based on the manufacturer's recommendations, stems may be attached to an extension tube in lieu of using stem couplings.
- F. Stem Guides
1. Stem guides shall be Type 316 stainless steel with UHMWPE bushings.
 2. Stems and extensions shall be supported with stem guides. The unsupported length shall be in accordance with the manufacturer's recommendations and shall not exceed a maximum L/R ratio of 200 except where required by gate travel.
 3. Stem guides shall be machine bored 1/16 inch larger than the stem diameter.
 4. Guides shall be held to the wall by stainless steel anchor bolts.
- G. Seals
1. Gates shall be provided with a self-adjusting UHMWPE seal system to restrict leakage in accordance with the requirements listed in this specification.
 2. Seals shall be provided to limit leakage to 0.05 gpm/foot of seating perimeter under design operating head conditions.
 3. Flush bottom invert seals on upward opening gates shall be EPDM.
 4. Side seals shall be designed to obtain the same leakage rate on both seating and unseating head pressure.
 5. Seals shall be mounted on the gate with stainless steel attachments bolts or stainless steel clamping bars and stainless steel fasteners.
 6. All downward opening weir gates shall be provided with UHMWPE seals across the invert member.
- H. Manual Gate Operators
1. Unless otherwise shown on the Contract Drawings, gates shall be operated by a floor stand mounted manual crank-operated gearbox.
 2. Operators shall be the rising stem with clear plastic cover with graduated gate position indicators.
 3. Provide gearing as necessary to coordinate manual operator with space and height available at gate installation location.

4. Provide indication of "OPEN" and arrow indicating direction of operator rotation to open gate.
5. The lifting mechanism shall be capable of withstanding, without damage, an effort of up to 200 pounds.
6. Provide manual operator with roller or ball bearings.
7. Provide lubrication fittings for grease lubrication of bearings.
8. All manual operators shall be provided with a threaded cast bronze lift nut to engage the operating stem.
9. All manual operators shall be equipped with roller or ball bearings above and below the operating nut and to support the stainless steel input shaft.
10. Positive mechanical seals shall be provided above and below the operating nut to exclude moisture and dirt and prevent leakage of lubricant out of the hoist.
11. Manual gate operators shall function with a maximum effort not to exceed 40 pounds when the gate is in the closed position and experiencing the maximum operating head.
12. Pedestals shall be constructed of Type 316 stainless steel with a 1/2-inch minimum thick base plate and adaptor plate.
13. The pedestal height shall be such that the crank is located approximately 36-inches above the floor.
14. Wall brackets constructed of Type 316 stainless steel with a 1/2-inch thick minimum thickness shall be used to support floor stands where shown on the Contract Drawings.

2.6 ANCHOR BOLTS AND HARDWARE

- A. All necessary bolts, anchor bolts, mounting and assembly hardware shall be of Type 316 stainless steel and shall be furnished by the gate manufacturer. Anchor bolts shall have a minimum diameter of 1/2-inch.

2.7 SPARE PARTS

- A. Spare parts shall be packed in wooden boxes, labeled with manufacturer's name, address and telephone number; local representative's name, address and telephone number; and the name of equipment the part is for.
- B. A suggested list of parts for two years of operation and their associated cost shall be provided by the manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Stainless steel gates and accessories shall be stored and handled in accordance with the manufacturer's recommendations and the applicable provisions of the AWWA C561.
- B. Stainless steel gate assemblies shall be completely factory assembled, shipped as a unit, disassembled onsite and installed in strict conformance with the manufacturer's recommendations.
- C. All gates shall be thoroughly cleaned prior to installation.
- D. Prepare all concrete mounting surfaces prior to installation.

3.2 INSTALLATION

- A. Install stainless steel gates as shown on the Contract Drawings and in accordance with the manufacturer's installation instructions.
- B. Stem guides shall be set so that the stems are properly aligned and operate smoothly.
- C. All stainless steel bolts shall be coated with an anti-galling compound before the nuts are attached and tightened.
- D. Contractor to finish coat operator housings after installation.

3.3 FIELD QUALITY CONTROL

- A. Ease of Operation
 - 1. Adjustments in stem alignment or other changes required for maximum ease of operation shall be made at the Contractor's expense.
- B. The following field testing shall be performed on each of the gates:
 - 1. Pre-test Checkout:
 - a. The Contractor shall adjust, test and operate the gate manually. Manually open and close each gate two times using the operating nut. Any deficiencies shall be corrected at the Contractor's expense.
 - b. Manufacturer shall inspect the unit and certify proper installation and adjustments, either prior to or concurrent with the pre-test checkout. The Contractor shall submit the Manufacturer's Certificate of Installation to the Engineer prior to start of the Leakage Tests.
 - c. Prior to the start of the Leakage Test, the Contractor shall construct temporary bulk head(s) in structures, pipes or manholes as required to properly conduct leakage tests.
 - 2. Leakage Test:
 - a. Repeat item a. from the Pre-test Checkout.
 - b. Fill the appropriate structure or channel with raw wastewater and test for leakage. Leakage under design seating head conditions shall not exceed 0.05 gpm/foot of seating perimeter at the design seating head and design unseating head.

3.4 MANUFACTURER'S FIELD SERVICES

- A. The services of the manufacturer's representative shall be provided by the gate manufacturer during installation, testing, startup and adjustment, as required to achieve compliance with the specified requirements.
- B. The Owner's personnel shall have the right to witness the activities of manufacturer's representative during installation, testing, startup and adjustment.

3.5 SCHEDULE

Gate No.	Description	Max. Head (ft.)	Nominal Size	Gate Type	Operator
1	Influent Channel	16' (Unseating)	24" x 24"	Slide	Manual/Bevel Gear Handwheel
2	Wet Well Isolation	8' (Unseating)	12" x 18"	Slide	Manual/Handwheel

END OF SECTION

SECTION 40 05 76
LINE STOP BYPASS SYSTEM CONTRACT PS-317

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide all plans, labor, equipment, materials, and accessories necessary to implement a temporary line stop and bypass system for purpose of diverting pumped raw sewage (wastewater) flow around a pressurized section of existing force main during the renovation of a the existing pumping station and force main.
- B. Contractor is responsible for design, installation, operation, maintenance and removal of the required line stop bypass system.
- C. Line stop bypass system shall include line stop split sleeves and fittings upstream of the new force main tie-in connection location on the existing force main, existing force main drain connection with isolation valve, and appurtenance as required.
- D. The following index of this Section is presented for convenience:

Article	Title	Section Page
PART 1	GENERAL	1
1.1	Summary.....	1
1.2	Payment	2
1.3	Related Sections	2
1.4	References.....	2
1.5	Description	2
1.6	Quality Assurance	3
1.7	Submittals	3
1.8	Delivery, Storage and Handling	3
1.9	Spare Parts, Special and Supplies	3
1.10	Special Warranty Provisions/Guarantee Periods.....	3
PART 2	PRODUCTS.....	3
2.1	Manufacturers.....	3
2.2	Materials/Equipment.....	3
PART 3	EXECUTION	4
3.1	Examination/Preparation	4
3.2	Installation.....	5
3.3	Field Testing/Quality Control.....	5
3.4	Startup/Demonstration	5
3.5	Adjusting/Protection/Cleanup	5

1.2 PAYMENT

- A. There is no separate payment provision for this Section.

1.3 RELATED SECTIONS

- A. Section 03 30 00 – Cast-in-Place Concrete
- B. Section 31 23 16 – Excavation
- C. Section 31 23 19 – Dewatering
- D. Section 40 05 06 – Couplings, Adapters, and Specials for Process Piping.

1.4 REFERENCES

- A. American Society of Mechanical Engineers (ASME)
 - 1. B16.1 Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125 and 250
 - 2. B16.34 Valves-Flanged, Threaded, and Welding End.
- B. American Society for Testing and Materials (ASTM)
 - 1. A126 Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings
 - 2. A193 Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
- C. American and Steel Institute (AISI)
 - 1. 1144 Carbon Steel

1.5 DESCRIPTION

- A. Performance Requirements
 - 1. The existing force main from the existing Crotonville Pumping Station is a critical facility in the County's wastewater collection system and cannot be taken out of service. Short duration shut downs for line stop plugging devices insertion and removal only may be achieved with close coordination with the Engineer and Owner.
 - 2. Contractor shall retain the services of a Professional Engineer Licensed in the State of New York to design anchors necessary for the Line Stop Bypass System specifically proposed by the Contractor for this project.
 - 3. Bypass duration shall be as required to complete the work for installation of the new 16" gate valve on the discharge header within the existing pumping station, as shown on Contract Drawings.
 - 4. Existing force main has a static operating pressure of 80 psi.
- B. Description of Existing Crotonville Pumping Station Force Main:
 - 1. Material: 24 inch diameter ductile iron, Class and restraint unknown
 - 2. Interior coating: cement lined
 - 3. Exterior coating: asphaltic
 - 4. Age: 45 years old

1.6 QUALITY ASSURANCE

A. The Line stop contractor's Qualifications:

1. Contractor shall have a minimum of 5 years of experience in the installation and operation of similar sized line stopping assemblies.

1.7 SUBMITTALS

A. Prepare and submit a bypass plan for review by Engineer and Owner minimum of 45 days prior to mobilization of any line stop bypass system equipment. Plan shall include but not be limited to the following:

1. Locations, elevations, and materials for line stop bypass system components.
2. Plans showing staging areas for line stop bypass piping.
3. Line stopping procedures.
4. Quantity, size, material, location and method of installation of line stops and bypass piping.
5. Any temporary pipe supports and anchoring requirements, including thrust and restraint block sizes and locations.
6. Details to demonstrate the integrity of all line stop bypass system components including piping and fittings.
7. Schedule for mobilization, installation and demobilization of the line stop bypass system.

B. Contractor qualifications

1.8 DELIVERY, STORAGE AND HANDLING

A. Not used.

1.9 SPARE PARTS, SPECIAL AND SUPPLIES

A. Not used.

1.10 SPECIAL WARRANTY PROVISIONS/GUARANTEE PERIODS

A. Not used.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The line stop bypass system shall be furnished, installed and removed by one of the following manufacturers:

1. Garrison Enterprises, Inc, Vineland, NJ
2. Or approved equal.

2.2 MATERIALS/EQUIPMENT

A. Line Stop Fitting and Accessories

1. Line stop fitting shall be a full encirclement, split tee type consisting of an upper and lower saddle halves bolted together.
2. Saddle plates shall be carbon steel ASTM A283 Grade C with a minimum thickness of 0.375 inches. Plates shall be shaped to be concentric to the outside of the ductile iron main. The smallest inside diameter of the saddle and interior rings shall exceed the outside diameter of the pipe by a minimum of 0.250 inches to allow for ovality of the main.
3. Upper saddle half shall consist of a saddle plate, line stop flange, and stop nozzle. Fitting interior shall be grooved to retain a gasket to provide a seal between saddle plate and exterior of the force main
 - a. Line stop flange shall be machined from a 150 lb. forged steel flange (ASTM A181 or A105) or from pressure vessel quality steel plate (ASTM A285, Grade C); flat faced and drilled per ANSI B16.5. Line stop flange shall be securely welded to the nozzle and bored to receive the completion plug and the circumferential gasket of the stop machine plugged head.
 - b. Line stop nozzle shall be carbon steel ASTM A283 Grade C with a minimum thickness of 0.375 inches and be securely welded to the saddle plate. Line stop nozzle shall be located between the upper saddle and the flange.
4. Lower saddle plate shall be shaped to be concentric to the outside brackets shall match upper half.
5. Bolt, nut or stud, nut, and washer assemblies shall be furnished to draw the upper and lower saddles together for sealing. Bolting brackets shall be gusseted.
6. All steel shall meet the requirements of ASTM A36, as a minimum. All weldments shall be braced and stress relieved.
7. All bolts, studs and nuts shall be of the heavy series. Bolts shall be type 304 stainless steel.
8. Gaskets shall be molded from elastomer compounds that resist compression setting and are compatible with raw sewage in the 32 to 140 degree F temperature range.
9. Completion plug shall be machined from a stress relieved carbon steel weldment. It shall contain two circumferential grooves: one to receive the locking devices from the stop flange, and the second to contain a compressible "O" ring to seal pressure tight against the bore of the flange.
10. Blind flange shall have facing and drilling compatible with that of the line stop fitting flange and have a minimum thickness in accordance with AWWA C207, Class D.
11. Tapping sleeve and valve for bypass drain shall be in accordance with XXX. Drain valve shall be 6" Resilient wedge NRS tapping valve with fusion bonded coating in accordance with AWWA C 515 and C-550. The outlet of the valve shall be sealed with mechanical joint plug at completion of the bypass. Contractor shall have the option of recovering the drain valve by using a line stop type fitting with a completion plug and blind flange or abandoning the valves by leaving them attached to tapping sleeve.

PART 3 - EXECUTION

3.1 EXAMINATION/PREPARATION

- A. Contractor shall complete test pits at proposed line stop taps and force main tie-in locations to field verify force main condition, dimensional data including calipering the pipe O.D. to

determine ovality, joint locations, presence of any service connections, or adjoining utilities, and any other data required for ordering and installation of Line Stop Bypass System and force main tie-in connection.

- B. Contractor shall complete ultrasonic testing of existing force main at proposed line stop taps and force main tie-in locations to confirm force main wall thickness, uniformity, and structural integrity.
- C. Notify Owner and Engineer 7 days prior to scheduling of line stop bypass system installation.
- D. All equipment, line stop bypass system components and materials shall be onsite prior to commencement of any installation work associated with the line stop bypass system.

3.2 INSTALLATION

- A. Line stop bypass system shall be installed in accordance with manufacturer's requirements and recommendations, and approved work plan. The equipment shall consist of a full size, solid plugging head attached to a carrier body. The body is advanced and retracted from the main by means of a linear actuator. When retracted, the plugging head and carrier are housed in an adapter, bolted tight between the tapping valve and the actuator. The line stop contractor shall supply all temporary valves, equipment, and materials to install, remove, and permanently seal the line stop. Use clean water introduced through the drain valve to install the completion plug.
- B. Install any temporary pipe supports and anchoring requirements, including thrust and restraint concrete slabs, pipe collars and blocks prior to mounting temporary tapping valves and tapping machinery.

3.3 FIELD TESTING/QUALITY CONTROL

- A. Provide drain connection to confirm adequacy of bypass system prior to dismantling existing piping in the pumping station.
- B. Perform leakage and pressure tests of tapping sleeves and tapping valves using clean water prior to tapping the existing force main.
- C. Pressure and leakage test shall be conducted at 150 psig for a period of two (2) hours. No leakage is permitted.
- D. Provide Owner and Engineer 48 hours' notice prior to testing.

3.4 STARTUP/DEMONSTRATION

- A. Not used.

3.5 ADJUSTING/PROTECTION/CLEANUP

- A. Include provisions to maintain vehicular and pedestrian access, avoid damage to public and private property, and prevent leakage from hoses and piping.
- B. Immediately remove and dispose of all wastewater and offensive matter spilled during bypass operations at Contractor's expense.
- C. Repair any damage to public or private property caused by bypass system operations.

- D. Immediately notify Engineer and Owner if a spill occurs and take necessary action to clean up and disinfect spillage to satisfaction of Engineer and Owner and/or other governmental agencies.
- E. Contractor shall not be permitted to overflow, bypass, pump or otherwise convey drainage to any land, street, storm drain or water course.
- F. Cease bypass operations and return flows to normal configuration when directed by Engineer.
- G. When bypass operations are complete, flush bypass piping with fresh water and drain into Owner's wastewater system prior to disassembly.

END OF SECTION

SECTION 40 61 00

PROCESS CONTROL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes general requirements for the hardware associated with the Process Control System (PCS), as specified and as shown on the Contract Drawings.
- B. Equipment furnished shall be installed in an industrial type environment and powered from an electrical source that may include harmonic distortion, surges, sags, and other electrical noise under normal operating conditions. All equipment furnished shall function correctly in an environment where electrical noise, of the types referenced, are common during normal operations. If the equipment is found to be unable to operate in this environment, furnish additional and/or replacement equipment, surge protection, power line conditioners, UPS, or other equipment required to correct this problem, at no additional cost to the Owner.
- C. Obtain the services of an Instrumentation and Controls subcontractor, as specified in Section 40 61 13 CONTROL SYSTEM INTEGRATOR, who shall be responsible for the coordination, supply, and integration of the equipment specified herein. This subcontractor shall be referred to as the Control Systems Integrator (CSI).
- D. The CSI shall have total responsibility for the design, fabrication, configuration, testing, start-up, and implementation of all equipment specified herein and as shown on the Contract Drawings.
- E. Programming of the PLC, OIT and SCADA systems shall be completed by the Owner or the Owner's programmer.

1.2 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American National Standards Institute (ANSI)
 - 2. Institute of Electrical and Electronics Owner's Representatives (IEEE)
 - 3. International Society of Automation (ISA)
 - 4. National Electric Manufacturers Association (NEMA)
 - 5. National Electrical Code (NEC)
 - 6. National Electrical Testing Association (NETA)
 - 7. Underwriters Laboratories, Inc. (UL)
- B. Related Specification Sections
 - 1. Division 01 sections

- 2. Division 26 sections
- 3. Division 40 sections
- 4. Contract Drawings

1.3 COORDINATION

- A. Division 40 Sections for PCS integration and coordination requirements.
- B. Coordinate the size of each control enclosure and the quantity of control enclosures that are required at each location with all equipment and materials to be installed.

1.4 SUBMITTALS

- A. Submit the following in accordance with the Division 01 Requirements and supplemental requirements specified herein.
- B. Prior to obtaining any control material, detailed shop drawings on the material shall be submitted.
- C. Compliance Statement: Provide a Compliance Statement listing each Specification Section, and Part 1, 2, and 3 Sub-Sections, stating, paragraph-by-paragraph, compliance with the Specification, each minor nonconformity that is within the intent of the Specification, and proposed non-conformities. Provide a short description of minor non-conformities and detailed explanation of other non-conformities
- D. Shop Drawings
 - 1. Each component shall include manufacturer's model number, device designation consistent with Contract Drawings and quantity.
 - 2. Terminal block wiring layout showing numbered terminal block layout with connected wiring identified. Show field wiring as dashed.
 - 3. Product Data
 - a. Product Data: "Catalog cuts" and spec sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.
 - b. Submit technical data specifically prepared for the equipment being furnished including component data sheets, schedules, layouts, elevations, wiring diagrams, loop diagrams, manufacturer's instructions and similar information pertinent to the supplied system and components.
 - c. Submittals for individual pieces of equipment shall include quantity supplied and the instrumentation tag ID's or other identifying information if a tag ID is not applicable.
- E. Operation and Maintenance Data
 - 1. Submit Operation and Maintenance Manuals in accordance with Division 01, Section 40 71 00 INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS and supplemental requirements specified herein.

- F. Closeout Submittals
 - 1. Operation and Maintenance Manuals: Installation instructions, Configuration and setup instructions, Quick start guides, and User Manuals.
 - 2. Warranty Documentation: Start date, duration, conditions, manufacturer contact information, local vendor or support representative contact information.
 - 3. Sustainable Design Closeout Documentation.
- G. All tools, information and equipment required to fully maintain or modify the provided instrument shall be provided.

1.5 QUALITY ASSURANCE

- A. Reference Standards: Comply with all Federal and local laws or ordinances, as well as all applicable codes, standards, regulations and/or regulatory agency requirements including the partial listing below:
 - 1. Joint Industrial Council (JIC) Standards.
National Electrical Code (NEC).
 - 2. National Electrical Manufacturer's Association (NEMA) Standards.
Local and State Building Codes.
 - 3. Occupational Safety and Health Administration (OSHA) Regulations.
- B. All electrical materials and equipment shall be new and shall bear the label of the Underwriters Laboratory (UL), Inc., Factory Mutual (FM) or equivalent where standards have been established and label service regularly applies.
- C. Equipment not specifically described or identified by manufacturer's catalog numbers shall be designed in conformity with ANSI, IEEE, ISA, JIC, NEMA, and other applicable technical standards. The work shall have neat and finished appearance.
- D. Equipment shall be installed as recommended by the manufacturers.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Temporary storage of instruments shall be in clean dry indoor rooms with a temporary dehumidifier and electric heating to maintain the storeroom between 5 and 40 °C, with humidity less than 90%. Comply with manufacturer's additional written instructions for storing and periodic inspection and testing.
- B. Handle instrumentation materials and equipment in conformance with the manufacturer's written instructions.
- C. Deliver, store and handle of components and hardware in compliance with specified below:
 - 1. Receive panel mounted components and equipment to be installed inside enclosures, panels or consoles and install them as recommended by panel manufacturer's requirements.
 - 2. All equipment and materials shall be packaged at the factory to protect each

item from damage during shipment and storage.

3. Mount consoles, panels, or cabinets on skids for shipment.
4. Provide other blocking and cushioning material as required to prevent damage during shipment.
5. Provide temporary lifting lugs on each shipping package.
6. Include approximately one pint of touch-up paint for each finish color in shipment.
7. Do not ship enclosure to job site until the environment where the enclosure will be installed is as it will be at the conclusion of the Project.
8. Contractor shall coordinate the Work with any Work under this and other Contracts which may be in progress and could affect the installation and locations of the control enclosures.

1.7 WARRANTY

- A. Provide parts and labor warranty in accordance with the Division 01 and with the requirements herein.
- B. Provide an on-site parts and labor warranty for a minimum period of one year after Substantial Completion for all instruments. In cases where the manufacturer offers a longer warranty period, the longer warranty period shall apply as described by the manufacturer.
- C. All equipment not fully functional at the time of Substantial Completion shall have warranties extended to provide minimum one year coverage after making the instrument operational, unless otherwise approved by the Owner's Representative.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Refer to Section 40 90 00 INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS for requirements that apply here.
- B. Programmable controllers to be installed inside the enclosures shall be such that connections can be easily made and so that there is ample room for servicing each item.
- C. Support and restrain components to prevent any movement.
- D. Provide useful space and power supply capacity as spare for future expandability to a minimum of 1 item per item-type installed or 20% of quantity of each type-item installed, whichever yields the greater spare space.

2.2 PERFORMANCE

- A. PLCs and its hardware shall perform process control and monitoring function and allow remote monitoring. General requirements include:
 1. Receive analog data (via 4-20mA hardwired I/O), convert to Engineering Units

- (EU), process for alarms and reasonability checks and store.
 - 2. Receive digital data (hardwired I/O), check for alarm and status change and store.
 - 3. Perform control calculations, including software PID control based on system parameters and real-time data and output properly conditioned control commands.
 - 4. Perform sequential control functions and timing functions
 - 5. Respond to operator requests for displays, control commands and data.
 - 6. Communicate process data with Operator Interface Terminals (OIT) via Ethernet TCP/IP.
- B. The PLC-based controls for the system shall be based on an open programming environment which allows the Owner to make changes after the initial warranty period ends. The manufacturer shall provide complete and unprotected electronic copies of the PLC logic and OIT programs to the Owner following the operational testing period.

2.3 SOURCE QUALITY CONTROL

- A. Equipment shall be manufactured and assembled in accordance with the factory quality certification documents.
- B. Equipment shall be factory tested in accordance with manufacturer's standard inspections and tests.
 - 1. Fully assemble and test each PLC at the factory prior to shipment.
 - 2. As a minimum, test all I/O for conductivity and demonstrate that all specified functions can be performed.
 - 3. Notify the Engineer at least ten working days in advance of testing of all panels so the Engineer may observe testing if they elect to do so.

2.4 SPARE PARTS

- A. Provide the following spare parts, packaged in their original unopened boxes, for use by the Owner.
 - 1. (1) Surge Suppressor
 - 2. (2) Signal Surge Suppressor of each type supplied
 - 3. (1) Power supply of each type supplied
- B. All equipment shall be provided with one (1) set of bulbs, fuses, etc., necessary for continuous and accurate operation.
- C. Spare parts shall include all parts normally provided by the manufacturer for systems of similar size, construction, and purpose.
- D. All spare parts shall be packaged in separate containers with the part name and number clearly marked.

- E. Package spare parts in boxes, labeled with the manufacturer's name, address and telephone number; local representative's name, address and telephone number; name of equipment the parts are for and list of parts contained therein.
- F. All spare parts shall be included in the base bid.

2.5 PRODUCT

- A. Digital Indicator
 - 1. Panel mounted digital process display meter with universal inputs, DC current, DC voltage, resistance RTD or process signals.
 - 2. 5 digit dual line display with 0.7" digits.
 - 3. Sunlight readable display; variable intensity display.
 - 4. 50 to 250 VAC, 60Hz, 14 VA.
 - 5. Dual Form C output relays (5A @ 240 VAC)
 - 6. Retransmitted analog output.
 - 7. NEMA 4X/IP65 sealed front bezel.
 - 8. Manufacturer:
 - a. Red Lion
 - b. Precision Digital
 - c. Or equal
- B. Ethernet Switches (PLC)
 - 1. 10/100Base-T (RJ-45) auto-sensing, with a MDI-MDIX or automatic sensing uplink port to connect to other devices.
 - 2. Switched 10/100 ports that run at 10Mbps, 20Mbps, 100Mbps, or up to 200Mbps, providing dedicated bandwidth in Half or Full-Duplex modes.
 - 3. NWAY Technology that detects cabling type, speed, and Duplex mode. Compatible with all major network operating systems.
 - 4. Advanced "store-and-forward" packet switching to optimize data transfers. "Auto partitioning" to protect the system from downed network lines.
 - 5. Signal regeneration to ensure data transfer integrity. Large enough to accommodate 25% future connections.
 - 6. Industrial grade, rugged.
 - 7. Provide media converters as required for application.
 - 8. Manufacturers:
 - a. N-Tron
 - b. Phoenix Contact
 - c. Sixnet
 - d. Or Equal
- C. Power supplies

1. 24-Volt DC Power Supply adequately sized to provide power to field instruments and cabinet components as required with an additional 50% spare capacity.
2. Provide all power distribution equipment, overcurrent, and short circuit protection required to meet NEC and UL 508A requirements.
3. Fully enclosed, touch-safe DIN rail mounted, UL 508 Listed and CE approved.
4. Removable, pluggable connections for input and output power.
5. Provide a dry contact output for power supply failure.
6. Performance:
 - a. Output Voltage - 24 VDC +5 percent adjustable.
 - b. Overload Protection - Current limited to a preset value.
 - c. 86 percent efficient.
 - d. Temperature range: -20 to 50 degrees C.
 - e. Mean lifetime of 500,000 hours.
 - f. Two-year warranty.
 - g. Ripple and Noise - 24 mV RMS, 200-mV peak to peak.
 - h. Accept input voltages of both 120 VAC and 240 VAC.
7. Manufacturer/Model:
 - a. Phoenix Contact
 - b. Or Equal

D. Cellular Router (Allowance Item)

1. Intelligent 4G LTE router for industrial applications. Verizon Carrier.
2. Shall provide a secure, reliable connection to industrial controllers, process automation equipment.
3. License-free enterprise software: VPN, firewall, logging and authentication
4. Ethernet, serial I/O and Modbus bridging for connecting diverse field assets
5. Ports: (2) RJ-45; 10/100 Mbps (auto-sensing), (1) DB-9; DCE, RS-232/422/48
6. Power: 9 – 30 VDC
7. Temperature: 32 to 105 degF
8. Manufacturer: Digi Transport WR31

E. Fire Wall (Allowance Item)

1. Highest performance Unified Threat Management (UTM) firewall that provides native VPN for remote access.
2. Advanced networking features such as IPSec and SSL VPN, multiple ISP failover, load balancing, optional integrated 802.11n wireless and network segmentation.
3. Power: 100-240 VAC, 60Hz, 1A
4. Temperature: 32 to 105 degF

5. Manufacturer: SonicWall TZ Series

F. Racks

1. Provide a 2-post, 12U, 19-inch wide equipment rack for Network Equipment.
2. Equipment rack size shall be standard 19" EIA compliant server rack.
3. Equipment rack shall be floor mounted and shall be secured to ladder rack at top to provide stability.
4. Provide two 6.7 inch vertical wire managers on each side of the equipment rack.
5. Provide 2U horizontal wire managers, front and back, finger type.
6. Provide two (2) 20A, 120V, dedicated quad receptacles to equipment rack.
7. Each rack shall have 2 sets of vertical rails, adjustable in 1 inch increments.
8. Manufacturer:
 - a. Kendall Howard
 - b. Or Equal

G. UPS

1. Provide individual UPS systems for Tank Panel and Network Panel.
2. All PCS equipment (PLCs, OITs, SCADA computers, monitors, communications equipment, etc.) and all analyzers, transmitters, and PLC I/O (except motors) shall be powered from Uninterruptible Power Sources located in the same cabinet(s) or location, capable of powering 100% load for at least 15-minutes during power outages and power transfers to emergency power.
3. Utility power (interior light, utility receptacles) is not to be powered from the UPS.
4. Provide UPS with relay interface card for status and alarming.
5. Compact design with a wide operation temperature range.
6. Manufacture/Model:
 - a. Liebert
 - b. APC
 - c. Powerware
 - d. Or Equal

H. Surge Suppressors

1. Provide I/O surge suppression for all discrete and analog signals terminating or originating out of doors or in other buildings.
2. Surge suppressors shall be provided on all DC operated relay coils to minimize the high transient voltages generated when the circuit to the operating coil is opened.
3. Power line surge protectors shall be provided to protect equipment from transients on the AC power line. Surge Protectors shall meet the requirements of ANSI/IEEE C62.41. They shall be of the type required to protect equipment installed in an industrial environment

PART 3 - EXECUTION

3.1 GENERAL

3.2 EXAMINATION

- A. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- B. Examine roughing-in of equipment to verify the following:
 - 1. Environmental conditions are within the limitations established by the manufacturer.
- C. Verify that ground connections are in place and that installation of grounding described in Section "Grounding" is complete.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Install equipment as shown on the Contract Drawings and in accordance with the manufacturer's installation instructions and recommendations.
- B. Erect equipment in neat and workmanlike manner; align, level and adjust for satisfactory operation. Install so that parts are easily accessible for inspection, operation, maintenance and repair. Equipment shall be mounted upright, vertical, at eye level, and in locations easily and safely accessible. Minor deviations from indicated arrangements may be made, but only after obtaining approval from the Owner's Representative.
- C. Equipment shall be solidly grounded with an equipment grounding conductor as specified in Section "Grounding" and as recommended by the manufacturer. Control panels and instruments shall be grounded at the power supply end using a ground wire pulled with the power wires.
- D. Furnish and install all mounting stands, supports structures, brackets and accessories as required or detailed for the installation of the equipment furnished. Unless otherwise specified or required, supports shall be galvanized steel. All mounting hardware shall be stainless steel. Equipment mounted on walls in contact with soil or water shall be mounted offset from the wall a minimum of ¼-inch.
- E. Cutting and drilling of existing panels for new equipment as shown, specified, or required, shall include repair and touch up painting of panel after installation.

3.4 FIELD QUALITY CONTROL

- A. Prepare and perform Acceptance Tests as outlined in Section 40 71 00 INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS and in accordance with the requirements herein.
- B. Prepare for Acceptance Tests as follows:

1. After installing equipment but before power supply is energized, verify that grounding system is completed.
 2. Verify that equipment is installed and connected according to the Contract Documents.
 3. Verify that electrical wiring installation complies with manufacturer's submittal by means of point-to-point continuity testing.
 4. Verify that field-installed power and control wiring complies with the Electrical Specification requirements.
 5. Confirm that field wiring is terminated to the proper device, on the proper terminal, and identified with the appropriate wire number according to the drawings.
 6. Verify that equipment is ready for pre-commissioning checks in accordance with manufacturer's written instructions.
- C. Acceptance Tests: After installing equipment and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements as follows:
1. Perform visual and mechanical inspection and electrical tests, as it applies to all installed systems and devices.
 2. Verify the proper voltage at each powered circuit and each device.
 3. Verify that the PLC input and output modules in each panel are functional and configured correctly in the PLC program. Each PLC input and output channel, including spares, is to be tested.
 4. IO testing procedure will encompass the entire loop, from field devices to the PLC to the OIT/SCADA system, using manual control functionality.
 - a. Digital inputs (push buttons, selector switches, position switches, etc.) will be actuated in the field and confirmed at the PLC input as well as change in state (color or text) on the OIT.
 - b. Digital outputs (motors, relays, solenoids, etc.) will be energized via the OIT and confirmed via proper change in state of the final control element in the field, as well as change in state (color or text) on the OIT.
 - c. Analog inputs (transmitters) will be tested using actual process conditions, whenever possible. Verify that scaling is correct and the appropriate value is displayed on the OIT.
 - d. Analog outputs (valve position, VFD speed control, etc.) will be ramped from 0-100% or a step change output of 50% and 100% via the OIT. Response will be confirmed via proper change in state of the final control element in the field, as well as displaying the proper feedback on the OIT.
 5. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.5 MANUFACTURER'S FIELD SERVICES

- A. Provide the services of a factory-authorized service representative as outlined in Section 40 71 00 INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS and in accordance with the requirements herein.

3.6 OPERATION & MAINTENANCE MANUALS

- A. Prepare O&M Manuals as specified in Section 40 71 00 INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS and in accordance with the requirements herein.

3.7 DEMONSTRATION AND TRAINING

- A. Demonstrate and train Owner as specified in Section 40 71 00 INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS and in accordance with the requirements herein.
- B. Final Acceptance – Include 2 days of a qualified field technician's time to test equipment to demonstrate items below. Time for final acceptance shall be additional to other on-site time.
 - 1. The CSI shall be capable of performing these services without remote technical support. Services shall be scheduled by the Engineer in writing and shall be performed within four weeks of the Engineer's request. This on-site time may be requested to be split up into separate day-long visits and do not count towards, and may not be combined with, other on-site time specified herein.
- C. Training – Integrate the following training topics into the specified training sessions:
 - 1. Identification of each component of the Process Control Hardware.
 - 2. Identify incoming sources of power and instruct on how to disconnect AC power, including bypassing and discharging the UPS.
 - 3. DC Power Supply Troubleshooting – Describe methods to troubleshoot power supply operation, including measuring output voltage and comparing to required voltage. Define indicator light functions.
 - 4. PLC CPU, Communication Modules, and I/O Modules – Identify each component and detail their purpose integrating As-Builts into the training. Demonstrate how to ascertain when discrete signals are energized, when analog signals are open loop, and identifying indicator light functions.
 - 5. Ethernet Switch Troubleshooting – Identify indicator lights and how to access Ethernet switch's web utility for troubleshooting. Identify indicator lights and, using the link and activity lights, instruct on how to identify a disconnected link and how activity lights display when properly functioning.
 - 6. Procedures shall be physically performed rather than discussed in theory.

END OF SECTION

SECTION 40 61 13**PROCESS CONTROL SYSTEM INTEGRATOR****PART 1 - GENERAL****1.1 SUMMARY**

- A. This Section includes the requirements for the Contractor to obtain the services of an instrumentation and controls subcontractor. This subcontractor is referred to as the Control Systems Integrator (CSI).
- B. The CSI shall have total responsibility for the design, fabrication, configuration, calibration, testing, start-up, and implementation of the Process Control System (PCS), PCS cabinets, instrumentation configuration, and designated control panels as specified herein.
- C. The CSI shall meet with the Contractor, owner and Engineer to arrange and coordinate work efforts as described herein.
 - 1. The CSI shall supply, configure, and commission all instrumentation, instrumentation equipment, and components not supplied by equipment vendors (as shown on the drawings).
 - 2. Vendor-supplied instrumentation equipment and components, VFCs, motor starters/controllers, valve actuators, and other process control and monitoring equipment shall be configured by the individual Vendors in accordance with the Specification. Wiring from PCS Cabinets to process control and monitoring equipment shall be in conformance with the Loop Diagrams supplied by the CSI.
 - 3. CSI shall coordinate with the specific vendors to provide a seamless communications between systems and allow for full monitoring and control from SCADA systems.
- D. Programming of the PLC, OIT and SCADA systems shall be completed by the Owner or the Owner's programmer. The CSI shall coordinate with the Owner's programmer to complete all project requirements.

1.2 RELATED DOCUMENTS

- A. Drawings and general Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.3 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American National Standards Institute (ANSI)
 - 2. American Society for Testing Materials (ASTM)
 - 3. Institute of Electrical and Electronics Engineers (IEEE)
 - 4. International Society of Automation (ISA)
 - 5. National Electric Manufacturers Association (NEMA)
 - 6. National Electrical Code (NEC)
 - 7. Underwriters Laboratories, Inc. (UL)

- B. Related Specification Sections
 - 1. Division 26 sections
 - 2. Division 40 sections
 - 3. Contract Drawings

1.4 COORDINATION

- A. Review the contract requirements of the materials and equipment specified under Division 40, 41, 43, 44, and 46 for installation and interfacing with Plant SCADA.
- B. Coordinate the installation and interfacing requirements among the instruments and all control items shown in the Contract Drawings.
- C. Coordinate with other Contracts for process and utility services piping (air, water, etc.) to and away from instruments.
- D. Coordinate process requirements(s), electrical connection(s), and ranges for the instruments and all control items shown in the Contract Drawings.
- E. Coordination, preparation, assembly and submission of all submittals for items furnished and Work performed under this Contract.

1.5 MEETINGS

- A. The CSI shall perform the detailed integration and coordination of the control systems and furnish instrumentation equipment in accordance with this specification. As part of this coordination, the CSI is responsible for scheduling, organizing, host, and documenting meetings with Contractors, Vendors, Engineer and Client for the sole purpose of providing a full functioning process control system.
- B. Coordination with Process Mechanical Equipment Manufacturers
 - 1. Coordinate with process mechanical equipment manufacturer's in order to obtain control system requirements and special control components. The CSI shall review and coordinate with the equipment manufacturer's submittals.
 - 2. The Engineer and Resident Engineer are not required to supply information to the CSI that is available from within this project's contract, including supplier information, when the CSI is capable of obtaining such information directly.
- C. Required Meetings
 - 1. Initial Coordination Meeting - Schedule, coordinate, and host an initial coordination meeting with the Contractor, Owner, and Engineer to review the scope and schedule of the project. The meeting shall be attended by the CSI project manager and all other parties that are involved in the integration of the control system. CSI shall come equipped with the approved Detailed Work Plan.
 - 2. Pre-Submittal Review Meeting - The Pre-submittal review meeting shall be held over 1, 4-hour meeting and shall be conducted within 30 working days of Contract award. Take minutes of the pre-submittal conference. The pre-submittal review meeting shall feature:
 - a. Task assignments, roles and responsibilities.
 - b. A list of equipment and materials required for the control system and the manufacturer's name and model number for each proposed item.

- c. A list of proposed outages. Outages may include:
 - 1) Power system outages associated with cut-over of equipment.
 - 2) Process equipment outages associated with the change-out of existing field instruments.
 - 3) Control system outages because of changes to PLC architecture or PLC communications architecture.
 - 4) Control system outages because of changes to software deployment and/or cut-over from existing PLC software to new PLC software.
 - d. A list of proposed clarifications to the Contract Documents along with a brief explanation of each item. Resolution shall be subject to a separate formal submittal and review by the Engineer
 - 3. CSI Progress Meetings
 - a. Schedule, coordinate, and host CSI-specific progress meetings during the course of the project to coordinate integration requirements with the equipment manufacturers, Contractors and Owner's Programmer. The progress meetings shall be held at an agreeable time for the Owner, Contractor, Programmer and Engineer.
 - b. Develop the meeting agenda and distribute to the attendees a minimum of three days prior to the meeting for review. Update agenda with reviewer's comments and come prepared to address attendee's questions. Provide copies of all handouts for all attendees.
 - c. The following topics shall be addressed by individual meetings to coordinate the work:
 - 1) Control System Integration Strategy
 - 2) CSI Project Plan
 - 3) Functional Description Review
 - 4) Initial Graphical Interface Screens
 - d. The CSI shall hold a minimum of 6 additional progress meetings at the project site to coordinate the work.
 - 4. Equipment Modifications Field Meetings - Schedule, coordinate, and host on-site meetings with the Contractor, Owner, and Engineer as required to overview modifications to existing equipment and systems. The meeting shall be attended by the CSI project manager and all other parties involved in the integration of the control system.
- D. The CSI shall take detailed meeting minutes (i.e., record of meeting discussions) for all meetings hosted by the CSI. Meeting minutes shall:
 - 1. Identify all topics of discussion and all pertinent details of each topic.
 - 2. Identify the party that is speaking for each topic and each statement that is recorded.
 - 3. Categorize statements as ideas or agreed-upon actions.
 - 4. Record meeting date(s) and time(s), as well as attendees of the meeting.
 - 5. Be distributed to the project team within three business days of the meeting date.

1.6 SUBMITTALS

- A. Submit the following in accordance with the Division 01 requirements and with the specifications herein.
 - 1. Prior to submitting any submittals in connection with the process control system, the CSI shall submit a preliminary submittal package consisting of **CSI**

- Qualifications, Project Plan and Coordination Drawings (Interconnection Wiring Diagrams)** in accordance with this section.
2. After preliminary submittal package has been approved, submit Detailed Shop Drawing Submittals, including, Equipment Data, Loop Drawings, Control Panel Drawings, and System Diagrams on the material specified.
 3. Provide **Program Development Submittals** at the various stages of the program to verify conformance to standards and guidelines specified herein or provided by the owner, at project kick off.
 4. Submit a **Testing and Demonstration Plan** for the control panel equipment and instrumentation furnished under this contract. Testing and demonstration shall include **Factory Acceptance Testing (FAT), Site Acceptance Test (SAT) and a Network Communications Test (NCT)**. After all test have been completed, submit a **Test Report** for each panel and instrumentation equipment tested.
 5. Submit **Operation and Maintenance Manuals** in accordance with Section 01 33 00 Submittal Requirements and in accordance with requirements of Section 40 90 00 Instrumentation and Control for Process Control Systems.
 6. Submit Final Process Control Documentation in addition to the O&M, including Calibration Reports, Final (as-tested) Program Development, I/O Lists, Instrument Lists, Alarm Setpoints and Equipment Parameters Lists.
- B. Compliance Statement: Provide a Compliance Statement listing each Specification Section, and Part 1, 2, and 3 Sub-Sections, stating, paragraph-by-paragraph, compliance with the Specification, each minor nonconformity that is within the intent of the Specification, and proposed non-conformities. Provide a short description of minor non-conformities and detailed explanation of other non-conformities
- C. Preliminary Submittal –
1. The **Qualifications Package** shall include the following information which shall be organized and formatted as follows:
 - a. Company Background - Provide a brief company overview detailing CSI's experience, capabilities, and available resources. Description of available resources shall include labor categories, staffing, equipment, material availability, testing equipment, and training staff and aids.
 - b. Experience in Water/Wastewater Applications - Provide a list and detailed description of recent (last 7 years) projects that the CSI has successfully performed. Each project shall be provided with the project duration and date of completion. At the Engineers discretion, the CSI may be required to provide as-built project documentation for complete system integration service experience for a minimum of three completed projects comparable in size, scope, and complexity.
 - c. Project Personnel Plan - Provide a brief project task list detailing the personnel to be utilized for engineering and design, fabrication, installation, startup, demonstration, and training for this project. Include personnel resumes for all personnel which will be performing services for this project. Provide name and resume for the proposed project manager for this project.
 - d. Quality Assurance Plan - Provide a brief summary of the CSI's in-place quality assurance plans for performing work from engineering through startup and training.
 - e. Facilities and Equipment - Provide a detailed list of office and fabrication space, location where fabrication of panels will take place, and available meeting facilities. List numbers and types of Computer Aided Drafting software and OITs that are available for this project.

- f. Maintenance – The CSI shall respond to a maintenance call within 4 hours, providing onsite normal maintenance services within 24 hours following a maintenance request, and emergency service within eight hours following an emergency service request. Maintenance call issues shall be resolved within 7 days. Normal and emergency maintenance service shall be made available 24 hours every day on a call basis for the warranty period. A point of contact and telephone number(s) shall be provided.
 - g. Reference Letters - Provide a minimum of five reference letters summarizing the CSI's performance on similar projects. Reference letters shall be from Contractors or Governments that have had contractual relationships with the CSI on specific projects.
- 2. The **Project Plan** shall describe the development of the Process Control System, complete with submittal and procurement schedule, progress meeting topics and dates, testing and delivery dates, project milestones.
- 3. Provide preliminary coordination drawings to include **Interconnection Wiring Diagrams** for CSI scope of work coordinated with the contract requirements, existing "As Built" documentation (if available) and existing PLC programs (if available). Interconnection Wiring Diagrams shall include the following as minimum.
 - a. Field wiring to components, regardless of whether or not the components are furnished by the CSI for panels and field devices furnished under this Contract. Indication of field wiring to components shall include terminations in intermediate terminal boxes, junction boxes (if applicable), field devices and instrumentation, control panels and equipment. Diagrams shall include terminal numbers for all new terminations to equipment. These drawings shall be signed during testing by the authorized person supervising the test.
 - b. Coordination drawings shall include interconnections to instrumentation not furnished by the CSI, such as valve limit switches, motor operators for valves, analyzers and other field devices. The scope of these drawings shall include any existing equipment to which new equipment shall interface, all equipment provided by the CSI, and equipment provided by the Electrical Contractor, Mechanical Contractor, and General Contractor of Contract 1, 2, 3 and 4 as specified in the Contract Documents. Loop Diagrams shall be marked "For Construction Coordination"
 - c. Coordinate with the Electrical Contractor to provide Control panel wiring diagrams for all control panels furnished for the project.
- D. Detailed Shop Drawings
 - 1. Instrumentation Equipment Datasheets
 - a. With each submittal, include a Compliance Statement listing each Specification Section, and Part 1, 2, and 3 Sub-Sections, stating, paragraph-by-paragraph, compliance with the Specification, each minor nonconformity that is within the intent of the Specification, and proposed nonconformities. Provide short description of minor nonconformities, and detailed explanation of other nonconformities
 - b. Each instrument shall include manufacturer's model number, device designation consistent with Contract Drawings and quantity.
 - c. Location of instrument if different that shown on the Contract Drawings.
 - d. Mounting details including location of anchoring flanges, holes and data on anchor bolt sizing and load carrying capacity.

- e. Terminal block wiring layout showing numbered terminal block layout with connected wiring identified. Show field wiring as dashed.
 - f. Product Data
 - 1) Product Data: "Catalog cuts" and spec sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.
 - 2) Submit technical data specifically prepared for the equipment being furnished including component data sheets, schedules, layouts, elevations, wiring diagrams, loop diagrams, manufacturer's instructions and similar information pertinent to the supplied system and components.
 - 3) Submittals for individual pieces of equipment shall include quantity supplied and the instrumentation tag ID's or other identifying information if a tag ID is not applicable.
 - g. Calibration Reports
 - 1) Provide calibration data as applicable to the instrument provided, showing the input value, output value and deviation percentage at 0, 25%, 50%, 75% and 100% of full capacity. Provide date and time of calibration.
 - 2) Report shall include as a minimum the following:
 - a) Project Name
 - b) Device Location
 - c) References
 - d) Tag
 - e) Manufacturer/Model
 - f) Manufacturer Serial Number
 - g) Test Equipment Type and ID Number
 - h) Date and Time Calibrated
2. Loop Diagrams
- a. A complete set of Instrument Loop Diagrams prepared in conformance with ISA-5.4-1991 with 5.2 Minimum Content Requirements and 5.3 Optional Content Information, showing all PCS components and wiring, as well as software addresses and communications links for those systems modified under this contract.
3. Control Panel Drawings
- a. Control panel general arrangement drawings, including plans, sections, elevations, internal layout, and door layout.
 - b. Submittals shall contain the NEMA type designation and manufacturer data describing the enclosures and showing its compliance with specifications and associated standards.
 - c. Complete bill of materials indexed to the control panel general arrangement drawings and wiring diagrams, with manufacturer's product data for each component. Indicate selections on manufacturer's catalog data sheets, and cross out inapplicable data.
 - d. Schematic wiring diagrams, including control elementary (ladder) diagrams, showing the following:
 - 1) Schematic (ladder) line numbers
 - 2) Relay contact reference line numbers (underline NC contacts)
 - 3) Wire numbers
 - 4) Device numbers
 - 5) Terminal numbers

- 6) Annotations of control switch action and relay logic names
 - e. Heat gain calculations showing adequate cooling capacity.
 - f. Uninterruptible power supply (UPS) size calculations showing connected load and runtime duration full load.
 - g. UL 508A (Industrial Control Panels) listing certificate.
- 4. System Diagrams
 - a. Provide a Local Area Network (LAN) Diagram. LAN Diagram shall show the topology and components that make up the network and how they interact. As minimum, LAN Diagram should contain the following:
 - 1) Include routers, hubs, firewalls, controllers (PLC), computers, servers, etc.
 - 2) Include device IP address, subnet and mask for all devices.
 - 3) Label devices and components, including wire types and communication protocols.
 - b. Multiple diagrams are acceptable. Organize multiple diagrams so that each captures a different aspect of the network.
 - c. Addressing:
 - 1) Coordinate all process equipment IP address (VFD, PLC, OIT, computers, switches, etc.) to be in the same physical layer.
 - 2) All IP addressing shall follow the Owner's IP address scheme, IT policies and practices.
 - 3) IP address assignment must be consistent and predictable. The device's address must not change and must survive node reset and/or cycling of power.

E. Program Development Submittals:

- 1. Provide intermediate program developments at the 30%, 90%, and 100% stages of development.
- 2. Preliminary Program Development Submittal (30%)
 - a. CSI shall provide a detailed summary outline defining the Graphic Screens for the SCADA Workstations. The outline shall include a hierarchy format with a navigation plan for accessing each individual screen.
 - b. Provide sample screens for a typical Equipment Display, and Equipment Parameter Display in color hardcopy drafts.
 - c. Provide samples of PLC ladder logic, register configuration and ordering of I/O.
- 3. Intermediate Program Development Submittal (90%)
 - a. The Intermediate submittal shall be submitted prior to the Software Factory Acceptance Tests specified herein. The Intermediate submittal shall incorporate the Engineer's and Owner's comments pertaining to the preliminary Program Development Submittal.
 - b. The Intermediate submittal shall include sample screens for all graphic display screens required for the system. Sample screens shall be color, hardcopy drafts.
 - c. Submittal shall include preliminary control logic for PLC, including preliminary documentation.
- 4. Pre-Final Program Development Submittal (100%)
 - a. Pre-Final submittal shall be submitted prior to the system testing periods specified in the General Conditions. The Pre-Final Submittal shall incorporate the Engineer's and Owner's comments and modifications agreed upon during the Factory Test.

- b. Pre-Final submittal shall include PLC program ladder logic, all screens developed for the SCADA workstation and OIT graphics, and all software documentation.

F. Testing and Demonstration

1. Submit a testing schedule and agenda for all factory testing of panels and associated PLC programming, OIT programming, OIT graphics development and SCADA graphics development.
 - a. The schedule shall list the location of panel fabrication, the location that the test will be conducted at, and the date the test will be conducted.
 - b. Schedule shall be submitted a minimum of 8 weeks prior to conducting actual testing. Where revisions to the dates contained in the schedule become necessary, the CSI shall submit revised dates a minimum of seven calendar days prior to conducting actual tests.
 - c. All tests shall be subject to observation by the Owner or designated representative.
2. Factory testing is described in Section 40 80 00.
3. Factory test reports shall be submitted for each panel tested.
 - a. Test report shall include date and time of test, personnel conducting test, personnel witnessing test, name of panel and fabricator, location of test, test equipment utilized, and a detailed description of the actual tests performed.
4. Site Acceptance Test and Demonstration
 - a. Submit a testing and demonstration plan for the equipment and instrumentation that is furnished by the CSI. The plan shall consist of two main components, 1) testing and 2) demonstration. Both testing and demonstration shall include individual field devices, individual pieces of equipment, and systems.
 - b. Testing and demonstration of the components, equipment and systems shall include details of staff to be used, testing equipment to be used, listing of equipment and systems to be tested, and a detailed description for testing.
 - 1) Testing shall include final testing of calibrated ranges and actuation settings of instrumentation and field devices, testing of panel mounted controls and control stations, and testing of interlocks, status indication and alarms between panels and systems.
 - c. The demonstration plan shall be similar to the testing plan in that the same tests shall be performed for the demonstration as were performed during testing.
 - 1) Testing shall include final testing of calibrated ranges and actuation settings of instrumentation and field devices, for the purposes of demonstrating the operation of the individual pieces of equipment, instrumentation and systems.
 - 2) Assume the Owner will be witnessing the tests.
 - 3) The CSI shall notify the Owner in writing a minimum of 14 days prior to performing demonstration of operation of the equipment and systems.
5. Site Acceptance testing is described in Section 40 80 00.
6. Site Acceptance test reports shall be submitted for each panel tested. Test report shall include date and time of test, personnel conducting test, personnel witnessing test, name of panel and fabricator, location of test, test equipment utilized, and a detailed description of the actual tests performed.

G. Operation and Maintenance Data

1. Submit Operation and Maintenance Manuals in accordance with Division 01 and with the requirements specified herein.
 2. Bind items (clean, and legible) in common folder or heavy notebooks cover and submit to Engineer before request for final acceptance.
 - a. Instrument equipment installation instructions, Configuration and setup instructions, Quick start guides, User Manuals.
 - b. Manufacturer's instructions on care and operation of equipment.
 - c. Wiring diagrams incorporating all field changes and Engineer's comments.
 - d. Complete typewritten operating instructions, covering all system descriptions and operation, emergency operating instructions and precautions.
 - e. Name, address and telephone number of supplier or representative of manufacturer for each item of equipment in Contract.
- H. Final Process Control (Closeout) Documentation
1. In addition to the requirements listed under Operation and Maintenance section, the CSI shall submit the following.
 - a. Warranty Documentation: Start date, duration, conditions, manufacturer contact information, local vendor or support representative contact information.
 - b. Software: Vendor, Manufacturer, and Contractor supplied.
 - c. Lists - Final submittal shall incorporate all modifications and changes made during field testing.
 - 1) I/O lists,
 - 2) Instrument Lists
 - 3) Alarm Setpoints
 - 4) Instrument Parameters Lists
 2. Record Drawings - Final submittal shall incorporate all modifications and changes made during field testing.
 - a. Contract Drawings
 - b. Control Panels Drawings
 - c. Wiring Diagrams
 - d. Loop Drawings
 - e. System Diagrams
 3. Application - Final submittal shall incorporate all modifications and changes made during field testing.
 - a. Final PLC Program Submittal (As-Tested) in its native format and in pdf.
 - b. Final OIT Program Submittal (As-Tested) in its native format and in color copies.
 - c. Final SCADA Submittal (As-Tested) in its native format and in color copies
 4. All tools, information and equipment required to fully maintain or modify the provided instrument shall be provided.

1.7 QUALITY ASSURANCE

- A. Reference Standards: Comply with all Federal and local laws or ordinances, as well as all applicable codes, standards, regulations and/or regulatory agency requirements.
- B. The CSI shall be regularly engaged in the business of instrumentation and controls and shall be responsible for the design, coordination, and installation of the equipment specified herein.

- C. The CSI shall demonstrate the requisite resources of in-house staff, facilities and finances to complete the project in the schedule specified.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Comply with the delivery, storage and handling requirements specified in related Division 40 Specification Sections.

1.9 WARRANTY

- A. Comply with the warranty requirements specified in related Division 40 Specification Sections.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Comply with the requirements specified in related Division 40 Specification Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Comply with the requirements specified in related Division 40 Specification Sections.

3.2 INSTALLATION

- A. Comply with the requirements specified in related Division 40 Specification Sections.

3.3 FIELD QUALITY CONTROL

- A. Comply with the requirements specified in related Division 40 Specification Sections.
- B. Testing
 1. Prepare for Acceptance Tests.
 2. Perform Acceptance Testing as specified in related Section 40 80 00.

3.4 SERVICES OF MANUFACTURER'S REPRESENTATIVE

- A. Engage a factory-authorized service representative to perform the following inspections, checks, and supervision of testing:
 1. Inspect field-assembled components, equipment installation, and electrical connections for compliance with the manufacturer's installation recommendations and requirements. Any required mounting, installation, and wiring corrections or adjustments shall be performed at no additional cost to the Owner.
 2. Set field-adjustable settings to the values recommended by the equipment manufacturer in combination with process requirements.
 3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and components.
 4. Supervise tests performed by independent testing firms. Witness initial energization and perform or supervise startup services.

5. Prepare written report to record the following:
 - a. Inspections and checks carried out on site.
 - b. Test procedures used.
 - c. Test results that comply with requirements.
 - d. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- B. Follow-up Services
 1. Monitoring and Adjusting: After Substantial Completion, but not more than twelve months after Final Acceptance, perform the following monitoring and adjusting tasks:
 - a. Replace failed and defective equipment (under warranty).
 - b. Recalibrate and reconfigure as necessary.
 - c. Retest and adjust as necessary.

3.5 OPERATION & MAINTENANCE MANUALS

- A. Prepare Operation & Maintenance Manuals as specified in Division 01 consisting of equipment manufacturers' O&M manuals, user manuals, installation instructions, configuration instructions, etc., and specified hereinafter.
- B. O&M Manuals shall include the following I&C documentation:
 1. Final as-tested drawings.
 - a. Control Panels
 - b. Wiring diagrams.
 - c. Loop Diagrams
 2. Final accepted programming source code
 - a. All Operator Interface Terminals (OIT)
 - b. All Programmable Logic Controllers (PLC)
 - c. SCADA HMI and Historian
 3. Calibration information: Manufacturer's calibration certification, field calibration data and field calibration check data as applicable
 4. Manufacturer's Field Start-up reports as applicable
 5. Warranty certificates.
 6. Field adjustable settings (e.g. setpoints, ranges, spans current alarm trips).
 7. Complete typewritten operating instructions, covering all systems descriptions and operation, emergency operating instructions and precautions.
 8. Name, address and telephone number of supplier and representative of manufacturer for each item of equipment in Contract

3.6 STARTUP AND TESTING

- A. All PCS networking, communications, and functionality shall be checked, tested, verified, and made fully functional and operational.
- B. Provide the services of the PCS programmer, necessary test equipment and qualified test personnel, during the "de-bugging" and commissioning phases of startup.
- C. Changes to the PCS application that may be required for changes in the control or equipment encountered in the field during construction and startup shall be completed at no additional cost.

- D. Prior to the commissioning of all new equipment, perform a "Site Acceptance Test" in the presence of the Owner's Representative and/or the Owner, using reviewed and approved IQ/OQ (Installation Qualification / Operation Qualification) testing procedures and documentation. Each field device and instrument must be successfully checked out through the OIT screens for proper operation, control, and status.
- E. In the event of failure of the field test, the CSI shall perform the necessary corrections and retest, at his own expense, until approved/accepted by Owner.
- F. Final acceptance will be dependent upon the satisfactory operation and performance after installation

3.7 DEMONSTRATION AND TRAINING

- A. Following successful startup and testing of all instrumentation, training of Owner selected personnel to adjust, operate and maintain the equipment.
- B. A written training outline shall be prepared and submitted to the Engineer for approval. When approved, the Contractor must provide at least a 2-week advance notice of training.
- C. Train Owner's maintenance personnel for a minimum of 4 hours on procedures and schedules for energizing and de-energizing, troubleshooting, servicing, and maintaining equipment and schedules.
- D. In addition to the training content specified in the equipment specification, integrate the following training topics into the specified training sessions:
 - 1. Review data in Operation and Maintenance Manuals.
 - 2. Review Normal Operating Procedures.
 - 3. Review Emergency Operating Procedures.

ENF OF SECTION

SECTION 40 63 43**PROGRAMMABLE LOGIC CONTROLLERS****PART 1 - GENERAL****1.1 SUMMARY**

- A. This Section includes general requirements for all Programmable Logic Controllers (PLC), I/O Modules, and/or Operator Interface Terminals (OIT) associated with Process Control System (PCS) Cabinets and panels, as specified and as shown on the Contract Drawings.
- B. Equipment furnished shall be installed in an industrial type environment and powered from an electrical source that may include harmonic distortion, surges, sags, and other electrical noise under normal operating conditions. All equipment furnished shall function correctly in an environment where electrical noise, of the types referenced, are common during normal operations. If the equipment is found to be unable to operate in this environment, furnish additional and/or replacement equipment, surge protection, power line conditioners, UPS, or other equipment required to correct this problem, at no additional cost to the Owner.
- C. Provide coordination, supply, and interconnection of the equipment specified herein.
- D. Provide the design, fabrication, configuration, programming, configuration, testing, start-up, and implementation of all equipment specified herein and as shown on the Contract Drawings.
- E. Programming of the PLC, OIT and SCADA systems shall be completed by the Owner or the Owner's programmer. Coordinate

1.2 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American National Standards Institute (ANSI)
 - 2. Institute of Electrical and Electronics Owner's Representatives (IEEE)
 - 3. International Society of Automation (ISA)
 - 4. National Electric Manufacturers Association (NEMA)
 - 5. National Electrical Code (NEC)
 - 6. National Electrical Testing Association (NETA)
 - 7. Underwriters Laboratories, Inc. (UL)
- B. Related Specification Sections
 - 1. Division 01 sections
 - 2. Division 26 sections

- 3. Division 40 sections
- 4. Contract Drawings

1.3 COORDINATION

- A. General:
 - 1. Review the installation requirements of the materials and equipment specified under Division 40, 41 and 46 for installation.
 - 2. Coordinate the size of each control enclosure and the quantity of control enclosures that are required at each location with all equipment and materials to be installed.
 - 3. The Remote I/O provided per this specification section shall communicate with the plant PLC controller via the Specified Communication Protocol.
- B. Contractor Responsibilities:
 - 1. Furnishing, installing and assuming complete responsibility for the installation and proper operation of all materials, equipment and hardware within the enclosures as designated on the Drawings and as specified herein.
 - 2. Coordination of the installation and interfacing requirements among the control enclosures and all items installed therein.
 - 3. Coordination, preparation, assembly and submission of all submittals for items furnished and Work performed under this Section.
 - 4. Ethernet Addressing - Coordinate IP addressing of all Ethernet networked devices with the Engineer, utilizing IP addresses supplied by the Engineer. Engineer supplied IP addresses shall be coordinated and configured in networked devices prior to shipment of equipment to the project site. IP address shall be entered into networked devices under this specification section.
- C. Others
 - 1. Exchange of System Data with Other PLCs - Coordinate the exchange of data between the PLCs supplied herein and OEM systems with other Contracts. Coordination shall identify the supplied system's and SCADA system's need for data for operation of the respective systems and shall identify specific data points that need to be communicated, PLC memory addresses where the data will reside, and data point details (data type, range, units, etc.)

1.4 SUBMITTALS

- A. Submit the following in accordance with the Division 01 General Requirements and supplemental requirements specified herein.
- B. Prior to obtaining any instrumentation material, detailed shop drawings on the material shall be submitted.
- C. Compliance Statement: Provide a Compliance Statement listing each Specification Section, and Part 1, 2, and 3 Sub-Sections, stating, paragraph-by-paragraph, compliance with the Specification, each minor nonconformity that is within the intent of the

Specification, and proposed non-conformities. Provide a short description of minor non-conformities and detailed explanation of other non-conformities

D. Shop Drawings

1. Each component shall include manufacturer's model number, device designation consistent with Contract Drawings and quantity.
2. Terminal block wiring layout showing numbered terminal block layout with connected wiring identified. Show field wiring as dashed.
3. Product Data
 - a. Product Data: "Catalog cuts" and spec sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.
 - b. Submit technical data specifically prepared for the equipment being furnished including component data sheets, schedules, layouts, elevations, wiring diagrams, loop diagrams, manufacturer's instructions and similar information pertinent to the supplied system and components.
 - c. Submittals for individual pieces of equipment shall include quantity supplied and the instrumentation tag ID's or other identifying information if a tag ID is not applicable.
4. Process Control System Coordination - Submit the following information within 45 days after receiving an approved shop drawing submittal for the equipment.
 - a. Scaling/range of values for all analog data points (i.e., 0 to 60 Hertz, 0 to 10.00 mg/L, etc.).
 - b. Engineering units of all analog data points (i.e., gpm, mgd, mg/L, feet, inches, etc.).
 - c. Alarms – Identify alarm conditions that are annunciated in the OEM OIT. Differentiate alarm conditions from events. Prioritize alarm conditions and identify alarm conditions that are worthy of notifying the operations staff via the plant's alarm notification system (dialer).
 - d. Key operating setpoints useful to the operating staff to view remotely. Access to all setpoints is required.
 - e. PLC Program – Complete electronic form of PLC program for coordination with plant process control system.
5. Reports
 - a. Provide Factory Acceptance Tests, field tests, acceptance tests, and functional tests as applicable to the equipment provided.
6. Provide written Point-to-Point test report.

E. Operation and Maintenance Data

1. Submit Operation and Maintenance Manuals in accordance with Division 01, Section 40 71 00 Instrumentation and Control for Process Systems and supplemental requirements specified herein.
2. Submit a detailed "sequence of operation" controls narrative which completely describes the operation of the control system. Written narrative shall be provided with sufficient detail to demonstrate complete operation of the

system. Controls narrative shall be specific to this Project. (Generic descriptions from catalog and/or O&M data is not acceptable) Controls narrative shall include the following as a minimum:

- a. System Alarm Monitoring.
- b. System Alarm/Acknowledge/Reset Procedures.
- c. Power Outage Shutdown and Power Restoration Sequencing.
- d. System Diagnostics.
- e. Preventative Maintenance.

F. Closeout Submittals

- 1. Operation and Maintenance Manuals: Installation instructions, Configuration and setup instructions, Quick start guides, and User Manuals.
- 2. Warranty Documentation: Start date, duration, conditions, manufacturer contact information, local vendor or support representative contact information.
- 3. Sustainable Design Closeout Documentation.
- 4. Documented PLC/OIT source code and configuration files in electronic format. All software, licensing, and support shall be transferred to the Owner and provide written proof of transfer.
- 5. Licensed PLC/OIT development software with installation media.

G. All tools, information and equipment required to fully maintain or modify the provided instrument shall be provided.

1.5 QUALITY ASSURANCE

- A. Reference Standards: Comply with all Federal and local laws or ordinances, as well as all applicable codes, standards, regulations and/or regulatory agency requirements including the partial listing below:
 - 1. Joint Industrial Council (JIC) Standards.
National Electrical Code (NEC).
 - 2. National Electrical Manufacturer's Association (NEMA) Standards.
Local and State Building Codes.
 - 3. Occupational Safety and Health Administration (OSHA) Regulations.
- B. All electrical materials and equipment shall be new and shall bear the label of the Underwriters Laboratory (UL), Inc., Factory Mutual (FM) or equivalent where standards have been established and label service regularly applies.
- C. Equipment not specifically described or identified by manufacturer's catalog numbers shall be designed in conformity with ANSI, IEEE, ISA, JIC, NEMA, and other applicable technical standards. The work shall have neat and finished appearance.
- D. Equipment shall be installed as recommended by the manufacturers.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Temporary storage of instruments shall be in clean dry indoor rooms with a temporary dehumidifier and electric heating to maintain the storeroom between 5 and 40 °C, with humidity less than 90%. Comply with manufacturer's additional written instructions for storing and periodic inspection and testing.
- B. Handle instrumentation materials and equipment in conformance with the manufacturer's written instructions.
- C. Deliver, store and handle of programmable controllers and control systems in compliance with specified below:
 - 1. Receive panel mounted components and equipment to be installed inside enclosures, panels or consoles and install them as recommended by panel manufacturer's requirements.
 - 2. All equipment and materials shall be packaged at the factory to protect each item from damage during shipment and storage.
 - 3. Mount consoles, panels, or cabinets on skids for shipment.
 - 4. Provide other blocking and cushioning material as required to prevent damage during shipment.
 - 5. Provide temporary lifting lugs on each shipping package.
 - 6. Include approximately one pint of touch-up paint for each finish color in shipment.
 - 7. Do not ship enclosure to job site until the environment where the enclosure will be installed is as it will be at the conclusion of the Project.
 - 8. Contractor shall coordinate the Work with any Work under this and other Contracts which may be in progress and could affect the installation and locations of the control enclosures.

1.7 WARRANTY

- A. Provide parts and labor warranty in accordance with the Division 01 and with the requirements herein.
- B. Provide an on-site parts and labor warranty for a minimum period of one year after Substantial Completion for all instruments. In cases where the manufacturer offers a longer warranty period, the longer warranty period shall apply as described by the manufacturer.
- C. All equipment not fully functional at the time of Substantial Completion shall have warranties extended to provide minimum one year coverage after making the instrument operational, unless otherwise approved by the Owner's Representative.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Refer to Section 40 71 00 Instrumentation and Control for Process Systems for requirements that apply here.
- B. Programmable controllers and components to be installed inside the enclosures and/or as facial features on the enclosures so that connections can be easily made and so that there is ample room for servicing each item.
- C. Support and restrain components to prevent any movement.
- D. Provide useful space and power supply capacity as spare for future expandability to a minimum of 1 item per item-type installed or 20% of quantity of each type-item installed, whichever yields the greater spare space.

2.2 PERFORMANCE

- A. PLCs shall perform process control and monitoring function and allow remote monitoring. General requirements include:
 - 1. Receive analog data (via 4-20mA hardwired I/O), convert to Engineering Units (EU), process for alarms and reasonability checks and store.
 - 2. Receive digital data (hardwired I/O), check for alarm and status change and store.
 - 3. Perform control calculations, including software PID control based on system parameters and real-time data and output properly conditioned control commands.
 - 4. Perform sequential control functions and timing functions
 - 5. Respond to operator requests for displays, control commands and data.
 - 6. Communicate process data with Operator Interface Terminals (OIT) via Ethernet TCP/IP.
- B. The PLC-based controls for the system shall be based on an open programming environment which allows the Owner to make changes after the initial warranty period ends. The manufacturer shall provide complete and unprotected electronic copies of the PLC logic and OIT programs to the Owner following the operational testing period.

2.3 SOURCE QUALITY CONTROL

- A. Equipment shall be manufactured and assembled in accordance with the factory quality certification documents.
- B. Equipment shall be factory tested in accordance with manufacturer's standard inspections and tests.
 - 1. Fully assemble and test each PLC and I/O at the factory prior to shipment.
 - 2. As a minimum, test all I/O for conductivity and demonstrate that all specified functions can be performed.

3. Notify the Engineer at least ten working days in advance of testing of all panels so the Engineer may observe testing if they elect to do so.

2.4 SPARE PARTS

- A. Provide the following spare parts, packaged in their original unopened boxes, for use by the Owner.
 1. (1) Power supply of each type supplied
 2. (1) I/O Module each type supplied
 3. (2) I/O Signal Surge Suppressor of each type
 4. 25% spare fuses of each type used
- B. All equipment shall be provided with one (1) set of bulbs, fuses, etc., necessary for continuous and accurate operation.
- C. Spare parts shall include all parts normally provided by the manufacturer for systems of similar size, construction, and purpose.
- D. All spare parts shall be packaged in separate containers with the part name and number clearly marked.
- E. Package spare parts in boxes, labeled with the manufacturer's name, address and telephone number; local representative's name, address and telephone number; name of equipment the parts are for and list of parts contained therein.
- F. All spare parts shall be included in the base bid.

2.5 PRODUCT

- A. Digital Controller
 1. Controllers shall be battery-backed static RAM and nonvolatile flash memory, or approved equal.
 2. RS-232 port, reserved for local programming only.
 3. Two (2) 10/100Base-T Ethernet ports, one for local OIT communications, one for LAN/WAN network communications.
 4. I/O and networking/communications cards & modules as required.
 5. Size PLC I/O back planes as required. A minimum of 25% spare slots shall be available at installation. All empty slots shall have blank filler cards or protective covers.
 6. 25% spare I/O points of each type, installed and pre-wired to terminal strips.
 7. CPU requirements:
 - a. Supports ladder logic programming, structure text, sequential function blocks;
 - b. Have battery-backed RAM memory, rated for a minimum of 1 year with a fresh battery. The battery shall be capable of maintaining RAM memory for a minimum of 2 weeks after the "Battery-Low" indicating LED turns on;

- c. Be equipped with a “flash” EEPROM memory backup module, sized to backup 100% the CPU memory (used and unused);
 - d. Retain its program and data register contents indefinitely provided AC power is maintained;
 - e. Built-in math coprocessor;
 - f. Have LED status indicators including “battery-low”;
 - g. Built-in real-time clock and calendar;
 - h. Timed-interrupted routine for examining specific information;
 - i. There shall be a minimum of 16 I/O modules that the PLC CPU can support
 - j. Be sized to provide 50% spare memory after fully configured and programmed;
- 8. Firmware
 - a. Controller hardware, communication modules containing “flashable” firmware shall be flashed with the latest and most compatible firmware version before startup and checkout
- 9. Manufacturer/Model:
 - a. Rockwell Automation Allen-Bradley CompactLogix (preferred)
 - b. Schneider Electric Modicon
 - c. Or Equal
- B. Input and Output Modules
 - 1. General:
 - a. All field instruments and field devices shall be hardwired to the Remote I/O modules, utilizing conventional signals (4-20 mAdc, 24 Volts DC, 120 Volts AC, dry relay contacts, *etc.*) over individual copper conductors. Intelligent I/O networks for instrumentation shall not be used.
 - b. Equipment providing similar function shall be of the same manufacturer and, as much as possible, the same model/series for purposes of parts interchangeability.
 - c. Equipment shall be new, of the latest design, original, free from defects, and shall have a new warranty.
 - d. All cables, software, mounting kits shall be included, compatible with the PLC and manufactured by these manufacturers.
 - e. PLC and I/O shall be of the same manufacturer for seamless functionality.
 - 2. Discrete I/O modules shall be 16-point 24Vdc. Filtering up to 10 milliseconds for contact bounce.
 - a. Isolated 600 volts between field wiring and back plane.
 - b. LED to indicate status on each point.
 - c. Discrete Output (DO) modules shall be 16-point individually isolated dry relay-contact type (2A minimum at 120VAC contact rating).
 - 3. Analog I/O:

- a. 2-wire loop powered instruments shall be powered from the same power source within the same PLC cabinet. Single-ended analog input cards can be used.
- b. 4-wire non-loop powered instruments require isolated analog inputs. Single-ended inputs shall not be used.
- c. All 4-20 mAdc analog outputs shall be isolated from each other.
- 4. Manufacturer/Model:
 - a. Of same make as the digital controller

C. Software

- 1. Provide one (1) retail package (box and manuals included) of the PLC manufacturer's most current "Professional Edition" PLC offline/online programming software for use in conjunction with the PLC equipment supplied (to become the property of the Owner). The software provided must be fully compatible with the firmware level of all PLC hardware supplied. Provide all communication cables necessary for a laptop computer to upload/download and modify/monitor the PLC program offline/online.
- 2. All software licenses shall not expire and support shall be renewable.
- 3. Provide all necessary communication cables and miscellaneous hardware required by the software, to be turned over to Owner.
- 4. Any additional software or drivers required by the PLC software shall be provided at no additional cost to the Owner.
- 5. All software, licensing, and support shall be registered to the CSI until time of substantial startup completion. At this time, the CSI shall transfer registration and Ownership of all supplied software, licensing, and support to the Owner.
- 6. The CSI shall maintain, install, configure, and deliver all software updates, patches, and revisions until proof of transfer of registration and ownership to the Owner has been received.
- 7. All PLC hardware, communication modules, I/O modules, and networking hardware containing "flashable" firmware shall be flashed with the latest and most compatible firmware version before startup and checkout.
- 8. The CSI shall pay up registration and technical support (in the Owner's name) with the software manufacturers for the entire duration of the project warranty period so that there's no lapse in software support or coverage for the Owner. Project warranty period starts from the day of Owner acceptance, not the completion of startup, or when the software was purchased.
- 9. The CSI shall also provide the Owner two (2) identical DVDs, each containing the same "fully-documented" CSI developed software applications for all PLCs, OITs, and SCADA containing all program files (source code), cross references, data tables, document export files, initial setpoint/startup values, configurations, driver setups, applications, and all other files developed and used by the CSI during development, debug, and successful startup.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- B. Examine roughing-in of equipment to verify the following:
 - 1. Environmental conditions are within the limitations established by the manufacturer.
- C. Verify that ground connections are in place and that installation of grounding described in Section "Grounding" is complete.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install equipment as shown on the Contract Drawings and in accordance with the manufacturer's installation instructions and recommendations.
- B. Erect equipment in neat and workmanlike manner; align, level and adjust for satisfactory operation. Install so that parts are easily accessible for inspection, operation, maintenance and repair. Equipment shall be mounted upright, vertical, at eye level, and in locations easily and safely accessible. Minor deviations from indicated arrangements may be made, but only after obtaining approval from the Owner's Representative.
- C. Equipment shall be solidly grounded with an equipment grounding conductor as specified in Section "Grounding" and as recommended by the manufacturer. Control panels and instruments shall be grounded at the power supply end using a ground wire pulled with the power wires.

3.3 PROGRAMMING

- A. The Owner or Owner's Programmer is responsible for the programming of all PLC, OIT and SCADA.
- B. SCADA System Coordination
 - 1. Digital Controller shall be suitable for integration with the SCADA system over the specified communication protocol.
 - 2. Protocol Converter – The supplied Remote I/O shall communicate to the Owner's PLC system via the specified communication protocol. If this protocol is not available from the manufacturer's controller, the manufacturer shall provide a protocol converter in the system control panel that converts the PLC's native communication protocol to the specified communication protocol. In such case, the manufacturer is responsible for configuring and maintaining the protocol converter throughout the construction phase of the project. Protocol converter shall be Red Lion, DSP Series, or equal.
 - 3. All status and control functions for interface with plant SCADA shall be made

through hardwired field connections. All other information, not critical to the operation of the equipment, shall be passed to the plant SCADA through communications protocol.

4. All status, control, and alarm functions shall be accessible through the SCADA system. At minimum, all monitoring, control, and functionality accessible from the system's OIT shall be available through the SCADA system via communication between the plant's HMI application and the supplied PLC program.

3.4 DEMONSTRATION AND TRAINING

- A. Final Acceptance – Include 1/2 day of a manufacturer-approved field technician's time to test equipment to demonstrate functionality. Time for final acceptance shall be additional to other on-site time and may occur after panel is complete.
- B. Training – In addition to the training content specified in the equipment specification, integrate the following training topics into the specified training sessions:
 1. Identification of each component within the Remote I/O Panel.
 2. Identify incoming sources of power and instruct on how to disconnect AC power, including bypassing and discharging the UPS.
 3. DC Power Supply Troubleshooting – Describe methods to troubleshoot power supply operation, including measuring output voltage and comparing to required voltage. Define indicator light functions.
 4. Communication Modules, and I/O Modules – Identify each component and detail their purpose integrating As-Built into the training. Demonstrate how to ascertain when discrete signals are energized, when analog signals are open loop, and identifying indicator light functions.
 5. Ethernet Switch Troubleshooting – Identify indicator lights and how to access Ethernet switch's web utility for troubleshooting. Identify indicator lights and, using the link and activity lights, instruct on how to identify a disconnected link and how activity lights display when properly functioning.
 6. All procedures shall be as recommended by the respective equipment manufacturer.
 7. Procedures shall be physically performed rather than discussed in theory.
 8. Training shall be video recorded and submitted to the Engineer for review and approval.

END OF SECTION

SECTION 40 67 00**CONTROL SYSTEM EQUIPMENT PANELS****PART 1 - GENERAL****1.1 SUMMARY**

- A. This Section includes general requirements for the control panels including PLC cabinets and panels, Remote I/O panels, RTU, display panels, relay panels, annunciator panels, flow control panels, interface panels, termination boards, radio repeater panels or any other assembly of electrical components shop assembled in enclosures associated with the Process Control System (PCS), as specified and as shown on the Contract Drawings.
- B. Equipment furnished shall be installed in an industrial type environment and powered from an electrical source that may include harmonic distortion, surges, sags, and other electrical noise under normal operating conditions. All equipment furnished shall function correctly in an environment where electrical noise, of the types referenced, are common during normal operations. If the equipment is found to be unable to operate in this environment, furnish additional and/or replacement equipment, surge protection, power line conditioners, UPS, or other equipment required to correct this problem, at no additional cost to the Owner.

1.2 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American National Standards Institute (ANSI)
 - 2. Institute of Electrical and Electronics Owner's Representatives (IEEE)
 - 3. International Society of Automation (ISA)
 - 4. National Electric Manufacturers Association (NEMA)
 - 5. National Electrical Code (NEC)
 - 6. National Electrical Testing Association (NETA)
 - 7. Underwriters Laboratories, Inc. (UL)
- B. Related Specification Sections
 - 1. Division 01 sections
 - 2. Division 26 sections
 - 3. Division 40 sections
 - 4. Contract Drawings

1.3 COORDINATION

- A. Division 40 Sections for PCS integration and coordination requirements.
- B. Coordinate the size of each control enclosure and the quantity of control enclosures that are required at each location with all equipment and materials to be installed.

1.4 SUBMITTALS

- A. Submittals shall be submitted in accordance with the provisions set forth in Division 1 Sections of the Contract Documents and supplemental requirements specified herein.
- B. Prior to obtaining any control material, detailed shop drawings on the material shall be submitted.
- C. Compliance Statement: Provide a Compliance Statement listing each Specification Section, and Part 1, 2, and 3 Sub-Sections, stating, paragraph-by-paragraph, compliance with the Specification, each minor nonconformity that is within the intent of the Specification, and proposed non-conformities. Provide a short description of minor non-conformities and detailed explanation for the non-conformity.
- D. Shop drawings shall present complete and accurate information relative to all working dimensions, equipment weights, assembly, and section views, and all necessary details pertaining to coordinating the work of the Contract. Shop drawings shall contain information such as special tools and other items of information that are required to demonstrate detailed compliance with the Contract Documents.
- E. In addition to the requirements of 40 90 00 Instrumentation and Control for Process Systems, shop drawings shall also include the following:
 - 1. NEMA type designation and manufacturer data describing the enclosures and showing its compliance with specifications and associated standards.
 - 2. Location plan for each control enclosure. Indicate electrical classification of each location.
 - 3. Control panel assembly drawings detailing panel cut-out locations and sizes, back panel and device layout and locations.
 - 4. Electrical point-to-point wiring diagrams showing detailed internal wiring and wiring to field devices. Device tag numbers shall be indicated where shown on the Contract Drawings. Terminal blocks and wiring numbers shall be identified on the wiring diagrams.
 - 5. Bill of Materials for all equipment and accessories.
 - 6. Manufacturer's catalog information for all components and accessories.
 - 7. Manufacturer's standard wiring diagrams including all available terminal connections for each component.
 - 8. Heat gain calculations showing adequate cooling capacity.
 - 9. UPS sizing calculations and run time charts showing adequate capacity and run capacity.
 - 10. Spare Parts List (including specified spare parts to be furnished by the Contractor and manufacturer's recommended spare parts list for each type of unit).
 - 11. Project specific installation instructions and mounting details for each component. Materials of construction for supports, brackets, and mounting hardware shall be provided with details for each type of equipment mounting rack.
 - 12. A list of nameplate titles and control panel labels shall be submitted.
 - 13. Identify spare control panel space for future equipment.
 - 14. Each component shall include manufacturer's model number, device designation consistent with Contract Drawings and quantity.
 - 15. Terminal block wiring layout showing numbered terminal block layout with connected wiring identified. Show field wiring as dashed.

- F. Factory Acceptance Testing
 - 1. Submit Factory Acceptance Test plan for review and approval.
 - 2. Notify the Engineer at least ten working days in advance of testing of all panels so the Engineer may observe testing if they elect to do so.
 - 3. Submit Factory Acceptance Test report prior to panel shipment.
- G. Operation and Maintenance Data
 - 1. Submit Operation and Maintenance Manuals in accordance with Division 01, Section 40 90 00 Instrumentation and Control for Process Systems and supplemental requirements specified herein.
- H. Closeout Submittals
 - 1. Operation and Maintenance Manuals: Installation instructions, Configuration and setup instructions, Quick start guides, and User Manuals.
 - 2. Warranty Documentation: Start date, duration, conditions, manufacturer contact information, local vendor or support representative contact information.
- I. All tools, information and equipment required to fully maintain or modify the provided instrument shall be provided.

1.5 QUALITY ASSURANCE

- A. Reference Standards: Comply with all Federal and local laws or ordinances, as well as all applicable codes, standards, regulations and/or regulatory agency requirements including the partial listing below:
 - 1. Joint Industrial Council (JIC) Standards.
National Electrical Code (NEC).
 - 2. National Electrical Manufacturer's Association (NEMA) Standards.
Local and State Building Codes.
 - 3. Occupational Safety and Health Administration (OSHA) Regulations.
- B. All electrical materials and equipment shall be new and shall bear the label of the Underwriters Laboratory (UL), Inc., Factory Mutual (FM) or equivalent where standards have been established and label service regularly applies.
- C. The control panel enclosure, components, and controls shall be UL Listed and Labeled. Control panels shall conform to the requirements of UL 508.
- D. Equipment shall be factory tested in accordance with manufacturer's standard inspections and tests.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Temporary storage of all control panels, cabinets and equipment shall be in a humidity-controlled, less than 90%, environment heated to a minimum of 55°F, maximum of 85°F.
- B. Deliver, store and handle of components and hardware in compliance with specified below:

1. Receive panel mounted components and equipment to be installed inside enclosures, panels or consoles and install them as recommended by panel manufacturer's requirements.
 2. Do not ship equipment to job site until the environment where the enclosure will be installed is as it will be at the conclusion of the Project.
 3. Contractor shall coordinate the Work with any Work under this and other Contracts which may be in progress and could affect the installation and locations of the control enclosures.
- C. Assume custody of the CSI furnished equipment when it is picked up, loaded and delivered to the project site and shall assume liability for damage to the equipment after they are picked up. Contract 2B will remain responsible for the Owner's equipment until Substantial Completion.
- D. All equipment, crates and boxes shall be unloaded, stored and protected per manufacturer/supplier recommendations.
- E. Upon delivery of equipment, the Contractor representative and the Resident Engineer will make a joint inspection of the condition of each piece of equipment and shall note, in writing, the defects in said equipment. Damage or loss of equipment and materials after the date of their delivery to the Contractor shall be repaired or replaced at the Contractor's expense.
- F. Protect all equipment from vandalism, falling construction debris, paint sprays and any other construction activity that may damage the equipment.

1.7 WARRANTY

- A. All equipment not fully functional at the time of Substantial Completion shall have warranties extended to provide minimum one year coverage after making the equipment operational, unless otherwise approved by the Owner's Representative.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Refer to Section 40 71 00 Instrumentation and Control for Process Systems for requirements that apply here.
- B. The control panels and associated components shall be furnished as a coordinated assembly requiring only field connections of the power and control circuits for a complete and operating installation as specified and shown on the Contract Drawings.
- C. Programmable controllers, devices and components to be installed inside the enclosures and/or as facial features on the enclosures, shall be installed so that connections can be easily made and so that there is ample room for servicing each item.
- D. Control panels and its components shall perform process control, monitoring functions and allow for remote monitoring, as shown or specified.

- E. Provide useful space and power supply capacity as spare for future expandability to a minimum of 20% of quantity of each type-item installed.
- F. Devices which penetrate enclosure shall be constructed/rated/installed to maintain enclosure rating.

2.2 PRODUCT DESCRIPTION

- A. Main Control Panel
 - 1. Description: PLC Based Panel
 - 2. Env. Rating: Indoor NEMA 12
 - 3. Function: Control and Monitoring
 - 4. Design: PLC-based
 - 5. Interface: 12" Operator Interface
 - 6. Mounting: Self standing
 - 7. HVAC: No
 - 8. UPS: Yes
- B. Network Panel
 - 1. Description: Network Panel
 - 2. Env. Rating: Indoor NEMA 12
 - 3. Function: Network
 - 4. Design: Communication-based
 - 5. Interface: None;
 - 6. Mounting: Surface mount on wall
 - 7. HVAC: No
 - 8. UPS: Yes

2.3 GENERAL REQUIREMENTS

- A. Enclosure Construction
 - 1. General
 - a. Dimensions of enclosures shown on the Contract Drawings are minimum required dimensions. Provide each enclosure as required to house the electrical equipment shown or specified. Each enclosure shall be sized such that a minimum of 20% spare open space is provided on the interior subpanel and/or swingout panel for mounting of future equipment. Spare Space shall be located in one clear and open, contiguous area of the subpanel.
 - b. Cabinets and control panels shall include an equipment support system for mounting internal wiring and control components, and for the proper support of long case instruments. This system shall ensure that equipment is adequately supported by the main structural frame members. Fixed support members shall not be attached to front panels or removable access panels.
 - c. Steel enclosures shall be constructed of a minimum of 14 gauge steel and shall be constructed in accordance with NEMA requirements. Seams shall be continuously welded and ground smooth, with no holes or knockouts. Exterior hardware, including mounting hardware shall be stainless steel unless otherwise noted.
 - d. Panel cutouts shall be provided for mounting components as arranged on the Contract Drawings and shall include cutouts and cover plates, and shall

be capable of being removed for the addition of future components. Components shall be door mounted unless otherwise noted. Control panels requiring rear access shall have the components mounted on side opposite the door.

2. NEMA 12 Steel Enclosures
 - a. NEMA 12 enclosures shall be dust-tight, drip-tight suitable for protecting enclosed equipment and components from fibers, flyings, lint, dust and dirt. NEMA 12 enclosures shall provide a degree of protection against light splashing, seepage, dripping and external condensation of non-corrosive liquids.
 - b. Manufacturers
 - 1) Saginaw
 - 2) Hoffman
 - 3) Or equal
3. NEMA 4X Stainless Steel Enclosures
 - a. NEMA 4X enclosures shall be water-tight and dust-tight suitable for outdoor installations. NEMA 4X enclosures shall protect enclosed equipment against splashing water, seepage of water, falling or hose-directed water, severe external condensation, and shall be corrosion resistant.
 - b. Enclosures shall be constructed of 14 gauge Type 304 stainless steel. Trim shall be Type 304 stainless steel. Exterior shall be unpainted.
 - c. Manufacturers
 - 1) Saginaw
 - 2) Hoffman
 - 3) Or equal
4. NEMA 4X Aluminum Enclosures
 - a. NEMA 4X enclosures shall be water-tight and dust-tight suitable for indoor or outdoor installations. NEMA 4X enclosures shall protect enclosed equipment against splashing water, seepage of water, falling or hose-directed water, severe external condensation, and corrosive agents.
 - b. Enclosures shall be constructed of Type 5052-H32 aluminum. Continuous hinge shall be aluminum. Exterior shall be unpainted.
 - c. Manufacturers
 - 1) Hammond Manufacturing
 - 2) Austin Electrical Enclosures
 - 3) Or equal

B. Enclosure Doors

1. Enclosures shall be provided with front access single or double overlapping doors as required for the enclosure size. Door(s) shall be provided with heavy duty three point spring-roller latches operated by a key locking handle. Latch rods shall have rollers to facilitate door closing. Provide a minimum of two keys for each lock. Locks shall be keyed the same. Door assemblies for NEMA 4X stainless steel enclosures shall be constructed to maintain the NEMA rating of the enclosure assembly without the use of external door clips or hasps.
2. Door(s) shall be mounted with continuous piano hinges. Contractor shall coordinate door swing (right hand or left hand) for each control panel to avoid interference with other equipment mounted adjacent to the control panels.
3. A rolled lip around minimum three sides of door shall be provided to prevent dirt and liquid from dropping into the panel when door is open.
4. Door(s) shall be fitted with a neoprene gasket applied with oil resistant adhesive and held in place with stainless steel retaining strips.

5. Enclosures mounted outdoors shall be provided with stainless steel door stops to hold the door(s) in the open position. The open position shall be field adjustable.

C. Interior Subpanels

1. Interior subpanels for component mounting shall be provided and assembled for each enclosure. Interior subpanels shall be constructed of 14 gauge steel finished in white enamel paint. Subpanels shall be provided with intermediate stiffeners where required to maintain surface flatness and panel rigidity. Fasteners, screws, and equipment mounting racks shall be stainless steel.
2. Provide "swing-out" type panels where shown on the Contract Drawings. Swing-out panels shall be of similar construction to subpanels specified above. Swing-out interior panels shall be provided with a continuous stainless steel piano hinge along the side of the panel. A stainless steel catch latch shall be provided to lock the swing-out panel in-place to prevent unwanted movement. Heavy duty hinges shall be provided as required to carry the load of the swing-out panels as mounted equipment.
3. Provide stationary shelves where shown on the Contract Drawings. Shelves shall be of similar construction to subpanels specified above and shall be vented to prevent equipment overheating. Shelves shall be provided with mounting brackets able to sustain the entire weight of the equipment.
4. Intrinsically safe relays shall be grouped and mounted on a separate designated area of the interior subpanel for each control panel (where applicable). This area shall be provided with a 4 sided non-metallic barrier which isolates the intrinsically safe relays from the other components mounted in the control panel.

D. Enclosure Finish

1. With the exception of NEMA 4X stainless steel enclosures, sheet metal components shall be thoroughly cleaned, bonderized and finished with a prime coat and two top coats of a two-component, catalyzed, polyurethane enamel. Texture semi-gloss finish shall be applied to provide a non-glare and abrasion resistant surface. Enclosures shall be provided with gray finish inside with a white enamel interior unless otherwise specified.

E. Enclosure Accessories

1. A large print pocket shall be provided on interior face of the enclosure door(s). Where this cannot be accommodated due to windows and other control devices mounted on the door, the print pockets shall be mounted on the interior side of the control panels.
2. Rain hoods shall be provided for outdoor control panels and instrument enclosures as shown on the Contract Drawings.
3. Circuit Breaker Operation
 - a. Where shown on the Contract Drawings, circuit breaker disconnect handle operators shall provided. Handle operator shall be accessible from the face of the panel, and shall be capable of being locked in either the ON and OFF position with a padlock.
 - b. Handle operators shall prevent opening of the control panel doors with the handle in the ON position. Operators shall be provided with a defeater mechanism to allow authorized personnel to open the door with the handle in the ON position.

4. Service Lights and Receptacles
 - a. A service light complete with lamp, safety shield, on-off switch and utility receptacle shall be furnished where shown on the Contract Drawings.

2.4 ENCLOSURE HVAC

A. General

1. Control panels enclosures shall be provided with louvers, forced ventilation, or air conditioners as required to prevent heat build-up within the enclosure. Except for enclosures mounted outdoors or with the rear of the panel directly adjacent to a wall, place louvers in the rear of the enclosure, top and bottom. For enclosures mounted with the rear of the panel directly adjacent to a wall, place louvers on the side or front of the panel.
2. Thermostats shall be surface mount type with a temperature range of 40 to 100 degrees F (field adjustable over the entire range). Thermostats shall be provided with a stainless steel shell. Thermostat contacts shall be rated a minimum of 10 amperes at 120 VAC. Contacts shall close on temperature rise for cooling and open on temperature rise for heating equipment. Insulation bushings and mounting hardware shall be provided as required to mount the thermostats.

B. Louvers

1. Control panel louvers shall be constructed of the same material as the enclosure.
2. Intake louvers shall be provided with washable aluminum air filters used for ventilation. Provide 1 can of filter spray adhesive for every enclosure.

C. Ventilation Fans

1. Provide forced ventilation fans, with washable aluminum air filters and finger guards. Fans motors shall operated on 115 VAC, 60 Hz. power and shall be provided with integral thermal protection. Motors shall be rated for 20,000 hours of continuous operation without lubrication or service. Fan noise shall not exceed 50 db at 5 feet.

D. Heaters

1. Provide thermostatically controlled heaters that shall maintain the temperature inside the control panel above 40 degrees F. Heaters shall operate on 115 VAC, 1 phase power supply.
2. Freeze Protection - Heaters shall be provided for freeze protection of control panels and shall be sized per the panel volume by the control panel fabricator.
3. Condensation Protection - Provide thermostatically controlled, fan driven heaters for all outdoor enclosures for condensation control unless otherwise specified.
4. Mount heaters near the bottom of center of the enclosure. Do not mount the electronic components closer than 6 inches to the heater.

E. Corrosion Inhibitors

1. Furnish enclosures with vapor phase protective corrosion inhibiting devices, tape, or emitters sized for the individual panel volume.
2. Activate the inhibitor upon delivery to the site. Do not store panels with inhibitors inactive. If necessary, cover panels to reduce ventilation and prolong inhibitor life.

2.5 ELECTRICAL SYSTEMS

A. Power Distribution

1. Control panels shall include provisions for distributing power to single phase equipment shown on the Contract Drawings. Control panels shall include a main circuit breaker which shall disconnect power to the entire system. Incoming terminals shall be oversized to accommodate wiring and cable sizes as shown on the Contract Drawings.
2. Branch circuit breakers shall be provided on control power circuits and each individual circuit distributed from the panel. Circuit breakers shall be grouped on a single subpanel or DIN rail. Place subpanel so that there is a clear view of and access to the breakers when the door is open. Use branch circuit breakers rated at no more than twice the load.
3. Provide control power transformers and power supplies as required to obtain an operable system. Control power transformers shall be provided with suitable fusing on the primary and secondary side of the transformers. Control power transformers shall be sized as required to power equipment as shown on the Contract Drawings.
4. Place no more than 20 devices on any single circuit. Do not exceed 12 amperes on 15 amp branch circuit.
5. Where multiple units provide parallel operations, do not group devices on the same branch circuit.

B. Circuit Protective Devices

1. Circuit Breakers
 - a. Circuit Breakers shall be of the thermal magnetic air type, and shall be as specified in Division 16. Circuit breakers shall be appropriately sized to protect the equipment served and per the requirements of the National Electrical Code.
 - b. Thermal magnetic air circuit breakers shall be provided for branch circuit disconnect service and short circuit protection of motor control and auxiliary circuits.
2. Fuses
 - a. Provide fuses as required and specified for protecting individual control circuits and systems. Fuse ratings shall be sized to protect the equipment served and per the requirements of the National Electrical Code.
3. Surge Protection
 - a. Each control panel shall be provided with transient voltage surge arresters on the incoming power supply as required to protect the equipment from voltage surges and sags.

C. Terminal Blocks

1. General
 - a. Terminal blocks shall be feed through, single level, and suitable for DIN rail mounting. Terminal blocks shall be fabricated complete with marking strip, covers, end plates, partitions, and screw type pressure connectors.
 - b. Terminal blocks shall be UL listed, rated for 600 VAC, 25 amperes unless otherwise noted.
 - c. Not less than 25 percent spare terminals shall be provided.
 - d. Terminal blocks for external connections shall be suitable for No. 12 AWG wire.

2. Terminal blocks for low voltage instrumentation circuits shall be rated for 300 VAC, 10 amperes.
3. Separate terminals shall be used for AC and DC voltages. These terminals shall be labeled AC and DC and shall be provided with two distinct colors. Separate wireways shall be installed for AC and DC voltages. AC and DC wiring shall be kept separate at all times.
4. Fuse terminal blocks shall be provided with LED blown fuse indicators and shall be capable of being disconnected without the use of any special tools.
5. Ground terminals shall be green.
6. Terminal blocks shall be located in the bottom of the panel, except where otherwise shown or noted. Terminal blocks shall be located near the doors or access panels of the enclosures to facilitate field wiring connections. Minimum spacing between terminal blocks shall be 5 inches and a minimum of 4 inches all around.
7. Terminals shall be labeled to agree with identification on submittal drawings. A terminal shall be provided for each conductor of external circuits, plus one ground for each shielded cable. Wires shall be numbered using wire markers. Wire numbers shall agree with terminal numbers, submittals, and remote equipment wiring designations.

D. Internal wiring

1. Internal instrument and component device wiring shall be as normally furnished by the manufacturer.
2. With the exception of low voltage instrumentation circuits (less than 30 V), interconnecting wiring and wiring to terminals for external connection shall be not less than No. 14 AWG copper, insulated for not less than 600 volts, with a moisture and heat resistant material and flame-retardant nonmetallic covering.
3. Wiring, except where noted, shall terminate on panel terminal blocks. Wiring shall be from terminal to terminal with no splices. Wiring from external devices shall terminate at the panel's field termination terminal blocks.
4. Instrumentation circuits shall be shielded.
5. Wiring shall be grouped or cabled and firmly supported to the panel. Not less than eight inches of clearance shall be provided between the terminal strips and the base of vertical panels for conduit and wiring space. Plastic wireway, shall be used to route wire within the panel and shall be provided with removable covers. Wireway shall be run in continuous length with snap on covers. AC and DC wiring shall be run in separate plastic wireways. Splices in wireways is prohibited.
6. Tie-wraps used for bundling wire shall be cinched carefully to eliminate grooving the insulation.
7. Each control loop or system shall be individually fused, and fuses and circuit breakers shall be clearly labeled and located for easy maintenance.
8. Color code wiring as follows:

a. Line and load circuits (ac or dc power)	Black
b. Current carrying grounded conductor (neutral)	White
c. AC control circuits	Red
d. DC control circuits	Blue
e. Interlock control circuits on the panel energized	
f. from external source	Yellow
g. Equipment grounding conductors	Green

E. Circuit Identification

1. Devices mounted on or within the enclosures shall be permanently identified. The device and terminal identifications shall agree with those shown on the Contract Drawings.
2. Circuit identification shall be as specified in Division 26 of the Contract Documents.

F. Controls and Instruments

1. Panel mounted control relays, pushbuttons, indicating lights, selector switches, and components shall be as specified in Division 26.
2. Panel mounted displays, Operator Interface Terminals (OIT), Human Machine Interface (HMI), controllers, switches, routers, communication equipment and components shall be as specified in Division 40.
3. Device, Junction, Pull Boxes and other conduit system accessories shall be as specified in Division 26.

G. Grounding

1. Enclosures shall be provided with two grounding lugs located on opposite sides of the enclosure for connection to external grounding system.
2. Provide a ground bus in each panel for the shield and signal grounding circuits.
3. Swing-out panels shall be grounded and provided with flexible grounding braids that allow the swing-out panels to be opened.

2.6 CONTROL PANEL IDENTIFICATION**A. General**

1. Control panels and enclosures shall be provided with nameplates on the exterior of each enclosure identifying the application function of the equipment enclosed such as "HARRIMAN TANK PANEL". Nameplates shall be mounted directly above equipment.
2. Control panels and enclosures shall be provided with nameplates on the exterior of each enclosure identifying the voltage within panel.
3. Control panels which contain electrical power components, shall be marked with the short circuit current rating (SCCR), on the exterior of the panel. Each panel label shall contain the following information:
 - a. Manufacturer/Fabricator's name
 - b. Supply voltage (indicate slash rated where applicable), phase, frequency and full load current
 - c. Short circuit current rating of the control panel based one of the following:
 - 1) SCCR of a listed and labeled assembly
 - 2) SCCR established utilizing and approved method
4. In addition, for selector switches and/or pushbuttons, a factory installed legend plate shall be provided to indicate the function each control station performs, such as "ON" or "OFF."
5. Nameplates shall be engraved 1/4 inch high (2 inch high for enclosure titles) black capital letters on a 1/8" thick plastic black tag with white letters mechanically attached to enclosure. Lettering shall be in capitals except as shown. Nameplate text shall be as shown or scheduled on the Contract Drawings.
6. Interior mounted components and equipment shall be provided with nameplates. Nameplates shall be located adjacent to, but not on, the given

device and visibility shall not be obstructed by wire bundles or other equipment. Nameplates shall include device identification number as well as descriptive name.

7. Field Instrumentation Equipment shall be provided with identification tags as specified in the Division 40 of the Contract Documents.
8. Enclosures shall be provided with instruction plaques indicating any warnings or special instructions required by the component manufacturers. Warning plaques shall be red with white lettering.
9. Control panels that contain wiring fed from multiple external power sources shall be provided with a nameplate on the front of the enclosure indicating:

-WARNING -
THIS PANEL IS FED BY
MULTIPLE POWER SOURCES

10. Nameplates shall be permanently secured to enclosures and backpanels.

2.7 MISCELLANEOUS ITEMS

A. Wiring Diagrams

1. A glossy embossed elementary wiring diagram shall be provided, permanently attached to the inside door of each control panel. The wiring diagram shall include all shop drawing and field changes and revisions performed during construction.

B. Padlocks

1. Padlocks shall be suitable for outdoor, severe weather use and shall be provided with the following features:
 - a. Boron alloy-steel shackles which repel saws and bolt cutters. Dual locking shackles shall resist forcing or prying.
 - b. Pick resistant spool pins.
 - c. Durable thermo-plastic cover to protect lock body and key cylinder from dirt, dust, and other contaminants.
 - d. Special drain channels to move water through the lock body.
 - e. 2-1/8 inch wide steel case and five pin W6000 removable cylinder.
2. Padlocks shall be keyed alike such that all locks can be opened via the same key number. Provide 6 padlocks and 6 keys for this project.
3. Manufacturers
 - a. Master - Pro-series 6121
 - b. Or equal

C. Surge Suppressors

1. Surge suppressors shall be provided on all DC operated relay coils to minimize the high transient voltages generated when the circuit to the operating coil is opened.

2.8 SPARE PARTS

- A. Provide the following spare parts, packaged in their original unopened boxes, for use by the Owner.
 1. <2> relay assemblies of each size and type installed.

2. <2> relay bases of each type installed.
 3. <2> fuse cartridge for each one installed.
 4. <2> plug-in replaceable surge elements for each size and type installed.
- B. Package spare parts in boxes, labeled with the manufacturer's name, address and telephone number; local representative's name, address and telephone number; name of equipment the parts are for and list of parts contained therein.
- C. All spare parts shall be included in the base bid.

PART 3 - EXECUTION

3.1 GENERAL

- A. Fabricate control panels, install instruments and components plumb, and wire in the factory. Test wiring and check plumbing prior to shipment.
- B. Use panel fabrication techniques that allow for removal and maintenance of all equipment after installation.
- C. Cut, punch, or drill cutouts for panel mounted instruments and smoothly finish with rounded edges.
- D. Place knockouts for the wiring of freestanding panels either at top or bottom of the panel. Cover holes for future devices with a plastic plate.
- E. Wiring
1. Panel wiring shall be installed by the panel manufacturer and shall be brought out to identified terminal blocks. Inter-wiring between panel sections shall be from terminal blocks to terminal blocks. Terminal blocks for panel wiring shall be correlated with those for the electrical equipment by the panel manufacturer.
- F. Component Location
1. Equipment shown or specified to be furnished with the panels shall be mounted by the panel manufacturer. Panel mounted controls shall be located such that they are easily accessible. Panel mounted controls and components shall be mounted a minimum of 30" above grade or finished floor and a maximum of 72" above finished floor. The panels shall be furnished as completely assembled units, requiring only field connections of power and control wiring.

3.2 EXAMINATION

- A. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- B. Examine roughing-in of equipment to verify the following:
1. Environmental conditions are within the limitations established by the manufacturer.
- C. Verify that ground connections are in place and that installation of grounding described in Section "Grounding" is complete.

- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Install equipment as shown on the Contract Drawings and in accordance with the manufacturer's installation instructions and recommendations.
- B. Erect equipment in neat and workmanlike manner; align, level and adjust for satisfactory operation. Install so that parts are easily accessible for inspection, operation, maintenance and repair. Equipment shall be mounted upright, vertical, at eye level, and in locations easily and safely accessible. Minor deviations from indicated arrangements may be made, but only after obtaining approval from the Owner's Representative.
- C. Equipment shall be solidly grounded with an equipment grounding conductor as specified in Section "Grounding" and as recommended by the manufacturer. Control panels and instruments shall be grounded at the power supply end using a ground wire pulled with the power wires.
- D. Furnish and install all mounting stands, supports structures, brackets and accessories as required or detailed for the installation of the equipment furnished. Unless otherwise specified or required, supports shall be galvanized steel. All mounting hardware shall be stainless steel. Equipment mounted on walls in contact with soil or water shall be mounted offset from the wall a minimum of ¼-inch.
- E. Cutting and drilling of existing panels for new equipment as shown, specified, or required, shall include repair and touch up painting of panel after installation.

END OF SECTION

SECTION 40 71 00

INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes general requirements for all instrumentation as shown on the Contract Drawings.
- B. This Section shall apply to all instrumentation furnished on this project, regardless of whether it is specifically identified in Division 40.
- C. Supply, mount, install, wire, terminate, and configure all instrumentation, instrumentation equipment, and components as specified herein. Provide all necessary brackets and mounting hardware required by the instrument manufacturer for proper installation.
- D. Mount, install, wire, terminate, and configure Owner furnished instrumentation, and components as noted in the contract drawings. Provide all necessary brackets and mounting hardware required by the instrument manufacturer for proper installation.

1.2 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American National Standards Institute (ANSI)
 - 2. American Society for Testing Materials (ASTM)
 - 3. American Water Works
 - 4. Institute of Electrical and Electronics Engineers (IEEE)
 - 5. International Society of Automation (ISA)
 - 6. National Electric Manufacturers Association (NEMA)
 - 7. National Electrical Code (NEC)
 - 8. Underwriters Laboratories, Inc. (UL)
- B. Related Specification Sections
 - 1. Division 01 sections
 - 2. Division 26 sections
 - 3. Division 40 sections
 - 4. Contract Drawings

1.3 COORDINATION

- A. Review the installation requirements of the materials and equipment specified under other specifications for installation and interfacing with Plant SCADA.

- B. Coordinate the installation and interfacing requirements among the instruments and all control items shown in the Contract Drawings.
- C. Coordinate with other Contracts for process and utility services piping (air, water, etc.) to and away from instruments.
- D. Coordinate process requirements(s), electrical connection(s), and ranges for the instruments and all control items shown in the Contract Drawings.
- E. Coordination, preparation, assembly and submission of all submittals for items furnished and Work performed under this Contract.

1.4 SUBMITTALS

- A. Submit the following in accordance with the Division 01 General Requirements.
- B. Prior to obtaining any instrumentation material, detailed shop drawings on the material shall be submitted.
- C. All "Or approved equal" alternates shall meet and/or exceed all specified requirements, features, and capabilities of the listed equipment and shall be submitted in accordance with the General Conditions/General Requirements
- D. Shop Drawings
 - 1. Each instrument shall include manufacturer's model number, device designation consistent with Contract Drawings and quantity.
 - 2. Location of instrument if different that shown on the Contract Drawings.
 - 3. Mounting details including location of anchoring flanges, holes and data on anchor bolt sizing and load carrying capacity.
 - 4. Terminal block wiring layout showing numbered terminal block layout with connected wiring identified. Show field wiring as dashed.
 - 5. Product Data
 - a. Product Data: "Catalog cuts" and spec sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.
 - b. Submit technical data specifically prepared for the equipment being furnished including component data sheets, schedules, layouts, elevations, wiring diagrams, loop diagrams, manufacturer's instructions and similar information pertinent to the supplied system and components.
 - c. Submittals for individual pieces of equipment shall include quantity supplied and the instrumentation tag ID's or other identifying information if a tag ID is not applicable.
 - 6. Reports
 - a. Provide factory tests, field tests, acceptance tests, and functional tests as applicable to the instrument provided.
 - b. Provide factory training certificates for manufacturer's representatives
 - 7. Calibration
 - a. Instruments shall be factory calibrated whenever possible to minimize field adjustments and insure proper operation.

- b. Provide Calibration Certificates.
- E. Operation and Maintenance Data
 - 1. Submit Operation and Maintenance Manuals in accordance with Division 01 and with the requirements specified herein.
- F. Closeout Submittals
 - 1. Operation and Maintenance Manuals: installation instructions, configuration and setup instructions, quick start guides, user manuals.
 - 2. Warranty documentation: start date, duration, conditions, manufacturer contact information, local vendor or support representative contact information.
 - 3. Sustainable design closeout documentation: final setpoints and operating parameters/settings in tabular format, factory calibration certificates, factory testing reports.
 - 4. Software: vendor, manufacture, and contractor supplied.
 - 5. All tools, information and equipment required to fully maintain or modify the provided instrument shall be provided.

1.5 QUALITY ASSURANCE

- A. Reference Standards: Comply with all Federal and local laws or ordinances, as well as all applicable codes, standards, regulations and/or regulatory agency requirements including the partial listing below:
 - 1. Joint Industrial Council (JIC) Standards.
 - 2. Local and State Building Codes.
 - 3. Occupational Safety and Health Administration (OSHA) Regulations.
- B. All electrical materials and equipment shall be new and shall bear the label of the Underwriters Laboratory (UL), Inc., Factory Mutual (FM) or equivalent where standards have been established and label service regularly applies.
- C. Instruments not specifically described or identified by manufacturer's catalog numbers shall be designed in conformity with ANSI, IEEE, ISA, JIC, NEMA, and other applicable technical standards. The work shall have neat and finished appearance.
- D. Instrumentation equipment shall be installed as recommended by the manufacturers. Furnish the services of competent factory trained representatives of the instrumentation manufacturer to supervise the installation for proper assembly, start and operate the equipment, and conduct the field tests.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Temporary storage of instruments shall be in clean dry indoor rooms with a temporary dehumidifier and electric heating to maintain the storeroom between 5 and 40 °C, with humidity less than 90%. Comply with manufacturer's additional written instructions for storing and periodic inspection and testing.

- B. Handle instrumentation materials and equipment in conformance with the manufacturer's written instructions.
- C. Deliver and store analytical instruments with "shelf-life" to the site within 30 days of installation.
- D. Deliver, store and handle of control panels, cabinets and packaged control systems in compliance with individual sections and the supplemental requirements specified below:
 - 1. Receive panel mounted instruments and equipment to be installed inside enclosures, panels or consoles and install them as recommended by panel manufacturer's requirements.
 - 2. All equipment and materials shall be packaged at the factory to protect each item from damage during shipment and storage.
 - 3. Disassemble sectionalized consoles, panels and cabinets for shipment after completion of factory testing.
 - 4. Mount consoles, panels, or cabinets on skids for shipment.
 - 5. Provide other blocking and cushioning material as required to prevent damage during shipment.
 - 6. Provide temporary lifting lugs on each shipping package.
 - 7. Include approximately one pint of touch-up paint for each finish color in shipment.
 - 8. Do not ship enclosure to job site until the environment where the enclosure will be installed is as it will be at the conclusion of the Project.
 - 9. Contractor shall coordinate the Work with any Work under this and other Contracts which may be in progress and could affect the installation and locations of the control enclosures.

1.7 WARRANTY

- A. Provide parts and labor warranty in accordance with the Division 01 and with the requirements herein.
- B. Provide an on-site parts and labor warranty for a minimum period of one year after Substantial Completion for all instruments. In cases where the manufacturer offers a longer warranty period, the longer warranty period shall apply as described by the manufacturer.
- C. All instruments that are not fully functional at the time of Substantial Completion shall have warranties extended to provide minimum one year coverage after making the instrument operational, unless otherwise approved by the Owner's Representative.

1.8 DEFINITIONS

AUTO	Control Mode selection in which control directives are programmed into the PLC and are initiated via interlocks, timing and sequencing functions or external signals such as level controls, air flow sensors, pressure switches, etc.
Control Directive	Command which is either operator initiated at a workstation or OIT, or automatically initiated by the PLC to perform a specific function as defined in the control descriptions.

Control Mode	Either AUTO or Manual selected at the PCS.
HOA	Hand-Off-AUTOMATIC selector switch (Typically located either in a field mounted control panel adjacent to the equipment, a MCC, or a VFD.)
HMI	Human Machine Interface
Icon	Symbol graphically representing a piece of equipment which is shown on a pictorial display. Symbol shall be shaded RED, GREEN, and AMBER to indicate the operating status or position status of the unit.
Interlock	A PLC programmed function which inhibits a control directive from being initiated upon certain criteria (i.e. low level conditions in a basin may prevent a pump from operating). Interlocks are required to be manually reset by an operator at the PCS after the condition is rectified.
Level 1 Security Access	Control directives which can be performed via general operators. All control directives designated in the control strategies shall be designated as a Level 1 Security Access unless otherwise noted.
Level 2 Security Access	Control directives that can be accessed by operating personnel with an identifying password enabling them to select and edit specific control directives and programming functions which Level 1 operators do not have privileges to.
L	Local
Local Control	Control of equipment from control stations, control panels, MCCs, and VFDs which are located in the field.
Lockout	A PLC programmed function which inhibits a control directive from being initiated upon certain criteria. (i.e. motor operated valve fail condition will lockout a particular blower/valve pair.) Lockouts will typically result in an alarm being displayed on the workstations, and will require a manual reset at the workstation once the alarm condition is rectified in order to allow equipment to restart.
Manual	Control Mode selection in which control directives are Operator initiated from the PCS. (PLC interlocks may inhibit certain Manual Control Directives).
MCC	Motor Control Center
MMI	Man Machine Interface

OIT	Operator Interface Terminal with graphic display software for allowing interface between operators and PLC control system, and to provide visual monitoring of various components of the system.
PCS	Process Control System
PLC	Programmable Logic Controller
Process	Generic term referring to a number of wastewater treatment system processes.
Rectified	Typically relating to an alarm condition in which the alarm(s) has been corrected in the field or at the piece of equipment by removing the error or faulty component. A local reset may be required to be activated prior to resetting an alarm condition at the PCS.
Remote Control	Control of equipment from the PCS, control stations, and control panels and which are remotely located from the equipment.
Sequence Mode	An operator selection at the PCS which selects specific programmed operating functions for equipment as defined in each control description (ie. Lead, Lag, Alternate)
VFD or VSD	Variable Frequency Drive or Variable Speed Drive

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Provide materials and products of make and model by the named manufacturer or vendor, as specified.
- B. For products specified by name and accompanied by the term 'or equal,' or 'or equivalent,' or 'or approved equal,' or 'or approved,' comply with requirements in Division 01 for submitting a substitution request to obtain approval for use of an unnamed product.

2.2 SYSTEM DESCRIPTION

- A. Electrical equipment and controls shall be provided as required to perform the control function as shown on the Contract Drawings and specified herein. Electrical and controls and relays shall be provided in accordance with the specifications contained herein and in Division 26 of the Contract Documents.
- B. Programmable controllers to be installed inside the enclosures and/or as facial features on the enclosures so that connections can be easily made and so that there is ample room for servicing each item. Every component in and on the enclosures shall be able to be removed

individually without affecting the other components and without the need to move other components.

2.3 ELECTRICAL IDENTIFICATION

- A. Instrumentation equipment, wires and cables shall be marked in the field in accordance with Division 26 Section Identification for Electrical Systems.
- B. Instrument ID tags: All instruments shall be permanently labeled/marked with a metallic (non-corrosive) tag containing the "Tag ID" and "Description" (i.e. FIT-5021; Sludge Transfer Flow Transmitter). A sample tag shall be submitted for review and approval before commencing instrument tagging.
 - 1. Each ID tag shall include the following information:
 - a. Instrument tag ID and number
 - b. Description
- C. Instrument service tags shall also be provided and be laminated vinyl type, minimum 3 inches by 5 inches with preprinted insert and "write on" type laminate for calibration and servicing information. Tag shall include a pre-punched hole for fastening to instrument with a nylon cable tie.
 - 1. Each instrument service tag shall include the following information: front and back (printed, laminated)
 - Front
 - a. Instrument tag ID and number
 - b. Description
 - c. Manufacturer:
 - d. Model:
 - e. Serial No. :
 - f. Calibrated Range:
 - g. Power Supply: ___ V AC or ___ V DC
 - h. Installed by: (Company Name)
 - i. Address: (Company Address)
 - j. Telephone Number: (Company Service telephone number)
 - Back
 - a. Instrument tag ID and number
 - b. Instrument type
 - c. Calibrated Range: ___ EU
 - d. Output: 4-20 mA
 - e. Alarms Set @ High: _____ @ Low: _____
 - f. Recommended Service Interval: ___ months
 - g. Last Serviced on: _____ (handwritten)
 - h. Last Serviced by: _____ (handwritten)

2.4 ELECTROMAGNETIC INTERFERENCE

- A. Power conversion equipment, including computer power supplies and Uninterruptible Power Supplies, shall be fitted with EMI (electromagnetic interference), RFI (radio frequency interference) and telephone interference filters to limit interference effects on other

equipment in the area in accordance with IEEE standards and recommendations applicable to the equipment.

- B. Equipment may be powered from electrical sources that may include harmonic distortion, surges, sags, and other electrical noise under normal operating conditions. Equipment furnished shall be installed with such accessories, surge protection, power line conditioners, UPS, or other means as may be required for it to function correctly in this noisy electrical environment.

2.5 ELECTRICAL AND SIGNAL CONDITIONING

- A. Electromagnetic interference
 - 1. Instruments shall be equipped with electromagnetic interference (EMI) filters to limit interference by power conversion and other EMF-generating equipment in the vicinity.
- B. Electrical noise
 - 1. Instruments may be powered from electrical sources that may include harmonic distortion, surges, sags, and other electrical noise under normal operating conditions.
 - 2. These instruments shall be installed with such accessories, surge protection, power line conditioners, UPS, or other means as may be required for it to function correctly in this noisy electrical environment.
- C. Surge protection
 - 1. Instrument power and signal wiring leaving or entering buildings shall be protected with surge suppressing/protecting devices.
 - 2. Inline instrument (i.e. flow meters) shall have surge suppressing/protecting devices on power wiring and signal wiring.
- D. Isolators/duplexers
 - 1. Signal isolators/duplexers shall be used for the re-transmission of signals to other areas, other locations, other loops, and especially when leaving the building.
 - 2. Signal isolators/duplexers shall be provided as required to ensure adjacent component impedance match (where feedback paths may be generated), or to maintain loop integrity during the removal of a loop component.
- E. Conditioners and converters
 - 1. Signal conditioners and converters shall be provided where required to resolve any signal level incompatibilities or provide required functions.
- F. Intrinsic Safety Barriers
 - 1. In Hazardous (Classified) areas, Intrinsic Safety Barriers (ISB) and conduit with filled seal-offs shall be used for both power and signal wiring, isolating the hazardous area from the safe area electrically.
 - 2. ISBs and associated wiring and conduits shall be separated from safe components as recommend in the NEC.

2.6 MATERIALS AND CONSTRUCTION

- A. Materials of construction shall be suitable for the intended application and environment and fully compatible with the process being measured (especially chemicals).
- B. Instruments located in unheated environments shall be provided with heating as required to prevent improper operation from freezing.
- C. Instruments and enclosures shall have degree of protection ratings suitable for the intended application (e.g., watertight, dust-tight, explosion-proof, water-proof, submersible, etc.) and environmental conditions. Equipment shall at a minimum have the following NEMA ratings and materials of construction, should they not be specified in their individual sections:
 - 1. Outdoor, general purpose weather-resistant: NEMA 3R (IP 14), steel.
 - 2. Indoor/Outdoor, general purpose weather-proof: NEMA 4 (IP 65) stainless steel type 316.
 - 3. Indoor/Outdoor, corrosive area, weather-proof: NEMA 4X (IP 66) stainless steel type 316.
 - 4. Indoor, corrosive area, weather-proof: NEMA 4X (IP 66) fiber glass or fiber reinforced plastic.
 - 5. Indoor/Outdoor, temporary or permanent immersion in water: NEMA 6P (IP 67 or IP 68) stainless steel type 316. Provide maximum submersion duration at a limited depth.
 - 6. Indoor, general purpose, clean dry rooms: NEMA 12 (IP 52), carbon steel.
 - 7. Hazardous (Classified) Areas: NEMA 7, epoxy powder-coated cast aluminum, for Class I, Division 1 Groups A, B, C and D. NEMA 9 epoxy powder-coated cast aluminum, for Class II, Division 1 Groups E, F and G.
- D. Shop Finishes
 - 1. With the exception of those parts and components customarily furnished unpainted, prepare and coat all metal surfaces with rust inhibitive shop paint. Shop paint shall be fully compatible with the field paint specified.
 - 2. Protect machined surfaces against damage and corrosion by other means.
 - 3. Enclosure finishes that are scratch or dented in the process of being installed shall be touched up prior to substantial completion.

2.7 INSTRUMENT AIR

- A. Dry, filtered control air at 30 psig nominal pressure shall be piped to instruments and instrument panels requiring air. Each instrument shall be provided with an integral, non-adjustable filter/regulator assembly to provide regulated air. Each instrument panel requiring air shall be provided with an adjustable filter/regulator assembly with gauge and an air manifold to provide air to pneumatic instruments. Air shall be filtered to 5-micron maximum particle size. Pressure reducers and regulators shall be furnished with additional instrumentation as required.
- B. Air piping, fittings, supports, connectors, labels, and labor shall be by the General Contractor, under the direction of the instrument supplier.

2.8 INSTRUMENT PROCESS PIPING

- A. The General Contractor shall be responsible for all process piping (water, air, etc.) to and from instruments as required.
- B. Process piping, fittings, supports, connectors, labels, and labor shall be by the General Contractor, under the direction of the instrument supplier.

2.9 MOUNTING HARDWARE

- A. Provide instrument and sensor mounting hardware (i.e. brackets, supports, clips, U-bolts, probe holders, etc.) as required by the instrument manufacturer for meeting the installation requirements in the Contract Documents.
- B. Mounting hardware shall be manufactured by the instrument manufacturer.
- C. Any devices, equipment, interfaces, hand-held devices, cables, connectors, and solutions necessary to configure, modify, analyze, and calibrate a supplied transmitter shall be provided with the transmitter and be turned over to the Owner after successful commissioning.

2.10 CLIMATE CONTROL

- A. For areas where the ambient air temperature will exceed the operating temperature range of the instrument, install the instrument in an enclosure with cooling means.
- B. For areas where the ambient air temperature will drop below the operating temperature range of the instrument, install the instrument in an enclosure with heating means.
- C. For areas where the humidity will exceed the operating maximum humidity of the instrument, install the instrument in an enclosure with dehumidification means.
- D. For areas where the instrument's display will have lengthy exposure to UV rays from the sun, install a sun shield to block the sun's rays.
- E. All enclosures mounted outdoors in direct exposure to rain, snow or sleet shall be provided with a rain guards to protect interior components from dripping water when enclosure door is opened

2.11 SUPPLIES

- A. Instruments shall be provided with one (1) year of consumable operational supplies (charts, pens, ribbons, filaments, sensors, bulbs, fuses, etc.).
- B. For analytical instruments, provide necessary calibration solutions, reagents, standards and equipment for one (1) year of manufacturer-recommended calibration frequencies.
- C. All supplies specified shall be included in the base bid.

2.12 EQUIPMENT

- A. Refer to Process Measurement Devices 40 7X XX
- B. Refer to Programmable Logic Controllers 40 63 43
- C. Refer to Process Control System 40 61 13
- D. Refer to Control System Equipment Panels 40 67 00

PART 3 - EXECUTION

3.1 GENERAL

- A. The Contractor may obtain the services of a Control Systems Integrator (or a qualified technician) to configure, test and commission all instrumentation & controls specified in Division 40.

3.2 EXAMINATION

- A. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- B. Examine roughing-in of instruments to verify the following:
- C. Environmental conditions are within the limitations established by the manufacturer.
- D. Each utility pipe and conduit is in the correct location.
- E. Examine walls, floors, roofs, and concrete bases for suitable conditions for installation, for example, all overhead work of other trades is complete.
- F. Verify that ground connections are in place and that installation of grounding described in Section 26 05 26 Grounding and Bonding for Electrical Systems is complete.
- G. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Install equipment in conformance with NEC and all local codes.
- B. Mount, install, wire, terminate, and configure all instrumentation, instrumentation equipment, and components as specified herein. Provide all necessary brackets and mounting hardware required by the instrument manufacturer for proper installation.
- C. Install instruments as shown on the Contract Drawings and in accordance with the manufacturer's installation instructions and recommendations.

- D. Unless otherwise specified or required, supports shall be aluminum or stainless steel. All mounting hardware shall be stainless steel. Equipment mounted on walls in contact with soil or water shall be mounted offset from the wall a minimum of ¼-inch.
- E. Dissimilar metals shall not be connected, spliced, or joined
- F. Align, level and adjust for satisfactory operation. Install so that parts are easily accessible for inspection, operation, maintenance and repair. Instrumentation shall be mounted upright, vertical, at eye level, and in locations easily and safely accessible. Minor deviations from indicated arrangements may be made, but only after obtaining approval from the Government's Representative.
- G. Unless otherwise noted install equipment on a concrete equipment base. Provide concrete work in conformance with Division 03.
 - 1. Floor mounted enclosures shall be installed on concrete bases with 1/4-inch thick rubber type pads. These pads shall completely cover the area of the enclosure that is against the base.
 - 2. Install anchor bolts and anchors.
 - 3. Provide vibration mitigation as required.
- H. Keep enclosures clean at all times. Keep enclosures doors closed except when actually working in the enclosure. Protect all equipment during installation including hole punching for conduit connection. Remove all filings and thread cuttings from enclosures.
- I. Electronic low-level signals
 - 1. Analog, discrete, and communication signals shall be properly isolated, bundled and supported. These signals shall be routed and separated from AC power wiring.
 - 2. AC power, DC power/signal, and communication cables shall be installed in separate conduit systems, and shall be physically separated by a minimum of 12 inches.
 - 3. All "intrinsically safe" wires and cables shall be kept isolated and installed in separate wire channels and conduit systems from normal power and signal wires - by at least two inches of space. Label wire channels and conduits "Intrinsic Wiring".
- J. Grounding
 - 1. Equipment shall be solidly grounded with an equipment grounding conductor as specified in Section 26 05 26 Grounding and Bonding for Electrical Systems and as recommended by the manufacturer. Control panels and instruments shall be grounded at the power supply end using a ground wire pulled with the power wires.
 - 2. All instruments and transmitters shall be grounded at the device's power source using a ground wire pulled with the power wires. Metal cases of loop-powered instruments shall be grounded at the control panel powering the loop using a ground wire pulled with the twisted-shielded pair of wires. All transmitters and metal cases shall be grounded at the control panel with a ground wire. Grounding through conduit and fittings and to grounds other than that of the control panel are not acceptable.
 - 3. The shield in twisted-shielded pairs shall be grounded at the power supply end. Meaning, 4-wire transmitters = ground at transmitter end, 3-wire transmitters = ground at power source end, 2-wire transmitters = ground at loop power source end.

3.4 FIELD QUALITY CONTROL

- A. Control panels shall be tested for proper operation and operational sequencing. Proper operation of control panels shall be demonstrated to the Engineer. Testing and demonstration shall be performed by a qualified service representative of the control panel fabricator or manufacturer.
 - 1. Factory Acceptance Testing reports are to be provided to Engineer for acceptance.
- B. Instruments shall be factory calibrated to minimize field adjustments and insure proper operation.
- C. Prepare for Acceptance Tests as follows:
 - 1. After installing equipment but before power supply is energized, verify that grounding system is completed.
 - 2. Verify that equipment is installed and connected according to the Contract Documents.
 - 3. Verify that electrical wiring installation complies with manufacturer's submittal by means of point-to-point continuity testing.
 - 4. Verify that field-installed power and control wiring complies with the Electrical Specification requirements.
 - 5. Verify that equipment is ready for pre-commissioning checks in accordance with manufacturer's written instructions.
- D. Acceptance Test
 - 1. The services of competent factory trained representatives of the manufacturer shall supervise startup, and operation of the equipment; and conduct the field tests.
 - 2. Instrumentation equipment shall be checked and the required adjustments shall be made by the representatives of the manufacturers.
 - 3. Instrumentation equipment shall be field tested in the presence of the Engineer and shall be demonstrated to operate satisfactorily.
 - 4. The Contractor shall provide the necessary test equipment and qualified test personnel.
 - 5. Perform visual and mechanical inspection and electrical tests as it applies to all installed systems and devices. Certify compliance with the following test parameters:
 - a. Verify the proper voltage at each powered circuit and each device.
 - b. Verify that the PLC input and output modules in each panel are functional and configured correctly in the PLC program. Each PLC input and output channel, including spares, is to be tested.
 - c. IO testing procedure will encompass the entire loop, from field devices to the PLC to the OIT/SCADA system, using manual control functionality.
 - 1) Digital inputs (push buttons, selector switches, position switches, etc.) will be actuated in the field and confirmed at the PLC input as well as change in state (color or text) on the OIT.
 - 2) Digital outputs (motors, relays, solenoids, etc.) will be energized via the OIT and confirmed via proper change in state of the final control element in the field, as well as change in state (color or text) on the OIT.

- 3) Analog inputs (transmitters) will be tested using actual process conditions, whenever possible. Verify that scaling is correct and the appropriate value is displayed on the OIT.
- 4) Analog outputs (valve position, VFD speed control, etc.) will be ramped from 0-100% or a step change output of 50% and 100% via the OIT. Response will be confirmed via proper change in state of the final control element in the field, as well as displaying the proper feedback on the OIT.
- d. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- 6. Markup and sign Loop Diagrams, Wiring Diagrams and P&IDs for record.
- 7. In the event of failure of the field test, the Contractor shall perform the necessary corrections and retest, at his own cost and expense, the equipment as directed by the Engineer.

3.5 SERVICES OF MANUFACTURER'S REPRESENTATIVE

- A. Engage a factory-authorized service representative to perform the following inspections, checks, and supervision of testing:
 - 1. Inspect field-assembled components, equipment installation, and electrical connections for compliance with the manufacturer's installation recommendations and requirements. Any required mounting, installation, and wiring corrections or adjustments shall be performed at no additional cost to the Owner.
 - 2. Set field-adjustable settings to the values recommended by the equipment manufacturer in combination with process requirements.
 - 3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and components.
 - 4. Supervise tests performed by independent testing firms. Witness initial energization and perform or supervise startup services.
 - 5. Prepare written report to record the following:
 - a. Inspections and checks carried out on site.
 - b. Test procedures used.
 - c. Test results that comply with requirements.
 - d. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- B. Follow-up Services
 - 1. Monitoring and Adjusting: After Substantial Completion, but not more than twelve months after Final Acceptance, perform the following monitoring and adjusting tasks:
 - a. Replace failed and defective equipment (under warranty).
 - b. Recalibrate and reconfigure as necessary.
 - c. Retest and adjust as necessary.

3.6 OPERATION & MAINTENANCE MANUALS

- A. Prepare Operation & Maintenance Manuals as specified in Division 01 consisting of equipment manufacturers' O&M manuals, user manuals, installation instructions, configuration instructions, etc., and specified hereinafter.

- B. O&M Manuals shall include the following:
1. Final as-tested drawings.
 - a. Control Panels
 - b. Wiring diagrams.
 - c. Loop Diagrams
 2. Final accepted programming source code
 - a. All Operator Interface Terminals (OIT)
 - b. All Programmable Logic Controllers (PLC)
 - c. SCADA HMI and Historian
 3. Calibration information: Manufacturer's calibration certification, field calibration data and field calibration check data as applicable
 4. Manufacturer's Field Start-up reports as applicable
 5. Warranty certificates.
 6. Field adjustable settings (e.g. setpoints, ranges, spans current alarm trips).
 7. Complete typewritten operating instructions, covering all systems descriptions and operation, emergency operating instructions and precautions.
 8. Name, address and telephone number of supplier and representative of manufacturer for each item of equipment in Contract

3.7 STARTUP AND TESTING

- A. All networking, communications, and functionality shall be checked, tested, verified, and made fully functional and operational.
- B. Provide the services of the programmer, necessary test equipment and qualified test personnel, during the "de-bugging" and commissioning phases of startup.
- C. Changes to the application that may be required for changes in the control or equipment encountered in the field during construction and startup shall be completed at no additional cost.
- D. Prior to the commissioning of all new equipment, perform a "Field Acceptance Test" in the presence of the Owner's Representative and/or the Owner, using reviewed and approved IQ/OQ (Installation Qualification / Operation Qualification) testing procedures and documentation. Each field device and instrument must be successfully checked out through the OIT screens for proper operation, control, and status. Refer to "Field Quality Control" specified herein.
- E. In the event of failure of the field test, the CSI shall perform the necessary corrections and retest, at his own expense, until approved/accepted by Owner.
- F. Final acceptance will be dependent upon the satisfactory operation and performance after installation

3.8 DEMONSTRATION AND TRAINING

- A. Following successful startup and testing of all instrumentation, training of Owner selected personnel to adjust, operate and maintain the equipment.

- B. A written training outline shall be prepared and submitted to the Engineer for approval. When approved, the Contractor must provide at least a 2-week advance notice of training.
- C. Train Owner's maintenance personnel for a minimum of 4 hours on procedures and schedules for energizing and de-energizing, troubleshooting, servicing, and maintaining equipment and schedules.
- D. In addition to the training content specified in the equipment specification, integrate the following training topics into the specified training sessions:
 - 1. Review data in Operation and Maintenance Manuals.
 - 2. Review Normal Operating Procedures.
 - 3. Review Emergency Operating Procedures.
- E. Refer to other Division 40 sections for specific requirements.

ENF OF SECTION

SECTION 40 71 13.13**INLINE MAGNETIC FLOW METER****PART 1 - GENERAL****1.1 SUMMARY**

- A. This Section includes general requirements for the instrumentation as shown on the Contract Drawings and specified under this specification. This section shall apply to all magnetic flow meters furnished on this project, regardless of whether it is specifically identified in Division 40.
- B. Supply, mount, install, wire, terminate, and configure all instrumentation, instrumentation equipment, and components as specified herein. Provide all necessary brackets and mounting hardware required by the instrument manufacturer for proper installation.
- C. Mount, install, wire, terminate, and configure Owner furnished instrumentation, and components as noted in the contract drawings. Provide all necessary brackets and mounting hardware required by the instrument manufacturer for proper installation.

1.2 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American National Standards Institute (ANSI)
 - 2. American Society for Testing Materials (ASTM)
 - 3. American Water Works
 - 4. Institute of Electrical and Electronics Owner's Representatives (IEEE)
 - 5. International Society of Automation (ISA)
 - 6. National Electric Manufacturers Association (NEMA)
 - 7. National Electrical Code (NEC)
 - 8. Underwriters Laboratories, Inc. (UL)
- B. Related Specification Sections
 - 1. Division 01 sections
 - 2. Division 26 sections
 - 3. Division 40 sections
 - 4. Contract Drawings

1.3 COORDINATION

- A. General
 - 1. Review the installation requirements of the materials and equipment specified under Division 40, 41, 43, 44, and 46 for installation and interfacing with Plant SCADA.
 - 2. Coordinate the installation and interfacing requirements among the instruments and all control items shown in the Contract Drawings.

3. Coordinate with other Contracts for process connection(s), electrical connection(s), and utility services piping (air, water, etc.) to and away from instruments.
 4. Coordinate, prepare, assemble and submit all submittals for items furnished and performed under this Contract.
- B. Project Site
1. Coordinate flow tube mounting locations with the piping and process installation. Provide a spool piece according to the timeline for working on the respective segment of pipe.
 2. Contractor shall be responsible to verify with the supplier that the appropriate ratings and options are provided for each application, taking into account area classification, flow, passing media, temperature, and vacuum limitations.
 3. Any deviation from that which is specified shall be brought to the engineers' attention during shop drawing submittals.

1.4 SUBMITTALS

- A. Submit the following in accordance with the Division 01 SUBMITTAL PROCEDURES, Section 40 71 00 INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS and with the requirements specified herein.
- B. Additional Requirements:
1. NIST calibration certificates for each flow meter provided.
 2. Submit Manufacturer's Certificate of proper installation.

1.5 QUALITY ASSURANCE

- A. Comply with all Federal and local laws or ordinances, as well as all applicable codes, standards, regulations and/or regulatory agency requirements including the partial listing below:
1. Joint Industrial Council (JIC) Standards.
 2. Local and State Building Codes.
 3. Occupational Safety and Health Administration (OSHA) Regulations.
- B. All electrical materials and equipment shall be new and shall bear the label of the Underwriters Laboratory (UL), Inc., Factory Mutual (FM) or equivalent where standards have been established and label service regularly applies.
- C. Instruments not specifically described or identified by manufacturer's catalog numbers shall be designed in conformity with ANSI, IEEE, ISA, JIC, NEMA, and other applicable technical standards. The work shall have neat and finished appearance.
- D. Instrumentation equipment shall be installed as recommended by the manufacturers. Furnish the services of competent factory trained representatives of the instrumentation manufacturer to supervise the installation for proper assembly, start and operate the equipment, and conduct the field tests.

1.6 DELIVERY AND HANDLING

- A. Temporary storage of instruments shall be in clean dry indoor rooms with a temporary dehumidifier and electric heating to maintain the storeroom between 5 and 40 °C, with

humidity less than 90%. Comply with manufacturer's additional written instructions for storing and periodic inspection and testing.

- B. Handle instrumentation materials and equipment in conformance with the manufacturer's written instructions.

1.7 WARRANTY

- A. Provide parts and labor warranty in accordance with the Division 01.
- B. Provide an on-site parts and labor warranty for a minimum period of one year after Substantial Completion for all instruments. In cases where the manufacturer offers a longer warranty period, the longer warranty period shall apply as described by the manufacturer.
- C. All instruments that are not fully functional at the time of Substantial Completion shall have warranties extended to provide minimum one year coverage after making the instrument operational, unless otherwise approved by the Owner's Representative.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The flow metering equipment manufacturer and model shall be the following or equal:
 1. Endress+Hauser Promag 400 Series
 2. Rosemount 8750W Series
 3. Krohne FX Series
 4. Or Equal

2.2 PRODUCT DESIGN

- A. The flow metering system shall be microprocessor-based and possess a non-volatile memory to store the sensor calibration and transmitter setup information. The electronics shall be interchangeable for meter sizes 1" - 90".
- B. Flow meters shall be designed to mount directly in the pipe and shall be sized such that velocity at normal low-flow exceeds 2 ft/s.
- C. The sensor shall be the proper size to measure the design flow rate of the piping and measure bi-directional flow as a standard.
- D. The sensor shall consist of a stainless steel flow tube with carbon steel flanges.
 1. Magnetic meters shall have ANSI Class 150 flanged with PTFE liners.
- E. The flow tube liner and electrode material shall be chosen to be compatible with the process fluid. All fluids require a minimum conductivity of 5µS/cm (20µS/cm for deionized water).
- F. The flow tube shall house two measuring electrodes, a grounding electrode, and one for physical empty pipe detection. The electrodes shall be bullet-nosed shaped and made of Hastelloy C4 and shall be cleaned by the velocity of the flow stream.

- G. The flow tube shall be rated NEMA 6/IP67 service shall allow for temporary immersion in water depths of 10 feet for 168 hours OR 30 feet for 48 hours.
- H. Provide gaskets for flanged fittings, deformable under pressure, between measuring tube or grounding rings and pipe flanges.
 - 1. Gaskets shall be at least 1/8-inch thick, ring or full-face as required for pipe, of a synthetic rubber compound containing not less than 50 percent by volume nitrile or neoprene, and shall be free from factice, reclaimed rubber, and other deleterious substances. Gaskets shall be suitable for service conditions specified, specifically designed for use with ductile iron pipe and fittings. Provide high temperature resistant sealing compound (Loctite PST 592 or equivalent) with Dimethacrylate-ester base, and Teflon.
 - 2. Flanged fitting bolts shall conform to ANSI B18.2.1. Exposed: ASTM A 307, Grade B. Buried or Submerged: ASTM A 193, Grade B8M, Class 2, Heavy hex, Type 316 stainless steel.
 - 3. Flanged fitting nuts shall conform to ANSI B18.2.2. Exposed: ASTM A 563, Grade A, Heavy hex. Buried or Submerged: ASTM A 194, Grade B8M, Heavy hex, Type 316 stainless steel.
- I. The transmitter shall be rated NEMA 4X and include a signal converter. The transmitter shall be mounted adjacent to the meter and shall be housed in a polycarbonate case. The transmitter shall be constructed to prevent moisture ingress, promote corrosion resistance, and be impervious to saline environments. The interconnecting cable of sufficient length shall be supplied with the meter.
- J. Flow tube and electronics shall be hydraulically calibrated together at a facility located in the United States and the calibration shall be traceable to the National Bureau of Standards. A computer printout of the actual calibration data giving indicated versus actual flows at a minimum of three (3) flow rates shall be provided with the meter.
- K. The transmitter shall be a microprocessor controller mounted integrally or remotely as specified in the instrument schedule. The transmitter shall incorporate a universal 100-240 VAC/18-30 VDC power supply.
 - 1. The transmitter shall allow local programming that can be operated through the enclosure window without opening the electrical enclosure.
 - 2. The transmitter display shall indicate simultaneous flow rate and total flow with 3 totalizers (forward, reverse and net total) and user-selectable engineering units, readout of diagnostic error messages.
 - 3. If NEMA 6 or 6P is specified in the instrument schedule, the transmitter shall be remotely mounted and custom length cables shall be attached at the factory. Verify cable length prior to ordering.
 - 4. The transmitter output shall 4-20mA HART®. Configure the transmitter to generate a pulse every unit of gallons. Unit of gallons shall be configured such that a pulse is not generated any more frequently than one pulse per second at peak flow.
 - 5. The transmitter output(s) shall be integral to the magnetic flowmeter transmitter electronics; using an external third party signal converter is unacceptable.
 - 6. The transmitter output selected must be supported by add-on instructions (AOI), Level 3 add-on profiles (AOP), device drivers (DD), general station description (GSD) files, instructions and pre-engineered code.

7. The transmitter shall retain all setup parameters and accumulated measurements internally in non-volatile memory in the event of power failure. The memory unit shall be transferrable from a damaged unit or used for a duplicate device with no loss of device parameters or data stored.
8. The transmitter shall be protected against voltage spikes from the power source with internal transient protection. Power consumption shall be no more than 16 VA, independent of meter size.
9. The transmitter and sensor shall include a method to verify flow meter performance to the original manufacturer specifications.
 - a. The system shall be traceable to factory calibration using a third party, attested onboard system pursuant to ISO standards.
 - b. The verification technique shall not require external handhelds, interfaces, special tooling or electrical access for a verification to be performed.
 - c. The transmitter shall store up to eight verifications in the microprocessor.
 - d. A verification of the system shall be possible at any time, locally or remotely, on demand and under process conditions.
 - e. The verification report shall be compliant to common quality systems such as ISO 9000 7.6.a to prove reliability of the meter specified accuracy.

2.3 ACCESSORIES

- A. Nameplates - Refer to Section 40 71 00, INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS.
- B. Mounting Hardware - Provide stainless steel mounting hardware as necessary to mount equipment in locations as described in the Contract Documents.
- C. Cabling - Provide power, and signal, cable and conduit to locate transmitters in locations shown on the Contract Documents and as listed in the instrument schedule.
- D. Lightning and Surge Protection - Provide lightning and surge protection for the equipment.
- E. Flow tubes shall be provided with grounding rings on each flange. Grounding electrodes or straps are not an acceptable alternative. Materials of construction shall Type 316L stainless steel, Hastelloy C or Zirconium as chemically compatible with the measured media. Provide Teflon-type gaskets, deformable under pressure, between measuring tube or grounding rings and pipe flanges.
- F. Spool Pieces - Provide one spool piece for each size flow tube provided. Provide the General Contractor with the spool piece according to their timeline for working on the respective segment of pipe.

2.4 SOURCE QUALITY CONTROL AND CALIBRATION

- A. Magnetic flow meters shall be factory calibrated on an ISO-17025 accredited test stand per "General Requirements for the Competence of Testing and Calibration Laboratories" with certified accuracy traceable to NIST.
- B. Each meter shall ship with a certificate of a 2-point calibration report exceeding stated standard accuracy of 0.5% of rate.

- C. A printout of the actual calibration data points shall indicate apparent and actual flows. The flow calibration data shall be confirmed by the manufacturer and shipped with the meters to the project site.
- D. The manufacturer shall provide complete documentation covering the traceability of all calibration instruments.

PART 3 - EXECUTION

3.1 GENERAL

- A. The mounting site for the transmitter should provide enough room for secure mounting, easy access to conduit ports, full opening of the transmitter covers, and easy readability of the display screen.
- B. Avoid installing transmitter in areas of excessive heat and vibration.
- C. To ensure specification accuracy over widely varying process conditions, install the sensor a minimum of five straight pipe diameters upstream and two pipe diameters downstream from the electrode plane.
- D. The sensor should be installed in a position that ensures the sensor remains full during operation. Vertical installation allows upward process fluid flow and keeps the cross-sectional area full, regardless of flow rate. Horizontal installation should be restricted to low piping sections that are normally full. In these cases, orient the electrode plane to within 45 degrees of horizontal.

3.2 EXAMINATION

- A. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- B. Examine roughing-in of equipment to verify the following:
 - 1. Environmental conditions are within the limitations established by the manufacturer.
- C. Verify that ground connections are in place and that installation of grounding described in Section "Grounding" is complete.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Install instruments as shown on the Contract Drawings and in accordance with the manufacturer's installation instructions and recommendations.
- B. Mount, install, wire, terminate, and configure all instrumentation, instrumentation equipment, and components as specified herein. Provide all necessary brackets and mounting hardware required by the instrument manufacturer for proper installation.
 - 1. Unless otherwise specified or required, supports shall be aluminum or stainless steel. All mounting hardware shall be stainless steel. Equipment mounted on

- walls in contact with soil or water shall be mounted offset from the wall a minimum of ¼-inch
2. Dissimilar metals shall not be connected, spliced, or joined.
- C. Align, level and adjust for satisfactory operation. Install so that parts are easily accessible for inspection, operation, maintenance and repair. Instrumentation shall be mounted upright, vertical, at eye level, and in locations easily and safely accessible. Minor deviations from indicated arrangements may be made, but only after obtaining approval from the Government's Representative.
- D. Specific attention should be given to the following technical requirements
1. Verify ground rings have been installed according to the manufacturer recommendations.
 2. Reduced inlet installations must be accompanied by manufacturer's documented evidence of third party testing and data collection in comparison to a traceable standard.
- E. Electronic low-level signals (analog, discrete, and communications) shall be properly isolated, bundled and supported. These signals shall be routed and separated from AC power wiring.
1. AC power, DC power/signal, and communication cables shall be installed in separate conduit systems, and shall be physically separated by a minimum of 12 inches.
 2. All "intrinsically safe" wires and cables shall be kept isolated and installed in separate wire channels and conduit systems from normal power and signal wires - by at least two inches of space. Label wire channels and conduits "Intrinsic Wiring".
- F. Grounding
1. Equipment shall be solidly grounded with an equipment grounding conductor as specified in Section 26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS and as recommended by the manufacturer. Control panels and instruments shall be grounded at the power supply end using a ground wire pulled with the power wires.
 2. All instruments and transmitters shall be grounded at the device's power source using a ground wire pulled with the power wires. Metal cases of loop-powered instruments shall be grounded at the control panel powering the loop using a ground wire pulled with the twisted-shielded pair of wires. All transmitters and metal cases shall be grounded at the control panel with a ground wire. Grounding through conduit and fittings and to grounds other than that of the control panel are not acceptable.
 3. The shield in twisted-shielded pairs shall be grounded at the power supply end. Meaning, 4-wire transmitters = ground at transmitter end, 3-wire transmitters = ground at power source end, 2-wire transmitters = ground at loop power source end.
- G. Cutting and drilling of existing panels for new instrumentation as shown, specified, or required, shall include repair and touch up painting of panel after installation.

3.4 FIELD QUALITY CONTROL

- A. Prepare for Acceptance Tests as follows:

1. After installing equipment but before power supply is energized, verify that grounding system is completed.
 2. Verify that equipment is installed and connected according to the Contract Documents.
 3. Verify that electrical wiring installation complies with manufacturer's submittal by means of point-to-point continuity testing.
 4. Verify that field-installed power and control wiring complies with the Electrical Specification requirements.
 5. Confirm that field wiring is terminated to the proper device, on the proper terminal, and identified with the appropriate wire number according to the drawings.
 6. Verify that equipment is ready for pre-commissioning checks in accordance with manufacturer's written instructions.
- B. Acceptance Tests: After installing equipment and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements as follows:
1. Perform visual and mechanical inspection and electrical tests according to NETA ATS, Section 7, as it applies to all installed systems and devices.
 2. Verify the proper voltage at each powered circuit and each device.
 3. Each instrument shall provide direct control of totalizer reset functions through the PLC.
 4. Each instrument shall be supported with a device profile permitting direct integration in the PLC.
 5. Analog inputs (transmitters) will be tested using actual process conditions, whenever possible. Verify that scaling is correct and the appropriate value is displayed on the OIT.
- C. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.5 MANUFACTURER'S FIELD SERVICES

- A. Engage a factory-authorized service representative to perform the following inspections, checks, and supervision of testing:
- B. Manufacturer representative shall verify installation of all installed flow tubes and transmitters.
1. Manufacturer representative shall notify the ENGINEER in writing of any problems or discrepancies and proposed solutions.
 2. Manufacturer representative shall perform field verification at the time of installation for long-term analysis of device linearity, repeatability and electronics health. A comparative report shall be generated for each meter tested
- C. Prepare written report to record the following:
1. Inspections and checks carried out on site.
 2. Test procedures used.
 3. Test results that comply with requirements.
 4. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

3.6 OPERATION & MAINTENANCE MANUALS

- A. Prepare O&M Manuals as specified in Section 40 90 00 INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS and in accordance with the requirements herein.

3.7 DEMONSTRATION AND TRAINING

- A. Final Acceptance – Include 1/2 day of a manufacturer-approved field technician's time to test equipment to demonstrate functionality.
- B. Training – In addition to the training content specified in the Section 40 710 00 INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS, integrate the following training topics into the specified training sessions:
 - 1. Identification of each component of the flow meter.
 - 2. Identify incoming sources of power and instruct on how to disconnect AC power.
 - 3. Communication – Demonstrate how to ascertain when discrete signals are energized, when analog signals are open loop, and identifying indicator light functions.

3.8 FOLLOW UP SERVICE

- A. Monitoring and Adjusting: After Substantial Completion, but not more than twelve months after Final Acceptance, perform the following monitoring and adjusting tasks:
 - 1. Replace failed and defective equipment (under warranty).
 - 2. Recalibrate and reconfigure as necessary.
 - 3. Retest and adjust as necessary.

END OF SECTION

SECTION 40 72 13**ULTRASONIC LEVEL METERS****PART 1 - GENERAL****1.1 SUMMARY**

- A. This Section includes general requirements for the ultrasonic type level measurement devices as shown on the Contract Drawings and specified under this specification. This section shall apply to all sensors furnished on this project, regardless of whether it is specifically identified in Division 40.
- B. Supply, mount, install, wire, terminate, and configure all instrumentation, instrumentation equipment, and components as specified herein. Provide all necessary brackets and mounting hardware required by the instrument manufacturer for proper installation.

1.2 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American National Standards Institute (ANSI)
 - 2. American Society for Testing Materials (ASTM)
 - 3. Institute of Electrical and Electronics Owner's Representatives (IEEE)
 - 4. International Society of Automation (ISA)
 - 5. National Electric Manufacturers Association (NEMA)
 - 6. National Electrical Code (NEC)
 - 7. Underwriters Laboratories, Inc. (UL)
- B. Related Specification Sections
 - 1. Division 01 sections
 - 2. Division 26 sections
 - 3. Division 40 sections
 - 4. Contract Drawings

1.3 COORDINATION

- A. General
 - 1. Review the installation requirements of the materials and equipment specified under Division 40, and 26 for installation and interfacing with Plant SCADA.
 - 2. Coordinate the installation and interfacing requirements among the instruments and all control items shown in the Contract Drawings.
 - 3. Coordinate with other Contracts for process connection(s), electrical connection(s), and utility services piping (air, water, etc.) to and away from instruments.
 - 4. Coordinate, prepare, assemble and submit all submittals for items furnished and performed under this Contract.

- B. Project Site
 - 1. Coordinate mounting locations with the process installation. Provide equipment according to the timeline for working on the respective area or work.
 - 2. Contractor shall be responsible to verify with the supplier that the appropriate ratings and options are provided for each application, taking into account area classification, fluid type, temperature, and vacuum limitations.
 - 3. Any deviation from that which is specified shall be brought to the engineers' attention during shop drawing submittals.
- C. Contractor is responsible to verify with the supplier that the transducer and transmitter are mounted in locations that do not compromise their integrity. Any such deviation from that which is specified shall be brought to the Engineer's attention during shop drawing submittals.

1.4 SUBMITTALS

- A. Submit the following in accordance with the Division 01 SUBMITTAL PROCEDURES, Section 40 71 00 INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS and with the requirements specified herein.
- B. Submit Manufacturer's Certificate of proper installation.

1.5 QUALITY ASSURANCE

- A. Comply with all Federal and local laws or ordinances, as well as all applicable codes, standards, regulations and/or regulatory agency requirements including the partial listing below:
 - 1. Joint Industrial Council (JIC) Standards.
 - 2. Local and State Building Codes.
 - 3. Occupational Safety and Health Administration (OSHA) Regulations.
- B. All electrical materials and equipment shall be new and shall bear the label of the Underwriters Laboratory (UL), Inc., Factory Mutual (FM) or equivalent where standards have been established and label service regularly applies.
- C. Instruments not specifically described or identified by manufacturer's catalog numbers shall be designed in conformity with ANSI, IEEE, ISA, JIC, NEMA, and other applicable technical standards.
- D. Instrumentation equipment shall be installed as recommended by the manufacturers. Furnish the services of competent factory trained representatives of the instrumentation manufacturer to supervise the installation for proper assembly, start and operate the equipment, and conduct the field tests.

1.6 DELIVERY AND HANDLING

- A. Temporary storage of instruments shall be in clean dry indoor rooms with a temporary dehumidifier and electric heating to maintain the storeroom between 5 and 40 °C, with humidity less than 90%. Comply with manufacturer's additional written instructions for storing and periodic inspection and testing.

- B. Handle instrumentation materials and equipment in conformance with the manufacturer's written instructions.

1.7 WARRANTY

- A. Provide parts and labor warranty in accordance with the Division 01 for both transmitter and transducer.
- B. Provide an on-site parts and labor warranty for a minimum period of one year after Substantial Completion for all instruments. In cases where the manufacturer offers a longer warranty period, the longer warranty period shall apply as described by the manufacturer.
- C. All instruments that are not fully functional at the time of Substantial Completion shall have warranties extended to provide minimum one year coverage after making the instrument operational, unless otherwise approved by the Owner's Representative.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Ultrasonic Level Meter
 - 1. Endress+Hauser FMU9x + FDU91
 - 2. Pulsar Ultra3 + dBi6
 - 3. Or Equal

2.2 PRODUCT DESIGN

- A. Ultrasonic Sensor
 - 1. Non-contact, echo-time measuring type, ultrasonic level measurement system consisting of sensor, electronic transmitter/controller and interconnecting cabling.
 - 2. The transducer shall be submersible and capable of instantaneous compensation for variations in temperature, atmospheric pressure, humidity and density.
 - 3. The transducer shall be encapsulated in silicone rubber inside a PVC housing.
 - 4. The direct reading zero adjustment shall eliminate the need for precise positioning of the transducer. Any calibration instruments required for start-up or field range change shall be furnished with the instrument. The head range switches shall accommodate spans from 1 foot to 33 feet. Accuracy of output shall be dependent on the span selected and shall be 1.0% of span or better.
 - 5. Maximum blanking distance of 12 inches. Maximum beam angle of 12°.
 - 6. Manufacturer sensor cable to be run to transmitter. If distance to transmitter is greater than 33 feet, provide junction box with terminal strip per manufacturer's recommendation and provide manufacturer's recommended cable of suitable length to reach the transmitter.
 - 7. Provide corrosion resistant mounting hardware for rigid support of sensor per manufacturer's recommendations.
 - 8. The transducer shall be suitable for surface or pipe yoke mounting.

- B. Transmitter
 - 1. The matching electronic transmitter shall be housed in a NEMA 4X corrosion resistant housing, suitable for surface mounting, and with digital display and operator keypad. Electronic transmitter to be mounted local at an accessible location near the measured process.
 - 2. 120 VAC input and a 4-20 mA isolated output directly proportional to the level. Three SPDT relays to program for alarms or control functions. Output shall be field selectable for direct or inverse function.

2.3 ACCESSORIES

- A. Nameplates - Refer to Section 40 71 00. Wording of nameplate shall be as specified in Instrument List.
- B. Mounting Hardware - Provide stainless steel mounting hardware as necessary to mount equipment in locations as described in the Contract Documents.
- C. Cabling - Provide power, and signal, cable and conduit to locate transmitters in locations listed in Instrument List and the Contract Documents according to Section 40 71 00.
- D. Lightning and Surge Protection - Provide lightning and surge protection for the equipment listed in Instrument List in accordance with Section 40 71 00.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install system in accordance with the Manufacturer's printed instructions unless otherwise indicated.
- B. Install equipment in conformance with NEC and all local codes.
- C. Install and interconnect all equipment, devices, electrical hardware, instrumentation and controls and process controller components into, out of and among the enclosures as indicated on the drawings.
- D. Keep enclosures clean at all times. Keep enclosures doors closed except when actually working in the enclosure. Protect all equipment during installation including hole punching for conduit connection. Remove all filings and thread cuttings from enclosures.

3.2 EXAMINATION

- A. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- B. Examine roughing-in of equipment to verify the following:
 - 1. Environmental conditions are within the limitations established by the manufacturer.
 - 2. Locations of external wiring and conduit and equipment connection.

3. Devices which penetrate enclosure shall be constructed/rated/installed to maintain enclosure rating.
- C. Verify that ground connections are in place and that installation of grounding described in Section "Grounding" is complete.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Install instruments as shown on the Contract Drawings and in accordance with the manufacturer's installation instructions and recommendations.
 1. Supply, mount, install, wire, terminate, and configure all instrumentation, instrumentation equipment, and components as specified herein. Provide all necessary brackets and mounting hardware required by the instrument manufacturer for proper installation.
 2. Unless otherwise specified or required, supports shall be aluminum or stainless steel. All mounting hardware shall be stainless steel. Equipment mounted on walls in contact with soil or water shall be mounted offset from the wall a minimum of ¼-inch
 3. Dissimilar metals shall not be connected, spliced, or joined.
 4. Align, level and adjust for satisfactory operation. Install so that parts are easily accessible for inspection, operation, maintenance and repair. Instrumentation shall be mounted upright, vertical, at eye level, and in locations easily and safely accessible. Minor deviations from indicated arrangements may be made, but only after obtaining approval from the Government's Representative.
- B. Specific attention should be given to the following technical requirements
 1. Verify ground rings have been installed according to the manufacturer recommendations.
 2. Reduced inlet installations must be accompanied by manufacturer's documented evidence of third party testing and data collection in comparison to a traceable standard.
- C. Electronic low-level signals (analog, discrete, and communications) shall be properly isolated, bundled and supported. These signals shall be routed and separated from AC power wiring.
 1. AC power, DC power/signal, and communication cables shall be installed in separate conduit systems, and shall be physically separated by a minimum of 12 inches.
 2. All "intrinsically safe" wires and cables shall be kept isolated and installed in separate wire channels and conduit systems from normal power and signal wires - by at least two inches of space. Label wire channels and conduits "Intrinsic Wiring".
- D. Grounding
 1. Equipment shall be solidly grounded with an equipment grounding conductor as specified in Section 26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS and as recommended by the manufacturer. Control panels and

instruments shall be grounded at the power supply end using a ground wire pulled with the power wires.

2. All instruments and transmitters shall be grounded at the device's power source using a ground wire pulled with the power wires. Metal cases of loop-powered instruments shall be grounded at the control panel powering the loop using a ground wire pulled with the twisted-shielded pair of wires. All transmitters and metal cases shall be grounded at the control panel with a ground wire. Grounding through conduit and fittings and to grounds other than that of the control panel are not acceptable.
3. The shield in twisted-shielded pairs shall be grounded at the power supply end. Meaning, 4-wire transmitters = ground at transmitter end, 3-wire transmitters = ground at power source end, 2-wire transmitters = ground at loop power source end.

- E. Cutting and drilling of existing panels for new instrumentation as shown, specified, or required, shall include repair and touch up painting of panel after installation.

3.4 FIELD QUALITY CONTROL

- A. Prepare for Acceptance Tests as follows:
 1. After installing equipment but before power supply is energized, verify that grounding system is completed.
 2. Verify that equipment is installed and connected according to the Contract Documents.
 3. Verify that electrical wiring installation complies with manufacturer's submittal by means of point-to-point continuity testing.
 4. Verify that field-installed power and control wiring complies with the Electrical Specification requirements.
 5. Confirm that field wiring is terminated to the proper device, on the proper terminal, and identified with the appropriate wire number according to the drawings.
 6. Verify that equipment is ready for pre-commissioning checks in accordance with manufacturer's written instructions.
- B. Acceptance Tests: After installing equipment and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements as follows:
 1. Perform visual and mechanical inspection and electrical tests according to NETA ATS, Section 7, as it applies to all installed systems and devices. Certify compliance with the following test parameters:
 2. Verify the proper voltage at each powered circuit and each device.
 3. Each instrument shall provide direct control of totalizer reset functions through the PLC.
 4. Each instrument shall be supported with a device profile permitting direct integration in the PLC.
 5. Analog inputs (transmitters) will be tested using actual process conditions, whenever possible. Verify that scaling is correct and the appropriate value is displayed on the OIT.
- C. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.5 MANUFACTURER'S FIELD SERVICES

- A. Engage a factory-authorized service representative to perform the following inspections, checks, and supervision of testing:
- B. Manufacturer representative shall verify installation of all sensors and transmitters.
 - 1. Manufacturer representative shall notify the ENGINEER in writing of any problems or discrepancies and proposed solutions.
 - 2. Manufacturer representative shall perform field verification at the time of installation for long-term analysis of device linearity, repeatability and electronics health. A comparative report shall be generated for each meter tested
- C. Prepare written report to record the following:
 - 1. Inspections and checks carried out on site.
 - 2. Test procedures used.
 - 3. Test results that comply with requirements.
 - 4. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

3.6 OPERATION & MAINTENANCE MANUALS

- A. Prepare O&M Manuals as specified in Section 40 71 00 INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS and in accordance with the requirements herein.

3.7 DEMONSTRATION AND TRAINING

- A. Final Acceptance – Include 1/2 day of a manufacturer-approved field technician's time to test equipment to demonstrate functionality.
- B. Training – In addition to the training content specified in the Section 40 71 00 INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS, integrate the following training topics into the specified training sessions:
 - 1. Identification of each component of the flow meter.
 - 2. Identify incoming sources of power and instruct on how to disconnect AC power.
 - 3. Communication – Demonstrate how to ascertain when discrete signals are energized, when analog signals are open loop, and identifying indicator light functions.

3.8 FOLLOW UP SERVICE

- A. Monitoring and Adjusting: After Substantial Completion, but not more than twelve months after Final Acceptance, perform the following monitoring and adjusting tasks:
 - 1. Replace failed and defective equipment (under warranty).
 - 2. Recalibrate and reconfigure as necessary.
 - 3. Retest and adjust as necessary.

END OF SECTION

SECTION 40 72 43**PRESSURE TYPE LEVEL METERS****PART 1 - GENERAL****1.1 SUMMARY**

- A. This Section includes general requirements for the pressure type level measurement devices as shown on the Contract Drawings and specified under this specification. This section shall apply to all hydrostatic sensors furnished on this project, regardless of whether it is specifically identified in Division 40.
- B. Supply, mount, install, wire, terminate, and configure all instrumentation, instrumentation equipment, and components as specified herein. Provide all necessary brackets and mounting hardware required by the instrument manufacturer for proper installation.
- C. Mount, install, wire, terminate, and configure Owner furnished instrumentation, and components as noted in the contract drawings. Provide all necessary brackets and mounting hardware required by the instrument manufacturer for proper installation.

1.2 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American National Standards Institute (ANSI)
 - 2. American Society for Testing Materials (ASTM)
 - 3. Institute of Electrical and Electronics Owner's Representatives (IEEE)
 - 4. International Society of Automation (ISA)
 - 5. National Electric Manufacturers Association (NEMA)
 - 6. National Electrical Code (NEC)
 - 7. Underwriters Laboratories, Inc. (UL)
- B. Related Specification Sections
 - 1. Division 01 sections
 - 2. Division 26 sections
 - 3. Division 40 sections
 - 4. Contract Drawings

1.3 COORDINATION

- A. General
 - 1. Review the installation requirements of the materials and equipment specified under Division 40, and 26 for installation and interfacing with Plant SCADA.
 - 2. Coordinate the installation and interfacing requirements among the instruments and all control items shown in the Contract Drawings.

3. Coordinate with other Contracts for process connection(s), electrical connection(s), and utility services piping (air, water, etc.) to and away from instruments.
 4. Coordinate, prepare, assemble and submit all submittals for items furnished and performed under this Contract.
- B. Project Site
1. Coordinate mounting locations with the process installation. Provide equipment according to the timeline for working on the respective area or work.
 2. Contractor shall be responsible to verify with the supplier that the appropriate ratings and options are provided for each application, taking into account area classification, fluid type, temperature, and vacuum limitations.
 3. Any deviation from that which is specified shall be brought to the engineers' attention during shop drawing submittals.

1.4 SUBMITTALS

- A. Submit the following in accordance with the Division 01 SUBMITTAL PROCEDURES, Section 40 71 00 INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS and with the requirements specified herein.
- B. Additional Requirements:
1. Scaled AutoCAD drawings illustrating the actual mounting locations for each hydrostatic transducer. Indicate dimensions of tanks, distances from the centerline of the signal beam and the tank wall, and any nearby obstructions.
 2. Scaled AutoCAD drawings illustrating the actual mounting locations for each sensor immersed in the process. Indicate the sensor location, junction box location and the distance from the probe tip to the floor.
 3. Submit Manufacturer's Certificate of proper installation.

1.5 COORDINATION

- A. Contractor is responsible to verify with the supplier that the transducer and transmitter are mounted in locations that do not compromise their integrity. Any such deviation from that which is specified shall be brought to the Engineer's attention during shop drawing submittals.
- B. Coordinate with other Contracts for process and utility services piping (air, water, etc.) to and away from instruments.
- C. Coordinate process requirements(s), electrical connection(s), and ranges for the instruments and all control items shown in the Contract Drawings.

1.6 QUALITY ASSURANCE

- A. Comply with all Federal and local laws or ordinances, as well as all applicable codes, standards, regulations and/or regulatory agency requirements including the partial listing below:
1. Joint Industrial Council (JIC) Standards.
 2. Local and State Building Codes.
 3. Occupational Safety and Health Administration (OSHA) Regulations.

- B. All electrical materials and equipment shall be new and shall bear the label of the Underwriters Laboratory (UL), Inc., Factory Mutual (FM) or equivalent where standards have been established and label service regularly applies.
- C. Instruments not specifically described or identified by manufacturer's catalog numbers shall be designed in conformity with ANSI, IEEE, ISA, JIC, NEMA, and other applicable technical standards.
- D. Instrumentation equipment shall be installed as recommended by the manufacturers. Furnish the services of competent factory trained representatives of the instrumentation manufacturer to supervise the installation for proper assembly, start and operate the equipment, and conduct the field tests.

1.7 DELIVERY AND HANDLING

- A. Temporary storage of instruments shall be in clean dry indoor rooms with a temporary dehumidifier and electric heating to maintain the storeroom between 5 and 40 °C, with humidity less than 90%. Comply with manufacturer's additional written instructions for storing and periodic inspection and testing.
- B. Handle instrumentation materials and equipment in conformance with the manufacturer's written instructions.

1.8 WARRANTY

- A. Provide parts and labor warranty in accordance with the Division 01 for both transmitter and transducer.
- B. Provide an on-site parts and labor warranty for a minimum period of one year after Substantial Completion for all instruments. In cases where the manufacturer offers a longer warranty period, the longer warranty period shall apply as described by the manufacturer.
- C. All instruments that are not fully functional at the time of Substantial Completion shall have warranties extended to provide minimum one year coverage after making the instrument operational, unless otherwise approved by the Owner's Representative.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Hydrostatic (Submersible Pressure) Transducer
 - 1. Esterline KPSI 700 Series
 - 2. Siemens A1000i
 - 3. Endress+Hauser FMX21
 - 4. Or Equal

2.2 PRODUCT DESIGN

- A. Application – Wastewater wet well where debris, foam, steam, or surface turbulence is present

- B. The level transducer shall be loop powered device operating on 10-30Vdc loop power and shall generate a continuous linear 4-20 mA dc signal from hydrostatic pressure proportional to the wastewater level.
- C. The sensor shall be a ruggedized solid-state head-pressure sensing device, suitable for continuous submergence, utilizing a breather tube.
- D. Sensor shall be designed for harsh applications with a flush-mounted diaphragm of not less than 2 inch constructed of Teflon coated sensing diaphragm.
- E. Submersible sensor cable shall not support the full weight of the sensor assembly and shall be a minimum of 30 feet. Provide cable grips and stainless steel hooks required to support cable. Field verify actual length.
- F. When located in hazardous classified locations, components and installation must be FM approved and installed for such an application. Intrinsic components shall be installed in non-hazardous areas.
- G. Provide the sensor with a NEMA 4X terminal box with breathable filter of GORE-TEX or similar, for breather tube reference pressure. Install in close proximity to sensor, in a safe area.
- H. Provide sensor signal wiring and power supply with surge protection and intrinsically safe wiring where required.
- I. Provide a Digital Indicator, in a NEMA 4 enclosure, for level indication and re-transmission of 4-20mA signal to Plant SCADA.
 - 1. Panel mounted digital process display meter with universal inputs, DC current, DC voltage, resistance RTD or process signals.
 - 2. 5 digit dual line display with 0.7" digits.
 - 3. Sunlight readable display; variable intensity display.
 - 4. 50 to 250 VAC, 60Hz, 14 VA.
 - 5. Dual Form C output relays (5A @ 240 VAC)
 - 6. Retransmitted analog output.
 - 7. NEMA 4X/IP65 sealed front bezel.
 - 8. Manufacturer:
 - a. Red Lion
 - b. Precision Digital

2.3 ACCESSORIES

- A. Nameplates - Refer to Section 40 71 00. Wording of nameplate shall be as specified in Instrument List.
- B. Mounting Hardware - Provide stainless steel mounting hardware as necessary to mount equipment in locations as described in the Contract Documents.
- C. Cabling - Provide power, and signal, cable and conduit to locate transmitters in locations listed in Instrument List and the Contract Documents according to Section 40 71 00.
- D. Lightning and Surge Protection - Provide lightning and surge protection for the equipment listed in Instrument List in accordance with Section 40 71 00.

- E. Stilling Well (Hydrostatic Transducer)
 - 1. Stilling well shall be fabricated of PVC and shall extend from near bottom of the tank to 18" above the top of an accessible platform.
 - 2. Provide ½" diameter holes every three inches at 90 degree intervals along the bottom first six feet.
 - 3. Provide ½" diameter holes every six inches at 90 degree intervals along the upper length of the stilling well.
 - 4. Provide fasteners to anchor stilling well to wet-well wall.
 - 5. Provide a blind flange to the top of the stilling well and drill out a hole to allow the transducer cable to feed through. Provide a compression fitting.
 - 6. Provide a means to flush out stilling well with water, to prevent grit build-up.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install system in accordance with the Manufacturer's printed instructions unless otherwise indicated.
- B. Install equipment in conformance with NEC and all local codes.
- C. Install and interconnect all equipment, devices, electrical hardware, instrumentation and controls and process controller components into, out of and among the enclosures as indicated on the drawings.
- D. Keep enclosures clean at all times. Keep enclosures doors closed except when actually working in the enclosure. Protect all equipment during installation including hole punching for conduit connection. Remove all filings and thread cuttings from enclosures.

3.2 EXAMINATION

- A. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- B. Examine roughing-in of equipment to verify the following:
 - 1. Environmental conditions are within the limitations established by the manufacturer.
 - 2. Locations of external wiring and conduit and equipment connection.
 - 3. Devices which penetrate enclosure shall be constructed/rated/installed to maintain enclosure rating.
- C. Verify that ground connections are in place and that installation of grounding described in Section "Grounding" is complete.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Install instruments as shown on the Contract Drawings and in accordance with the manufacturer's installation instructions and recommendations.
 - 1. Supply, mount, install, wire, terminate, and configure all instrumentation, instrumentation equipment, and components as specified herein. Provide all necessary brackets and mounting hardware required by the instrument manufacturer for proper installation.
 - 2. Unless otherwise specified or required, supports shall be aluminum or stainless steel. All mounting hardware shall be stainless steel. Equipment mounted on walls in contact with soil or water shall be mounted offset from the wall a minimum of ¼-inch
 - 3. Dissimilar metals shall not be connected, spliced, or joined.
 - 4. Align, level and adjust for satisfactory operation. Install so that parts are easily accessible for inspection, operation, maintenance and repair. Instrumentation shall be mounted upright, vertical, at eye level, and in locations easily and safely accessible. Minor deviations from indicated arrangements may be made, but only after obtaining approval from the Government's Representative.
- B. Specific attention should be given to the following technical requirements
 - 1. Verify ground rings have been installed according to the manufacturer recommendations.
 - 2. Reduced inlet installations must be accompanied by manufacturer's documented evidence of third party testing and data collection in comparison to a traceable standard.
- C. Electronic low-level signals (analog, discrete, and communications) shall be properly isolated, bundled and supported. These signals shall be routed and separated from AC power wiring.
 - 1. AC power, DC power/signal, and communication cables shall be installed in separate conduit systems, and shall be physically separated by a minimum of 12 inches.
 - 2. All "intrinsically safe" wires and cables shall be kept isolated and installed in separate wire channels and conduit systems from normal power and signal wires - by at least two inches of space. Label wire channels and conduits "Intrinsic Wiring".
- D. Grounding
 - 1. Equipment shall be solidly grounded with an equipment grounding conductor as specified in Section 26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS and as recommended by the manufacturer. Control panels and instruments shall be grounded at the power supply end using a ground wire pulled with the power wires.
 - 2. All instruments and transmitters shall be grounded at the device's power source using a ground wire pulled with the power wires. Metal cases of loop-powered instruments shall be grounded at the control panel powering the loop using a ground wire pulled with the twisted-shielded pair of wires. All transmitters and metal cases shall be grounded at the control panel with a ground wire.

Grounding through conduit and fittings and to grounds other than that of the control panel are not acceptable.

3. The shield in twisted-shielded pairs shall be grounded at the power supply end. Meaning, 4-wire transmitters = ground at transmitter end, 3-wire transmitters = ground at power source end, 2-wire transmitters = ground at loop power source end.

- E. Cutting and drilling of existing panels for new instrumentation as shown, specified, or required, shall include repair and touch up painting of panel after installation.

3.4 FIELD QUALITY CONTROL

- A. Prepare for Acceptance Tests as follows:
 1. After installing equipment but before power supply is energized, verify that grounding system is completed.
 2. Verify that equipment is installed and connected according to the Contract Documents.
 3. Verify that electrical wiring installation complies with manufacturer's submittal by means of point-to-point continuity testing.
 4. Verify that field-installed power and control wiring complies with the Electrical Specification requirements.
 5. Confirm that field wiring is terminated to the proper device, on the proper terminal, and identified with the appropriate wire number according to the drawings.
 6. Verify that equipment is ready for pre-commissioning checks in accordance with manufacturer's written instructions.
- B. Acceptance Tests: After installing equipment and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements as follows:
 1. Perform visual and mechanical inspection and electrical tests according to NETA ATS, Section 7, as it applies to all installed systems and devices. Certify compliance with the following test parameters:
 2. Verify the proper voltage at each powered circuit and each device.
 3. Each instrument shall provide direct control of totalizer reset functions through the PLC.
 4. Each instrument shall be supported with a device profile permitting direct integration in the PLC.
 5. Analog inputs (transmitters) will be tested using actual process conditions, whenever possible. Verify that scaling is correct and the appropriate value is displayed on the OIT.
- C. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.5 MANUFACTURER'S FIELD SERVICES

- A. Engage a factory-authorized service representative to perform the following inspections, checks, and supervision of testing:
- B. Manufacturer representative shall verify installation of all sensors and transmitters.

1. Manufacturer representative shall notify the ENGINEER in writing of any problems or discrepancies and proposed solutions.
 2. Manufacturer representative shall perform field verification at the time of installation for long-term analysis of device linearity, repeatability and electronics health. A comparative report shall be generated for each meter tested
- C. Prepare written report to record the following:
1. Inspections and checks carried out on site.
 2. Test procedures used.
 3. Test results that comply with requirements.
 4. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

3.6 OPERATION & MAINTENANCE MANUALS

- A. Prepare O&M Manuals as specified in Section 40 71 00 INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS and in accordance with the requirements herein.

3.7 DEMONSTRATION AND TRAINING

- A. Final Acceptance – Include 1/2 day of a manufacturer-approved field technician's time to test equipment to demonstrate functionality.
- B. Training – In addition to the training content specified in the Section 40 71 00 INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS, integrate the following training topics into the specified training sessions:
1. Identification of each component of the flow meter.
 2. Identify incoming sources of power and instruct on how to disconnect AC power.
 3. Communication – Demonstrate how to ascertain when discrete signals are energized, when analog signals are open loop, and identifying indicator light functions.

3.8 FOLLOW UP SERVICE

- A. Monitoring and Adjusting: After Substantial Completion, but not more than twelve months after Final Acceptance, perform the following monitoring and adjusting tasks:
1. Replace failed and defective equipment (under warranty).
 2. Recalibrate and reconfigure as necessary.
 3. Retest and adjust as necessary.

END OF SECTION

SECTION 40 72 46**BUBBLER SYSTEMS****PART 1 - GENERAL****1.1 SUMMARY**

- A. This Section includes general requirements for bubbler systems devices as shown on the Contract Drawings and specified under this specification. This section shall apply to all bubbler devices furnished on this project, regardless of whether it is specifically identified in Division 40.
- B. Supply, mount, install, wire, terminate, and configure all instrumentation, instrumentation equipment, and components as specified herein. Provide all necessary brackets and mounting hardware required by the instrument manufacturer for proper installation.
- C. Mount, install, wire, terminate, and configure Owner furnished instrumentation, and components as noted in the contract drawings. Provide all necessary brackets and mounting hardware required by the instrument manufacturer for proper installation.

1.2 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American National Standards Institute (ANSI)
 - 2. American Society for Testing Materials (ASTM)
 - 3. Institute of Electrical and Electronics Owner's Representatives (IEEE)
 - 4. International Society of Automation (ISA)
 - 5. National Electric Manufacturers Association (NEMA)
 - 6. National Electrical Code (NEC)
 - 7. Underwriters Laboratories, Inc. (UL)
- B. Related Specification Sections
 - 1. Division 01 sections
 - 2. Division 26 sections
 - 3. Division 40 sections
 - 4. Contract Drawings

1.3 COORDINATION

- A. General
 - 1. Review the installation requirements of the materials and equipment specified under Division 40, and 26 for installation and interfacing with Plant SCADA.
 - 2. Coordinate the installation and interfacing requirements among the instruments and all control items shown in the Contract Drawings.

3. Coordinate with other Contracts for process connection(s), electrical connection(s), and utility services piping (air, water, etc.) to and away from instruments.
 4. Coordinate, prepare, assemble and submit all submittals for items furnished and performed under this Contract.
- B. Project Site
1. Coordinate mounting locations with the process installation. Provide equipment according to the timeline for working on the respective area or work.
 2. Contractor shall be responsible to verify with the supplier that the appropriate ratings and options are provided for each application, taking into account area classification, fluid type, temperature, and vacuum limitations.
 3. Any deviation from that which is specified shall be brought to the engineers' attention during shop drawing submittals.

1.4 SUBMITTALS

- A. Submit the following in accordance with the Division 01 SUBMITTAL PROCEDURES, Section 40 71 00 INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS and with the requirements specified herein.
- B. Additional Requirements:
1. Scaled AutoCAD drawings illustrating the actual mounting locations for each transmitter and compressor.
 2. Scaled AutoCAD drawings illustrating the actual mounting locations for each bubbler tube immersed in the process. Indicate the tube location, size, material of construction, routings and the distance from the floor.
 3. Submit Manufacturer's Certificate of proper installation.

1.5 COORDINATION

- A. Contractor is responsible to verify with the supplier that the transducer and transmitter are mounted in locations that do not compromise their integrity. Any such deviation from that which is specified shall be brought to the Engineer's attention during shop drawing submittals.
- B. Coordinate with other Contracts for process and utility services piping (air, water, etc.) to and away from instruments.
- C. Coordinate process requirements(s), electrical connection(s), and ranges for the instruments and all control items shown in the Contract Drawings.

1.6 QUALITY ASSURANCE

- A. Comply with all Federal and local laws or ordinances, as well as all applicable codes, standards, regulations and/or regulatory agency requirements including the partial listing below:
1. Joint Industrial Council (JIC) Standards.
 2. Local and State Building Codes.
 3. Occupational Safety and Health Administration (OSHA) Regulations.

- B. All electrical materials and equipment shall be new and shall bear the label of the Underwriters Laboratory (UL), Inc., Factory Mutual (FM) or equivalent where standards have been established and label service regularly applies.
- C. Instruments not specifically described or identified by manufacturer's catalog numbers shall be designed in conformity with ANSI, IEEE, ISA, JIC, NEMA, and other applicable technical standards.
- D. Instrumentation equipment shall be installed as recommended by the manufacturers. Furnish the services of competent factory trained representatives of the instrumentation manufacturer to supervise the installation for proper assembly, start and operate the equipment, and conduct the field tests.

1.7 DELIVERY AND HANDLING

- A. Temporary storage of instruments shall be in clean dry indoor rooms with a temporary dehumidifier and electric heating to maintain the storeroom between 5 and 40 °C, with humidity less than 90%. Comply with manufacturer's additional written instructions for storing and periodic inspection and testing.
- B. Handle instrumentation materials and equipment in conformance with the manufacturer's written instructions.

1.8 WARRANTY

- A. Provide parts and labor warranty in accordance with the Division 01 for both transmitter and transducer.
- B. Provide an on-site parts and labor warranty for a minimum period of one year after Substantial Completion for all instruments. In cases where the manufacturer offers a longer warranty period, the longer warranty period shall apply as described by the manufacturer.
- C. All instruments that are not fully functional at the time of Substantial Completion shall have warranties extended to provide minimum one year coverage after making the instrument operational, unless otherwise approved by the Owner's Representative.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Bubbler System
 - 1. Lesman Bubbler
 - 2. CA Briggs Company MPE2000
 - 3. Or Equal

2.2 PRODUCT DESIGN

- A. Application – Wastewater wet well where debris, foam, steam, or surface turbulence is present.

- B. Provide a fully automatic bubbler system complete with air supply regulator, filter, flow regulator, pressure transmitter, dip tube, and controls system with status indication, and system fault alarms. Bubbler system shall be housed in a NEMA 4 enclosure.
1. Air Supply Regulator
 - a. The Bubbler System shall contain an internal pressure regulator to reduce incoming air pressure from a regulator to the correct supply pressure for the application.
 - b. Regulator shall have a body construction of Aluminum, inner valve shall be brass, and be controlled with a non-rising adjustment knob. Inlet/outlet shall be 1/4" NPTF; gauge ports shall be 1/8" NPTF and have connections on the front and back.
 - c. Maximum Pressure: 200PSIG; 14BAR
 - d. Operating Temp: 40 to 120°F; 4 to 50°C
 - e. Regulator must be a modular connection with the Coalescing Filter in section 3.2.
 - f. The pressure regulator will have a pressure gauge indicating the outlet supply pressure
 2. Filter
 - a. System shall contain a 0.3 micron coalescing filter to remove dirt, oil, and water from incoming air supply. It shall contain a drain port on the bottom of the bowl to drain accumulated water which shall be piped to a drain connection on the bottom of the panel to with tubing.
 - b. Shall have Aluminum body construction, and shall contain inner and outer support core to prevent element from crushing in either flow direction. Shall have a manual level drain on the bottom of polycarbonate bowl. Inlet/outlet shall be 1/4" NPTF.
 - c. Maximum Pressure: 150 PSIG; 10 BAR
 - d. Operating Temp: 40 to 120 °F; 4 to 50 °C
 3. Flow Regulator
 - a. Shall provides a means for maintaining a practically constant volumetric rate of flow through the Dip tube and Dip tube piping regardless of variations in supply or outlet back pressure.
 - b. Shall have an aluminum body construction and shall have an attached Rotameter with a magnified sight glass for reading air flow.
 - c. Max: 150PSIG
 - d. Operating Temp: -40 to 180F; -40 to 82°C
 - e. Manufacturer: Shall be a Moore/Siemens 62 series Constant Differential Relay
 4. Pressure Transmitter
 - a. System shall contain a smart gauge pressure transmitter, temperature compensated, to read changing pressure in the bubbler Dip tube, which when converted (for the fluid's Specific Gravity) to specified engineering units provides a level reading.
 - b. Shall have an electrical housing constructed of low-copper die-cast aluminum. Connection shank, oval flange, and seal diaphragm shall be stainless steel.
 - c. Process connection shall be 1/2" NPTF, electrical connection/cable entry to be 1/2" NPTF.
 - d. Power supply voltage shall be 10.5-45VDC. Measuring cell fill fluid shall be Silicone oil. Transmitter shall have HART communication with a 4-20mA output.

- e. Transmitter shall have an integral digital display for pressure reading and pushbuttons for local configuration.
- f. Operating Temp: -22 to 185 °F; -30 to 85 °C
- g. Pressure transmitter shall be mounted in the vertical position on a mounting bracket.
- 5. Panel Meter
 - a. System shall contain a panel meter to provide DC power to the pressure transmitter, convert the pressure transmitter 4-20mA to level, display the level value and its engineering units, and retransmit the 4-20mA as either an active panel powered 4-20mA signal or as a passive loop powered 4-20mA signal for customers' use.
 - b. Panel meter enclosure shall have a body construction of 1/8DIN high impact plastic, NEMA 4X, IP65.
 - c. Shall have a 6 digit dual display.
 - d. 85 to 265 VAC 50/60.
 - e. 4-20mA output, and shall contain 2 SPTD form C relays rated 3A @30Vdc.
- C. Purge Circuit
 - 1. The bubbler system shall provide a purge circuit to clear the dip tube from any debris, sludge, etc. that may block the passage of air.
 - 2. The system shall lock or hold the indicated level at the initiation of and during the entire purge cycle to prevent a false process variable upset to any connected level control or false alarms from the turbulence expected from purge action.
 - 3. The bubbler system shall lock or hold the indicated level for a period of time after the purge is completed to allow the pressures to stabilize and equilibrate after the turbulence created by the purge cycle. 3. The pressure transmitter and constant flow regulator shall be blocked during the purge.
 - 4. A momentary pushbutton, labeled Purge, shall be mounted in the panel door. Pressing and holding the pushbutton switch shall directly connect the supply line pressure air to the DIP tube outlet to provide purge/blowdown air.

2.3 ACCESSORIES

- A. Nameplates - Refer to Section 40 71 00. Wording of nameplate shall be as specified in Instrument List.
- B. Mounting Hardware - Provide stainless steel mounting hardware as necessary to mount equipment in locations as described in the Contract Documents.
- C. Fittings:
 - 1. Pipe fittings shall be stainless steel
 - 2. 0 to 200°F @ 300psi max.
- D. Tubing
 - 1. Material: made from stainless steel.
 - 2. Purge tubing shall be 0.50" OD with 0.062" wall thickness
 - 3. Level pressure tubing shall be 0.375"OD with 0.050" wall thickness.
 - 4. Tubing shall have a working pressure rating of 250psi with a 1000psi burst pressure.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install system in accordance with the Manufacturer's printed instructions unless otherwise indicated.
- B. Install equipment in conformance with NEC and all local codes.
- C. Install and interconnect all equipment, devices, electrical hardware, instrumentation and controls and process controller components into, out of and among the enclosures as indicated on the drawings.
- D. Keep enclosures clean at all times. Keep enclosures doors closed except when actually working in the enclosure. Protect all equipment during installation including hole punching for conduit connection. Remove all filings and thread cuttings from enclosures.

3.2 EXAMINATION

- A. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- B. Examine roughing-in of equipment to verify the following:
 - 1. Environmental conditions are within the limitations established by the manufacturer.
 - 2. Locations of external wiring and conduit and equipment connection.
 - 3. Devices which penetrate enclosure shall be constructed/rated/installed to maintain enclosure rating.
- C. Verify that ground connections are in place and that installation of grounding described in Section "Grounding" is complete.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Install instruments as shown on the Contract Drawings and in accordance with the manufacturer's installation instructions and recommendations.
 - 1. Supply, mount, install, wire, terminate, and configure all instrumentation, instrumentation equipment, and components as specified herein. Provide all necessary brackets and mounting hardware required by the instrument manufacturer for proper installation.
 - 2. Unless otherwise specified or required, supports shall be aluminum or stainless steel. All mounting hardware shall be stainless steel. Equipment mounted on walls in contact with soil or water shall be mounted offset from the wall a minimum of ¼-inch
 - 3. Dissimilar metals shall not be connected, spliced, or joined.
 - 4. Align, level and adjust for satisfactory operation. Install so that parts are easily accessible for inspection, operation, maintenance and repair. Instrumentation shall be mounted upright, vertical, at eye level, and in locations easily and safely

accessible. Minor deviations from indicated arrangements may be made, but only after obtaining approval from the Government's Representative.

- B. Specific attention should be given to the following technical requirements
 - 1. Verify ground rings have been installed according to the manufacturer recommendations.
 - 2. Reduced inlet installations must be accompanied by manufacturer's documented evidence of third party testing and data collection in comparison to a traceable standard.
- C. Electronic low-level signals (analog, discrete, and communications) shall be properly isolated, bundled and supported. These signals shall be routed and separated from AC power wiring.
 - 1. AC power, DC power/signal, and communication cables shall be installed in separate conduit systems, and shall be physically separated by a minimum of 12 inches.
 - 2. All "intrinsically safe" wires and cables shall be kept isolated and installed in separate wire channels and conduit systems from normal power and signal wires - by at least two inches of space. Label wire channels and conduits "Intrinsic Wiring".
- D. Grounding
 - 1. Equipment shall be solidly grounded with an equipment grounding conductor as specified in Section 26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS and as recommended by the manufacturer. Control panels and instruments shall be grounded at the power supply end using a ground wire pulled with the power wires.
 - 2. All instruments and transmitters shall be grounded at the device's power source using a ground wire pulled with the power wires. Metal cases of loop-powered instruments shall be grounded at the control panel powering the loop using a ground wire pulled with the twisted-shielded pair of wires. All transmitters and metal cases shall be grounded at the control panel with a ground wire. Grounding through conduit and fittings and to grounds other than that of the control panel are not acceptable.
 - 3. The shield in twisted-shielded pairs shall be grounded at the power supply end. Meaning, 4-wire transmitters = ground at transmitter end, 3-wire transmitters = ground at power source end, 2-wire transmitters = ground at loop power source end.
- E. Cutting and drilling of existing panels for new instrumentation as shown, specified, or required, shall include repair and touch up painting of panel after installation.

3.4 FIELD QUALITY CONTROL

- A. Prepare for Acceptance Tests as follows:
 - 1. After installing equipment but before power supply is energized, verify that grounding system is completed.
 - 2. Verify that equipment is installed and connected according to the Contract Documents.

3. Verify that electrical wiring installation complies with manufacturer's submittal by means of point-to-point continuity testing.
 4. Verify that field-installed power and control wiring complies with the Electrical Specification requirements.
 5. Confirm that field wiring is terminated to the proper device, on the proper terminal, and identified with the appropriate wire number according to the drawings.
 6. Verify that equipment is ready for pre-commissioning checks in accordance with manufacturer's written instructions.
- B. Acceptance Tests: After installing equipment and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements as follows:
1. Perform visual and mechanical inspection and electrical tests according to NETA ATS, Section 7, as it applies to all installed systems and devices. Certify compliance with the following test parameters:
 2. Verify the proper voltage at each powered circuit and each device.
 3. Each instrument shall provide direct control of totalizer reset functions through the PLC.
 4. Each instrument shall be supported with a device profile permitting direct integration in the PLC.
 5. Analog inputs (transmitters) will be tested using actual process conditions, whenever possible. Verify that scaling is correct and the appropriate value is displayed on the OIT.
- C. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.5 MANUFACTURER'S FIELD SERVICES

- A. Engage a factory-authorized service representative to perform the following inspections, checks, and supervision of testing:
- B. Manufacturer representative shall verify installation of all sensors and transmitters.
1. Manufacturer representative shall notify the ENGINEER in writing of any problems or discrepancies and proposed solutions.
 2. Manufacturer representative shall perform field verification at the time of installation for long-term analysis of device linearity, repeatability and electronics health. A comparative report shall be generated for each meter tested
- C. Prepare written report to record the following:
1. Inspections and checks carried out on site.
 2. Test procedures used.
 3. Test results that comply with requirements.
 4. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

3.6 OPERATION & MAINTENANCE MANUALS

- A. Prepare O&M Manuals as specified in Section 40 71 00 INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS and in accordance with the requirements herein.

3.7 DEMONSTRATION AND TRAINING

- A. Final Acceptance – Include 1/2 day of a manufacturer-approved field technician's time to test equipment to demonstrate functionality.
- B. Training – In addition to the training content specified in the Section 40 71 00 INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS, integrate the following training topics into the specified training sessions:
 - 1. Identification of each component of the flow meter.
 - 2. Identify incoming sources of power and instruct on how to disconnect AC power.
 - 3. Communication – Demonstrate how to ascertain when discrete signals are energized, when analog signals are open loop, and identifying indicator light functions.

3.8 FOLLOW UP SERVICE

- A. Monitoring and Adjusting: After Substantial Completion, but not more than twelve months after Final Acceptance, perform the following monitoring and adjusting tasks:
 - 1. Replace failed and defective equipment (under warranty).
 - 2. Recalibrate and reconfigure as necessary.
 - 3. Retest and adjust as necessary.

END OF SECTION

SECTION 40 72 76**LEVEL SWITCHES****PART 1 - GENERAL****1.1 SUMMARY**

- A. This Section includes general requirements for the level switches as shown on the Contract Drawings and specified under this specification. This section shall apply to all sensors furnished on this project, regardless of whether it is specifically identified in Division 40.
- B. Supply, mount, install, wire, terminate, and configure all instrumentation, instrumentation equipment, and components as specified herein. Provide all necessary brackets and mounting hardware required by the instrument manufacturer for proper installation.

1.2 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American National Standards Institute (ANSI)
 - 2. American Society for Testing Materials (ASTM)
 - 3. Institute of Electrical and Electronics Owner's Representatives (IEEE)
 - 4. International Society of Automation (ISA)
 - 5. National Electric Manufacturers Association (NEMA)
 - 6. National Electrical Code (NEC)
 - 7. Underwriters Laboratories, Inc. (UL)
- B. Related Specification Sections
 - 1. Division 01 sections
 - 2. Division 26 sections
 - 3. Division 40 sections
 - 4. Contract Drawings

1.3 COORDINATION

- A. General
 - 1. Review the installation requirements of the materials and equipment specified under Division 40, and 26 for installation and interfacing with Plant SCADA.
 - 2. Coordinate the installation and interfacing requirements among the instruments and all control items shown in the Contract Drawings.
 - 3. Coordinate with other Contracts for process connection(s), electrical connection(s), and utility services piping (air, water, etc.) to and away from instruments.
 - 4. Coordinate, prepare, assemble and submit all submittals for items furnished and performed under this Contract.

- B. Project Site
 - 1. Coordinate mounting locations with the process installation. Provide equipment according to the timeline for working on the respective area or work.
 - 2. Contractor shall be responsible to verify with the supplier that the appropriate ratings and options are provided for each application, taking into account area classification, fluid type, temperature, and vacuum limitations.
 - 3. Any deviation from that which is specified shall be brought to the engineers' attention during shop drawing submittals.
- C. Contractor is responsible to verify with the supplier that the transducer and transmitter are mounted in locations that do not compromise their integrity. Any such deviation from that which is specified shall be brought to the Engineer's attention during shop drawing submittals.

1.4 SUBMITTALS

- A. Submit the following in accordance with the Division 01 SUBMITTAL PROCEDURES, Section 40 71 00 INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS and with the requirements specified herein.
- B. Submit Manufacturer's Certificate of proper installation.

1.5 QUALITY ASSURANCE

- A. Comply with all Federal and local laws or ordinances, as well as all applicable codes, standards, regulations and/or regulatory agency requirements including the partial listing below:
 - 1. Joint Industrial Council (JIC) Standards.
 - 2. Local and State Building Codes.
 - 3. Occupational Safety and Health Administration (OSHA) Regulations.
- B. All electrical materials and equipment shall be new and shall bear the label of the Underwriters Laboratory (UL), Inc., Factory Mutual (FM) or equivalent where standards have been established and label service regularly applies.
- C. Instruments not specifically described or identified by manufacturer's catalog numbers shall be designed in conformity with ANSI, IEEE, ISA, JIC, NEMA, and other applicable technical standards.
- D. Instrumentation equipment shall be installed as recommended by the manufacturers. Furnish the services of competent factory trained representatives of the instrumentation manufacturer to supervise the installation for proper assembly, start and operate the equipment, and conduct the field tests.

1.6 DELIVERY AND HANDLING

- A. Temporary storage of instruments shall be in clean dry indoor rooms with a temporary dehumidifier and electric heating to maintain the storeroom between 5 and 40 °C, with humidity less than 90%. Comply with manufacturer's additional written instructions for storing and periodic inspection and testing.

- B. Handle instrumentation materials and equipment in conformance with the manufacturer's written instructions.

1.7 WARRANTY

- A. Provide parts and labor warranty in accordance with the Division 01 for both transmitter and transducer.
- B. Provide an on-site parts and labor warranty for a minimum period of one year after Substantial Completion for all instruments. In cases where the manufacturer offers a longer warranty period, the longer warranty period shall apply as described by the manufacturer.
- C. All instruments that are not fully functional at the time of Substantial Completion shall have warranties extended to provide minimum one year coverage after making the instrument operational, unless otherwise approved by the Owner's Representative.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Level Switch, Float
 - 1. Flygt ENM-10
 - 2. Warrick Series M
 - 3. Or Equal
- B. Level Switch, Stem
 - 1. Gems LS-270
 - 2. Contegra Model FS-202
 - 3. Or Equal
- C. Level Switch, Leak
 - 1. Gems DWP-25
 - 2. Or Equal

2.2 PRODUCT DESIGN

- A. Level Switch – Float Type
 - 1. Type: Mercury-free, direct acting, pear shaped, eccentric weighted, displacement type liquid level sensor.
 - 2. Mechanical tilt float level switch, with a sealed cable and an impact & corrosion resistant ABS or PVC hermetically sealed shell.
 - 3. Float switch cable shall be provided with sensor as an integral assembly. The cord shall be 16 gauge 2 or 3 conductor SJOW oil resistant CPE, of sufficient length to allow connection at junction box (without splices, unless otherwise shown) above sump area.
 - 4. The contact rating shall be 10 amp at 120 VAC.
 - 5. Install float with cable restraints and weights as necessary for proper operation at the correct level and location.
 - 6. Float switches in hazardous classified locations shall utilize intrinsic relays and wiring. Intrinsic components shall be installed in non-hazardous areas.

7. Cables shall be of sufficient length to mount the float switches at the locations shown on the Contract Drawings, plus an additional 10 feet (minimum) of cable. Cables shall be provided in continuous lengths between the float and the associated junction box or control panel. Excess cable shall be coiled and tie-wrapped to the cable mounting supports.
- B. Level Switch – Stem Type
1. Float switches shall be shown to be suitable for operation with required fluid in sump areas. Float switch junction box and mounting hardware shall meet NEMA 4X corrosion resistance requirements.
 2. Float shall activate “non-mercury” magnetically actuated switch within 1 inch of resting position. This float switch shall require no adjustments and need no calibration. Float operation under submergence, pressure or following long-term inactivity shall be reliable.
 3. The contact rating shall be 60 VA.
 4. Mount 1” above sump floor or as required by application.
 5. Float switch shall be with the provided with float switch, float switch conduit, and junction box for use with required fluid (specific gravity – 0.90).
 6. Float switches shall ride on a stem with actuation as necessary for proper operation at the correct level and location.
- C. Level Switch – Leak Detection Type
1. Switch shall be designed for use in annular space of double wall tanks to detect the presence of conductive liquid.
 2. Stainless steel probe in plastic housing.
 3. Leak switch cable shall be provided with sensor as an integral assembly. The cord shall be 16 gauge 2 conductor SJOW oil resistant CPE, of 25 foot length to allow connection at junction box (without splices, unless otherwise shown) above tank area.
 4. The contact rating shall be 50VA.
 5. Provide Monitoring panels for a complete leak detection system.
 - a. Monitoring panels shall be used in conjunction with the leak sensor and shall contain an adjustable sound horn, alarm & status LED indications, test & acknowledge buttons and auxiliary contacts.
 - b. 120 Vac supply voltage.
 - c. NEMA 4 polycarbonate enclosure.
 - d. Normally open sensor, contact rating 10Amp @ 120Vac.
 - e. Manufactured by Warrick RA-431A

2.3 ACCESSORIES

- A. Nameplates - Refer to Section 40 71 00. Wording of nameplate shall be as specified in Instrument List.
- B. Intrinsic Barriers – Provide Intrinsic Safety Relays (ISR) and conduit with filled seal-offs for both power and signal wiring, isolating the hazardous area from the safe area electrically. Barriers shall be located in the safe areas.
- C. Mounting Hardware - Provide stainless steel mounting hardware as necessary to mount equipment in locations as described in the Contract Documents.

- D. Cabling - Provide power, and signal, cable and conduit to locate transmitters in locations listed in Instrument List and the Contact Documents according to Section 40 71 00.
- E. Lightning and Surge Protection - Provide lightning and surge protection for the equipment listed in Instrument List in accordance with Section 40 71 00.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install system in accordance with the Manufacturer's printed instructions unless otherwise indicated.
- B. Install equipment in conformance with NEC and all local codes.
- C. Install and interconnect all equipment, devices, electrical hardware, instrumentation and controls and process controller components into, out of and among the enclosures as indicated on the drawings.
- D. Keep enclosures clean at all times. Keep enclosures doors closed except when actually working in the enclosure. Protect all equipment during installation including hole punching for conduit connection. Remove all filings and thread cuttings from enclosures.

3.2 EXAMINATION

- A. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- B. Examine roughing-in of equipment to verify the following:
 - 1. Environmental conditions are within the limitations established by the manufacturer.
 - 2. Locations of external wiring and conduit and equipment connection.
 - 3. Devices which penetrate enclosure shall be constructed/rated/installed to maintain enclosure rating.
- C. Verify that ground connections are in place and that installation of grounding described in Section "Grounding" is complete.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Install instruments as shown on the Contract Drawings and in accordance with the manufacturer's installation instructions and recommendations.
 - 1. Supply, mount, install, wire, terminate, and configure all instrumentation, instrumentation equipment, and components as specified herein. Provide all necessary brackets and mounting hardware required by the instrument manufacturer for proper installation.

2. Unless otherwise specified or required, supports shall be aluminum or stainless steel. All mounting hardware shall be stainless steel. Equipment mounted on walls in contact with soil or water shall be mounted offset from the wall a minimum of ¼-inch
 3. Dissimilar metals shall not be connected, spliced, or joined.
 4. Align, level and adjust for satisfactory operation. Install so that parts are easily accessible for inspection, operation, maintenance and repair. Instrumentation shall be mounted upright, vertical, at eye level, and in locations easily and safely accessible. Minor deviations from indicated arrangements may be made, but only after obtaining approval from the Government's Representative.
- B. Specific attention should be given to the following technical requirements
1. Verify ground rings have been installed according to the manufacturer recommendations.
 2. Reduced inlet installations must be accompanied by manufacturer's documented evidence of third party testing and data collection in comparison to a traceable standard.
- C. Electronic low-level signals (analog, discrete, and communications) shall be properly isolated, bundled and supported. These signals shall be routed and separated from AC power wiring.
1. AC power, DC power/signal, and communication cables shall be installed in separate conduit systems, and shall be physically separated by a minimum of 12 inches.
 2. All "intrinsically safe" wires and cables shall be kept isolated and installed in separate wire channels and conduit systems from normal power and signal wires - by at least two inches of space. Label wire channels and conduits "Intrinsic Wiring".
- D. Grounding
1. Equipment shall be solidly grounded with an equipment grounding conductor as specified in Section 26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS and as recommended by the manufacturer. Control panels and instruments shall be grounded at the power supply end using a ground wire pulled with the power wires.
 2. All instruments and transmitters shall be grounded at the device's power source using a ground wire pulled with the power wires. Metal cases of loop-powered instruments shall be grounded at the control panel powering the loop using a ground wire pulled with the twisted-shielded pair of wires. All transmitters and metal cases shall be grounded at the control panel with a ground wire. Grounding through conduit and fittings and to grounds other than that of the control panel are not acceptable.
 3. The shield in twisted-shielded pairs shall be grounded at the power supply end. Meaning, 4-wire transmitters = ground at transmitter end, 3-wire transmitters = ground at power source end, 2-wire transmitters = ground at loop power source end.
- E. Cutting and drilling of existing panels for new instrumentation as shown, specified, or required, shall include repair and touch up painting of panel after installation.

3.4 FIELD QUALITY CONTROL

- A. Prepare for Acceptance Tests as follows:
 - 1. After installing equipment but before power supply is energized, verify that grounding system is completed.
 - 2. Verify that equipment is installed and connected according to the Contract Documents.
 - 3. Verify that electrical wiring installation complies with manufacturer's submittal by means of point-to-point continuity testing.
 - 4. Verify that field-installed power and control wiring complies with the Electrical Specification requirements.
 - 5. Confirm that field wiring is terminated to the proper device, on the proper terminal, and identified with the appropriate wire number according to the drawings.
 - 6. Verify that equipment is ready for pre-commissioning checks in accordance with manufacturer's written instructions.
- B. Acceptance Tests: After installing equipment and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements as follows:
 - 1. Perform visual and mechanical inspection and electrical tests according to NETA ATS, Section 7, as it applies to all installed systems and devices. Certify compliance with the following test parameters:
 - 2. Verify the proper voltage at each powered circuit and each device.
 - 3. Each instrument shall provide direct control of totalizer reset functions through the PLC.
 - 4. Each instrument shall be supported with a device profile permitting direct integration in the PLC.
 - 5. Analog inputs (transmitters) will be tested using actual process conditions, whenever possible. Verify that scaling is correct and the appropriate value is displayed on the OIT.
- C. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.5 MANUFACTURER'S FIELD SERVICES

- A. Engage a factory-authorized service representative to perform the following inspections, checks, and supervision of testing:
- B. Manufacturer representative shall verify installation of all sensors and transmitters.
 - 1. Manufacturer representative shall notify the ENGINEER in writing of any problems or discrepancies and proposed solutions.
 - 2. Manufacturer representative shall perform field verification at the time of installation for long-term analysis of device linearity, repeatability and electronics health. A comparative report shall be generated for each meter tested
- C. Prepare written report to record the following:
 - 1. Inspections and checks carried out on site.
 - 2. Test procedures used.

3. Test results that comply with requirements.
4. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

3.6 OPERATION & MAINTENANCE MANUALS

- A. Prepare O&M Manuals as specified in Section 40 71 00 INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS and in accordance with the requirements herein.

3.7 DEMONSTRATION AND TRAINING

- A. Final Acceptance – Include 1/2 day of a manufacturer-approved field technician's time to test equipment to demonstrate functionality.
- B. Training – In addition to the training content specified in the Section 40 71 00 INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS, integrate the following training topics into the specified training sessions:
 1. Identification of each component of the flow meter.
 2. Identify incoming sources of power and instruct on how to disconnect AC power.
 3. Communication – Demonstrate how to ascertain when discrete signals are energized, when analog signals are open loop, and identifying indicator light functions.

3.8 FOLLOW UP SERVICE

- A. Monitoring and Adjusting: After Substantial Completion, but not more than twelve months after Final Acceptance, perform the following monitoring and adjusting tasks:
 1. Replace failed and defective equipment (under warranty).
 2. Recalibrate and reconfigure as necessary.
 3. Retest and adjust as necessary.

END OF SECTION

SECTION 40 73 26**GAUGE PRESSURE TRANSMITTERS****PART 1 - GENERAL****1.1 SUMMARY**

- A. This Section includes general requirements for the gauge pressure devices as shown on the Contract Drawings and specified under this specification. This section shall apply to all sensors furnished on this project, regardless of whether it is specifically identified in Division 40.
- B. Supply, mount, install, wire, terminate, and configure all instrumentation, instrumentation equipment, and components as specified herein. Provide all necessary brackets and mounting hardware required by the instrument manufacturer for proper installation.

1.2 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American National Standards Institute (ANSI)
 - 2. American Society for Testing Materials (ASTM)
 - 3. Institute of Electrical and Electronics Owner's Representatives (IEEE)
 - 4. International Society of Automation (ISA)
 - 5. National Electric Manufacturers Association (NEMA)
 - 6. National Electrical Code (NEC)
 - 7. Underwriters Laboratories, Inc. (UL)
- B. Related Specification Sections
 - 1. Division 01 sections
 - 2. Division 26 sections
 - 3. Division 40 sections
 - 4. Contract Drawings

1.3 COORDINATION

- A. General
 - 1. Review the installation requirements of the materials and equipment specified under Division 40, and 26 for installation and interfacing with Plant SCADA.
 - 2. Coordinate the installation and interfacing requirements among the instruments and all control items shown in the Contract Drawings.
 - 3. Coordinate with other Contracts for process connection(s), electrical connection(s), and utility services piping (air, water, etc.) to and away from instruments.
 - 4. Coordinate, prepare, assemble and submit all submittals for items furnished and performed under this Contract.

- B. Project Site
 - 1. Coordinate mounting locations with the process installation. Provide equipment according to the timeline for working on the respective area or work.
 - 2. Contractor shall be responsible to verify with the supplier that the appropriate ratings and options are provided for each application, taking into account area classification, fluid type, temperature, and vacuum limitations.
 - 3. Any deviation from that which is specified shall be brought to the engineers' attention during shop drawing submittals.
- C. Contractor is responsible to verify with the supplier that the transducer and transmitter are mounted in locations that do not compromise their integrity. Any such deviation from that which is specified shall be brought to the Engineer's attention during shop drawing submittals.

1.4 SUBMITTALS

- A. Submit the following in accordance with the Division 01 SUBMITTAL PROCEDURES, Section 40 71 00 INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS and with the requirements specified herein.
- B. Submit Manufacturer's Certificate of proper installation.

1.5 QUALITY ASSURANCE

- A. Comply with all Federal and local laws or ordinances, as well as all applicable codes, standards, regulations and/or regulatory agency requirements including the partial listing below:
 - 1. Joint Industrial Council (JIC) Standards.
 - 2. Local and State Building Codes.
 - 3. Occupational Safety and Health Administration (OSHA) Regulations.
- B. All electrical materials and equipment shall be new and shall bear the label of the Underwriters Laboratory (UL), Inc., Factory Mutual (FM) or equivalent where standards have been established and label service regularly applies.
- C. Instruments not specifically described or identified by manufacturer's catalog numbers shall be designed in conformity with ANSI, IEEE, ISA, JIC, NEMA, and other applicable technical standards.
- D. Instrumentation equipment shall be installed as recommended by the manufacturers. Furnish the services of competent factory trained representatives of the instrumentation manufacturer to supervise the installation for proper assembly, start and operate the equipment, and conduct the field tests.

1.6 DELIVERY AND HANDLING

- A. Temporary storage of instruments shall be in clean dry indoor rooms with a temporary dehumidifier and electric heating to maintain the storeroom between 5 and 40 °C, with humidity less than 90%. Comply with manufacturer's additional written instructions for storing and periodic inspection and testing.

- B. Handle instrumentation materials and equipment in conformance with the manufacturer's written instructions.

1.7 WARRANTY

- A. Provide parts and labor warranty in accordance with the Division 01 for both transmitter and transducer.
- B. Provide an on-site parts and labor warranty for a minimum period of one year after Substantial Completion for all instruments. In cases where the manufacturer offers a longer warranty period, the longer warranty period shall apply as described by the manufacturer.
- C. All instruments that are not fully functional at the time of Substantial Completion shall have warranties extended to provide minimum one year coverage after making the instrument operational, unless otherwise approved by the Owner's Representative.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Gauge Pressure Transmitter
 - 1. Rosemount 2088
 - 2. Foxboro IGP-10
 - 3. Yokogawa EJA530A
 - 4. Or Equal

2.2 PRODUCT DESIGN

- A. General requirements
 - 1. "Smart" pressure transmitter, and microprocessor based digital transmitter with 1/2"- NPT process connections. The transmitter shall include local span and zero adjustment buttons or pots and have integral transient protection.
 - 2. Transmitters shall store the transmitters configuration in a non-volatile EEPROM. If the transmitter utilizes a hand-held device to program or configure the unit, provide one for each transmitter provided.
 - 3. Transmitter shall offer the HART communication protocol as a standard feature.
 - 4. Integral electronic components contained in an epoxy finished, low copper, NEMA 4 aluminum housing.
 - 5. Diaphragm Material - Hastelloy C, only.
 - 6. The transmitter shall be rated to minimum 500 psig static pressure.
 - 7. Transmitters shall be 24 VDC, loop-powered, proportional to process pressure
 - 8. All hardware connecting the pressure transmitter to the process shall be 316 stainless steel, including taps, fittings, valves, and piping.
 - 9. Integral LCD display to indicate values in field-selectable engineering units, integral pushbuttons to calibrate and configure the transmitter, and window cover to view the display without removal of transmitter covers. Display shall be capable of being replaced in the field.
 - 10. Translate gage pressure into a 4-20 mA current linear output.
 - 11. Transmitter shall be mounted in an upright position.
 - 12. Approved for UL, CSA, and FM ratings.

- B. Performance requirements
 - 1. Accuracy - +0.10 percent of calibrated span for 4-20 mA outputs.
 - 2. Linearity - +0.12 percent of calibrated span.
 - 3. Hysteresis - +0.07 percent of calibrated span.
 - 4. Repeatability - +0.07 percent of calibrated span.
 - 5. Operating Temperature - -30 degrees to 75 degrees C.
 - 6. Humidity Limits - 10 to 100 percent relative humidity.
 - 7. Six-Month Zero Shift Stability - Less than +0.25 percent.
 - 8. Six-Month span Shift Stability - Less than +0.25 percent.
- C. All dirty water (non-solids/sludge/slurry) pressure measuring switches shall have continuous duty, clamped Teflon diaphragm seals as manufactured by Ashcroft, Type 300; U.S. Gauge; or equal.
 - 1. Elements and diaphragm seals shall be by the same manufacturer and shall be shipped as complete units, factory filled with silicone fluid.
 - 2. Each transmitter and diaphragm seal unit shall be connected with the necessary brass pipefitting and a brass stopcock.
- D. Process Connection and isolation
 - 1. All pressure transmitters shall have 316 stainless steel block and bleed valves that shall serve to isolate the transmitter from the process for servicing, calibration, and isolation of the transmitter.
 - 2. Elements, diaphragm seals and manifolds shall be by the same manufacturer and shall be shipped as complete units, factory filled with fluid.

2.3 ACCESSORIES

- A. Nameplates - Refer to Section 40 71 00. Wording of nameplate shall be as specified in Instrument List.
- B. Mounting Hardware - Provide stainless steel mounting hardware as necessary to mount equipment in locations as described in the Contract Documents.
- C. Cabling - Provide power, and signal, cable and conduit to locate transmitters in locations listed in Instrument List and the Contract Documents according to Section 40 71 00.
- D. Lightning and Surge Protection - Provide lightning and surge protection for the equipment listed in Instrument List in accordance with Section 40 71 00.
- E. Process Electrical Isolation - Spool piece shall be National Sanitation Foundation (NSF) approved. Local spool piece between the pressure transmitter corporation stop and block and bleed valve.
- F. Calibration Kit - Provide one calibration kit that includes a reusable pressurized canister, analog gage pressure regulator appropriate for the transmitters supplied, and all hoses and connectors as necessary to pressurize canister and calibrate transmitters by simulating pressures to the high pressure ports.
- G. Vent Screws - All gage pressure transmitters shall have a vent screw on the process connection to the transmitter to release air from the pressure inlet to the diaphragm. Vent screw shall be manufacturer supplied.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install system in accordance with the Manufacturer's printed instructions unless otherwise indicated.
- B. Install equipment in conformance with NEC and all local codes.
- C. Install and interconnect all equipment, devices, electrical hardware, instrumentation and controls and process controller components into, out of and among the enclosures as indicated on the drawings.
- D. Keep enclosures clean at all times. Keep enclosures doors closed except when actually working in the enclosure. Protect all equipment during installation including hole punching for conduit connection. Remove all filings and thread cuttings from enclosures.

3.2 EXAMINATION

- A. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- B. Examine roughing-in of equipment to verify the following:
 - 1. Environmental conditions are within the limitations established by the manufacturer.
 - 2. Locations of external wiring and conduit and equipment connection.
 - 3. Devices which penetrate enclosure shall be constructed/rated/installed to maintain enclosure rating.
- C. Verify that ground connections are in place and that installation of grounding described in Section "Grounding" is complete.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Install instruments as shown on the Contract Drawings and in accordance with the manufacturer's installation instructions and recommendations.
 - 1. Supply, mount, install, wire, terminate, and configure all instrumentation, instrumentation equipment, and components as specified herein. Provide all necessary brackets and mounting hardware required by the instrument manufacturer for proper installation.
 - 2. Unless otherwise specified or required, supports shall be aluminum or stainless steel. All mounting hardware shall be stainless steel. Equipment mounted on walls in contact with soil or water shall be mounted offset from the wall a minimum of ¼-inch
 - 3. Dissimilar metals shall not be connected, spliced, or joined.
 - 4. Align, level and adjust for satisfactory operation. Install so that parts are easily accessible for inspection, operation, maintenance and repair. Instrumentation shall be mounted upright, vertical, at eye level, and in locations easily and safely

accessible. Minor deviations from indicated arrangements may be made, but only after obtaining approval from the Government's Representative.

- B. Specific attention should be given to the following technical requirements
 - 1. Verify ground rings have been installed according to the manufacturer recommendations.
 - 2. Reduced inlet installations must be accompanied by manufacturer's documented evidence of third party testing and data collection in comparison to a traceable standard.
- C. Electronic low-level signals (analog, discrete, and communications) shall be properly isolated, bundled and supported. These signals shall be routed and separated from AC power wiring.
 - 1. AC power, DC power/signal, and communication cables shall be installed in separate conduit systems, and shall be physically separated by a minimum of 12 inches.
 - 2. All "intrinsically safe" wires and cables shall be kept isolated and installed in separate wire channels and conduit systems from normal power and signal wires - by at least two inches of space. Label wire channels and conduits "Intrinsic Wiring".
- D. Grounding
 - 1. Equipment shall be solidly grounded with an equipment grounding conductor as specified in Section 26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS and as recommended by the manufacturer. Control panels and instruments shall be grounded at the power supply end using a ground wire pulled with the power wires.
 - 2. All instruments and transmitters shall be grounded at the device's power source using a ground wire pulled with the power wires. Metal cases of loop-powered instruments shall be grounded at the control panel powering the loop using a ground wire pulled with the twisted-shielded pair of wires. All transmitters and metal cases shall be grounded at the control panel with a ground wire. Grounding through conduit and fittings and to grounds other than that of the control panel are not acceptable.
 - 3. The shield in twisted-shielded pairs shall be grounded at the power supply end. Meaning, 4-wire transmitters = ground at transmitter end, 3-wire transmitters = ground at power source end, 2-wire transmitters = ground at loop power source end.
- E. Cutting and drilling of existing panels for new instrumentation as shown, specified, or required, shall include repair and touch up painting of panel after installation.

3.4 FIELD QUALITY CONTROL

- A. Prepare for Acceptance Tests as follows:
 - 1. After installing equipment but before power supply is energized, verify that grounding system is completed.
 - 2. Verify that equipment is installed and connected according to the Contract Documents.

3. Verify that electrical wiring installation complies with manufacturer's submittal by means of point-to-point continuity testing.
 4. Verify that field-installed power and control wiring complies with the Electrical Specification requirements.
 5. Confirm that field wiring is terminated to the proper device, on the proper terminal, and identified with the appropriate wire number according to the drawings.
 6. Verify that equipment is ready for pre-commissioning checks in accordance with manufacturer's written instructions.
- B. Acceptance Tests: After installing equipment and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements as follows:
1. Perform visual and mechanical inspection and electrical tests according to NETA ATS, Section 7, as it applies to all installed systems and devices. Certify compliance with the following test parameters:
 2. Verify the proper voltage at each powered circuit and each device.
 3. Each instrument shall provide direct control of totalizer reset functions through the PLC.
 4. Each instrument shall be supported with a device profile permitting direct integration in the PLC.
 5. Analog inputs (transmitters) will be tested using actual process conditions, whenever possible. Verify that scaling is correct and the appropriate value is displayed on the OIT.
- C. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.5 MANUFACTURER'S FIELD SERVICES

- A. Engage a factory-authorized service representative to perform the following inspections, checks, and supervision of testing:
- B. Manufacturer representative shall verify installation of all sensors and transmitters.
1. Manufacturer representative shall notify the ENGINEER in writing of any problems or discrepancies and proposed solutions.
 2. Manufacturer representative shall perform field verification at the time of installation for long-term analysis of device linearity, repeatability and electronics health. A comparative report shall be generated for each meter tested
- C. Prepare written report to record the following:
1. Inspections and checks carried out on site.
 2. Test procedures used.
 3. Test results that comply with requirements.
 4. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

3.6 OPERATION & MAINTENANCE MANUALS

- A. Prepare O&M Manuals as specified in Section 40 71 00 INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS and in accordance with the requirements herein.

3.7 DEMONSTRATION AND TRAINING

- A. Final Acceptance – Include 1/2 day of a manufacturer-approved field technician's time to test equipment to demonstrate functionality.
- B. Training – In addition to the training content specified in the Section 40 71 00 INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS, integrate the following training topics into the specified training sessions:
 - 1. Identification of each component of the flow meter.
 - 2. Identify incoming sources of power and instruct on how to disconnect AC power.
 - 3. Communication – Demonstrate how to ascertain when discrete signals are energized, when analog signals are open loop, and identifying indicator light functions.

3.8 FOLLOW UP SERVICE

- A. Monitoring and Adjusting: After Substantial Completion, but not more than twelve months after Final Acceptance, perform the following monitoring and adjusting tasks:
 - 1. Replace failed and defective equipment (under warranty).
 - 2. Recalibrate and reconfigure as necessary.
 - 3. Retest and adjust as necessary.

END OF SECTION

SECTION 40 73 36**PRESSURE AND DIFFERENTIAL PRESSURE SWITCHES****PART 1 - GENERAL****1.1 SUMMARY**

- A. This Section includes general requirements for the instrumentation as shown on the Contract Drawings and specified under this specification. This section shall apply to all pressure devices used for level furnished on this project, regardless of whether it is specifically identified in Division 40.
- B. Supply, mount, install, wire, terminate, and configure all instrumentation, instrumentation equipment, and components as specified herein. Provide all necessary brackets and mounting hardware required by the instrument manufacturer for proper installation.

1.2 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American National Standards Institute (ANSI)
 - 2. American Society for Testing Materials (ASTM)
 - 3. Institute of Electrical and Electronics Engineers (IEEE)
 - 4. International Society of Automation (ISA)
 - 5. National Electric Manufacturers Association (NEMA)
 - 6. National Electrical Code (NEC)
 - 7. Underwriters Laboratories, Inc. (UL)
- B. Related Specification Sections
 - 1. Division 01 sections
 - 2. Division 26 sections
 - 3. Division 40 sections
 - 4. Contract Drawings

1.3 COORDINATION

- A. General
 - 1. Review the installation requirements of the materials and equipment specified under other divisions for installation and interfacing with Plant SCADA.
 - 2. Coordinate the installation and interfacing requirements among the instruments and all control items shown in the Contract Drawings.
 - 3. Coordinate with other Contracts for process connection(s), electrical connection(s), and utility services piping (air, water, etc.) to and away from instruments.
 - 4. Coordinate, prepare, assemble and submit all submittals for items furnished and performed under this Contract.
- B. Project Site

1. Coordinate impulse piping, weld-o-lets, NPT, mounting locations with the piping and process installation. Provide equipment according to the timeline for working on the respective segment of pipe.
 2. Contractor shall be responsible to verify with the supplier that the appropriate ratings and options are provided for each application, taking into account area classification, flow, passing media, temperature, and vacuum limitations.
 3. Any deviation from that which is specified shall be brought to the engineers' attention during shop drawing submittals.
- C. Contractor is responsible to verify with the supplier that the transducer and transmitter are mounted in locations that do not compromise their integrity. Any such deviation from that which is specified shall be brought to the Engineer's attention during shop drawing submittals.

1.4 SUBMITTALS

- A. Submit the following in accordance with the Division 01 SUBMITTAL PROCEDURES, Section 40 71 00 INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS and with the requirements specified herein.
- B. Submit Manufacturer's Certificate of proper installation.

1.5 QUALITY ASSURANCE

- A. Comply with all Federal and local laws or ordinances, as well as all applicable codes, standards, regulations and/or regulatory agency requirements including the partial listing below:
1. Joint Industrial Council (JIC) Standards.
 2. Local and State Building Codes.
 3. Occupational Safety and Health Administration (OSHA) Regulations.
- B. All electrical materials and equipment shall be new and shall bear the label of the Underwriters Laboratory (UL), Inc., Factory Mutual (FM) or equivalent where standards have been established and label service regularly applies.
- C. Instruments not specifically described or identified by manufacturer's catalog numbers shall be designed in conformity with ANSI, IEEE, ISA, JIC, NEMA, and other applicable technical standards. The work shall have neat and finished appearance.
- D. Instrumentation equipment shall be installed as recommended by the manufacturers. Furnish the services of competent factory trained representatives of the instrumentation manufacturer to supervise the installation for proper assembly, start and operate the equipment, and conduct the field tests.

1.6 DELIVERY AND HANDLING

- A. Temporary storage of instruments shall be in clean dry indoor rooms with a temporary dehumidifier and electric heating to maintain the storeroom between 5 and 40 °C, with humidity less than 90%. Comply with manufacturer's additional written instructions for storing and periodic inspection and testing.

- B. Handle instrumentation materials and equipment in conformance with the manufacturer's written instructions.

1.7 WARRANTY

- A. Provide parts and labor warranty in accordance with the Division 01.
- B. Provide an on-site parts and labor warranty for a minimum period of one year after Substantial Completion for all instruments. In cases where the manufacturer offers a longer warranty period, the longer warranty period shall apply as described by the manufacturer.
- C. All instruments that are not fully functional at the time of Substantial Completion shall have warranties extended to provide minimum one year coverage after making the instrument operational, unless otherwise approved by the Owner's Representative.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Gauge/Differential Pressure Switch
 - 1. United Electric H100 Series
 - 2. Ashcroft L-Series, G-Series, Type 400
 - 3. Dwyer Mercoïd
 - 4. Or Equal

2.2 PRODUCT DESIGN

- A. General Requirements
 - 1. All switches supplied for this project shall be by the same manufacturer.
 - 2. Unless otherwise specified, switches shall be snap action, automatic reset, 120 volt, heavy duty AC switches, rated for 10 amps at 120VAC, and shall be adjustable over the normal operating range specified or as recommended by equipment manufacturers.
 - 3. Switches to be installed in non-hazardous areas shall have a watertight NEMA 4X corrosion resistant housing.
 - 4. All pressure switches shall have normally open contacts that close when the switch is activated.
 - a. High-pressure switches on pump discharges shall activate on pressure increase.
 - b. Low-pressure switches on pump intakes shall de-activate on pressure decrease.
 - 5. Pressure switches installed on the suction side of pumps shall be compound switches, able to perform and detect vacuum pressures.
 - 6. Switches shall be stem mounted in an upright position.
 - 7. Each switch and diaphragm seal unit shall be connected with the necessary brass pipefitting and a brass stopcock.
 - 8. Switch shall include knob type adjustment with tamperproof cover. Process connection shall be ½" NPT.
 - 9. Switch shall include variable adjustable deadband and repeatability of 1% of range.

10. Unless otherwise noted or required by application, wetted parts shall be brass.
 11. Diaphragm Material - Hastelloy-C.
 12. Approved for UL, CSA, and FM ratings.
- B. Performance requirements:
1. Accuracy - +0.10 percent of calibrated span.
 2. Linearity - +0.12 percent of calibrated span.
 3. Hysteresis - +0.07 percent of calibrated span.
 4. Repeatability - +0.07 percent of calibrated span.
 5. Operating Temperature - -30 degrees to 75 degrees C.
 6. Humidity Limits - 10 to 100 percent relative humidity.
 7. Six-Month Zero Shift Stability - Less than +0.25 percent.
 8. Six-Month span Shift Stability - Less than +0.25 percent.
- C. Process Connection and isolation
1. All dirty water (non-solids/sludge/slurry) pressure measuring switches shall have continuous duty, clamped Teflon diaphragm seals as manufactured by Ashcroft, Type 300; U.S. Gauge; or equal.
 - a. Each diaphragm seal shall have Type 316 stainless steel upper and lower housings.
 - b. The lower housing shall have a threaded connection and be provided with 1/2-inch NPT flush port.
 2. A valve manifold (block & bleed) shall be provided to permit zero checks, calibration, and isolation of the transmitter.
 3. Elements, diaphragm seals and manifolds shall be by the same manufacturer and shall be shipped as complete units, factory filled with fluid.
 4. Each switch and diaphragm seal unit shall be connected with the necessary brass pipefitting and a brass stopcock
- D. Differential
1. Differential switches used for air flow shall be differential pressure type providing a contact closure at 0.8" W.C. of air pressure. Switch shall have a pressure adjusting screw that allows changes to the pressure without a pressure gauge.
 2. Switch shall be suitable for duct mounting in vertical position, with pressure connections pointing downwards. Install High pressure connection to duct and Low pressure to atmosphere.
 3. CE, UL and CSA listed, FM approved for use in Class I, Div 1, Groups C and D, Class II Groups E, F, and G and Class III hazardous atmospheres (NEMA 7).

PART 3 - EXECUTION

3.1 GENERAL

- A. Install system in accordance with the Manufacturer's printed instructions unless otherwise indicated.
- B. Install equipment in conformance with NEC and all local codes.

- C. Install and interconnect all equipment, devices, electrical hardware, instrumentation and controls and process controller components into, out of and among the enclosures as indicated on the drawings.
- D. Keep enclosures clean at all times. Keep enclosures doors closed except when actually working in the enclosure. Protect all equipment during installation including hole punching for conduit connection. Remove all filings and thread cuttings from enclosures.

3.2 EXAMINATION

- A. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- B. Examine roughing-in of equipment to verify the following:
 - 1. Environmental conditions are within the limitations established by the manufacturer.
 - 2. Locations of external wiring and conduit and equipment connection.
 - 3. Devices which penetrate enclosure shall be constructed/rated/installed to maintain enclosure rating.
- C. Verify that ground connections are in place and that installation of grounding described in Section "Grounding" is complete.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Install instruments as shown on the Contract Drawings and in accordance with the manufacturer's installation instructions and recommendations.
 - 1. Supply, mount, install, wire, terminate, and configure all instrumentation, instrumentation equipment, and components as specified herein. Provide all necessary brackets and mounting hardware required by the instrument manufacturer for proper installation.
 - 2. Unless otherwise specified or required, supports shall be aluminum or stainless steel. All mounting hardware shall be stainless steel. Equipment mounted on walls in contact with soil or water shall be mounted offset from the wall a minimum of ¼-inch
 - 3. Dissimilar metals shall not be connected, spliced, or joined.
 - 4. Align, level and adjust for satisfactory operation. Install so that parts are easily accessible for inspection, operation, maintenance and repair. Instrumentation shall be mounted upright, vertical, at eye level, and in locations easily and safely accessible. Minor deviations from indicated arrangements may be made, but only after obtaining approval from the Government's Representative.
- B. Specific attention should be given to the following technical requirements
 - 1. Verify ground rings have been installed according to the manufacturer recommendations.

2. Reduced inlet installations must be accompanied by manufacturer's documented evidence of third party testing and data collection in comparison to a traceable standard.
- C. Electronic low-level signals (analog, discrete, and communications) shall be properly isolated, bundled and supported. These signals shall be routed and separated from AC power wiring.
1. AC power, DC power/signal, and communication cables shall be installed in separate conduit systems, and shall be physically separated by a minimum of 12 inches.
 2. All "intrinsically safe" wires and cables shall be kept isolated and installed in separate wire channels and conduit systems from normal power and signal wires - by at least two inches of space. Label wire channels and conduits "Intrinsic Wiring".
- D. Grounding
1. Equipment shall be solidly grounded with an equipment grounding conductor as specified in Section 26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS and as recommended by the manufacturer. Control panels and instruments shall be grounded at the power supply end using a ground wire pulled with the power wires.
 2. All instruments and transmitters shall be grounded at the device's power source using a ground wire pulled with the power wires. Metal cases of loop-powered instruments shall be grounded at the control panel powering the loop using a ground wire pulled with the twisted-shielded pair of wires. All transmitters and metal cases shall be grounded at the control panel with a ground wire. Grounding through conduit and fittings and to grounds other than that of the control panel are not acceptable.
 3. The shield in twisted-shielded pairs shall be grounded at the power supply end. Meaning, 4-wire transmitters = ground at transmitter end, 3-wire transmitters = ground at power source end, 2-wire transmitters = ground at loop power source end.
- E. Cutting and drilling of existing panels for new instrumentation as shown, specified, or required, shall include repair and touch up painting of panel after installation.

3.4 FIELD QUALITY CONTROL

- A. Prepare for Acceptance Tests as follows:
1. After installing equipment but before power supply is energized, verify that grounding system is completed.
 2. Verify that equipment is installed and connected according to the Contract Documents.
 3. Verify that electrical wiring installation complies with manufacturer's submittal by means of point-to-point continuity testing.
 4. Verify that field-installed power and control wiring complies with the Electrical Specification requirements.
 5. Confirm that field wiring is terminated to the proper device, on the proper terminal, and identified with the appropriate wire number according to the drawings.

6. Verify that equipment is ready for pre-commissioning checks in accordance with manufacturer's written instructions.
- B. Acceptance Tests: After installing equipment and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements as follows:
1. Perform visual and mechanical inspection and electrical tests as it applies to all installed systems and devices. Certify compliance with the following test parameters:
 2. Verify the proper voltage at each powered circuit and each device.
 3. Each instrument shall provide direct control of totalizer reset functions through the PLC.
 4. Each instrument shall be supported with a device profile permitting direct integration in the PLC.
- C. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.5 MANUFACTURER'S FIELD SERVICES

- A. Engage a factory-authorized service representative to perform the following inspections, checks, and supervision of testing:
- B. Manufacturer representative shall verify installation of all sensors and transmitters.
1. Manufacturer representative shall notify the ENGINEER in writing of any problems or discrepancies and proposed solutions.
 2. Manufacturer representative shall perform field verification at the time of installation for long-term analysis of device linearity, repeatability and electronics health. A comparative report shall be generated for each meter tested
- C. Prepare written report to record the following:
1. Inspections and checks carried out on site.
 2. Test procedures used.
 3. Test results that comply with requirements.
 4. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

3.6 OPERATION & MAINTENANCE MANUALS

- A. Prepare O&M Manuals as specified in Section 40 71 00 INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS and in accordance with the requirements herein.

3.7 DEMONSTRATION AND TRAINING

- A. Final Acceptance – Include 1/2 day of a manufacturer-approved field technician's time to test equipment to demonstrate functionality.
- B. Training – In addition to the training content specified in the Section 40 71 00 INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS, integrate the following training topics into the specified training sessions:

1. Identification of each component of the measuring device.
2. Identify incoming sources of power and instruct on how to disconnect AC power.
3. Communication – Demonstrate how to ascertain when discrete signals are energized, when analog signals are open loop, and identifying indicator light functions.

3.8 FOLLOW UP SERVICE

- A. Monitoring and Adjusting: After Substantial Completion, but not more than twelve months after Final Acceptance, perform the following monitoring and adjusting tasks:
1. Replace failed and defective equipment (under warranty).
 2. Recalibrate and reconfigure as necessary.
 3. Retest and adjust as necessary.

END OF SECTION

SECTION 40 76 00
GAS ANALYSIS SYSTEM

PART 1- GENERAL

1.1 SUMMARY

- A. This Section includes general requirements for the instrumentation as shown on the Contract Drawings and specified under this specification. This section shall apply to all gas detections systems furnished on this project, regardless of whether it is specifically identified in Division 40.
- B. Supply, mount, install, wire, terminate, and configure all instrumentation, instrumentation equipment, and components as specified herein. Provide all necessary tubing, sample pumps, filters, brackets and mounting hardware required by the instrument manufacturer for proper installation.

1.2 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American National Standards Institute (ANSI)
 - 2. American Society for Testing Materials (ASTM)
 - 3. Institute of Electrical and Electronics Engineers (IEEE)
 - 4. International Society of Automation (ISA)
 - 5. National Electric Manufacturers Association (NEMA)
 - 6. National Electrical Code (NEC)
 - 7. Underwriters Laboratories, Inc. (UL)
- B. Related Specification Sections
 - 1. Division 01 sections
 - 2. Division 26 sections
 - 3. Division 40 sections
 - 4. Contract Drawings

1.3 COORDINATION

- A. General
 - 1. Review the installation requirements of the materials and equipment specified under Division 40 and 26 for installation and interfacing with Plant SCADA.
 - 2. Coordinate the installation and interfacing requirements among the instruments and all control items shown in the Contract Drawings.
 - 3. Coordinate with other Contracts for process connection(s), electrical connection(s), and utility services piping (air, water, etc.) to and away from instruments.
 - 4. Coordinate, prepare, assemble and submit all submittals for items furnished and performed under this Contract.
- B. Project Site

1. Contractor shall be responsible to verify with the supplier that the appropriate ratings and options are provided for each application, taking into account area classification, flow, passing media, temperature, and vacuum limitations.
2. Any deviation from that which is specified shall be brought to the engineers' attention during shop drawing submittals.

1.4 SUBMITTALS

- A. Submit the following in accordance with the Division 01 SUBMITTAL PROCEDURES, Section 40 71 00 INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS and with the requirements specified herein.
- B. Additional Requirements:
 1. NIST calibration certificates for each flow meter provided.
 2. Submit Manufacturer's Certificate of proper installation.

1.5 QUALITY ASSURANCE

- A. Comply with all Federal and local laws or ordinances, as well as all applicable codes, standards, regulations and/or regulatory agency requirements including the partial listing below:
 1. Joint Industrial Council (JIC) Standards.
 2. Local and State Building Codes.
 3. Occupational Safety and Health Administration (OSHA) Regulations.
- B. All electrical materials and equipment shall be new and shall bear the label of the Underwriters Laboratory (UL), Inc., Factory Mutual (FM) or equivalent where standards have been established and label service regularly applies.
- C. Instruments not specifically described or identified by manufacturer's catalog numbers shall be designed in conformity with ANSI, IEEE, ISA, JIC, NEMA, and other applicable technical standards. The work shall have neat and finished appearance.
- D. Instrumentation equipment shall be installed as recommended by the manufacturers. Furnish the services of competent factory trained representatives of the instrumentation manufacturer to supervise the installation for proper assembly, start and operate the equipment, and conduct the field tests.

1.6 DELIVERY AND HANDLING

- A. Temporary storage of instruments shall be in clean dry indoor rooms with a temporary dehumidifier and electric heating to maintain the storeroom between 5 and 40 °C, with humidity less than 90%. Comply with manufacturer's additional written instructions for storing and periodic inspection and testing.
- B. Handle instrumentation materials and equipment in conformance with the manufacturer's written instructions.

1.7 WARRANTY

- A. Provide parts and labor warranty in accordance with the Division 01.

- B. Provide an on-site parts and labor warranty for a minimum period of one year after Substantial Completion for all instruments. In cases where the manufacturer offers a longer warranty period, the longer warranty period shall apply as described by the manufacturer.
- C. All instruments that are not fully functional at the time of Substantial Completion shall have warranties extended to provide minimum one year coverage after making the instrument operational, unless otherwise approved by the Owner's Representative.

PART 2- PRODUCTS

2.1 MANUFACTURERS

- A. Sensors/Transmitters
 - 1. MSA International
 - 2. Sensidyne
 - 3. Or Equal
- B. Gas Monitoring Panel
 - 1. MSA International
 - 2. Sensidyne
 - 3. Or Equal
- C. Alarming Light Stack
 - 1. Federal Signal
 - 2. Or equal

2.2 GENERAL REQUIREMENTS

- A. It is a requirement of this specification that the elements of the system be provided by a single supplier. This supplier shall have total responsibility for the entire system performance and compatibility of this section.
- B. For ease of identification, symbols for the various components of the metering system to be furnished and installed are given in the Table 1.

Nameplate	Equipment Designation	Device	Range	Alarm Setpoints
Storage Room	AE-140A	Hydrogen Sulfide Sensor	0 to 100 % LEL	Alarm = 10% Warning = 8%
	AE-140B	Combustible Gas Sensor	0 to 50 ppm	Alarm = 15 ppm Warning = 10 ppm
	AE-140C	Oxygen Sensor	0 to 25%	Low Alarm = 19.5% Hi Alarm = 23.5% Low Warning = 20.0%

				Hi Warning = 23.0%
Stair/Screening Room	AE-142A	Hydrogen Sulfide Sensor	0 to 100% LEL	Alarm = 10% Warning = 8%
	AE-142B	Combustible Gas Sensor	0 to 50 ppm	Alarm = 15 ppm Warning = 10 ppm
	AE-142C	Oxygen Sensor	0 to 25%	Low Alarm = 19.5% Hi Alarm = 23.5% Low Warning = 20.0% Hi Warning = 23.0%
	SMP-142	Sample Pump	-	Alarm = Fault

2.3 PRODUCT DESIGN

A. Combustible Gas Sensors

1. Combustible gas sensor shall be the infrared light type. The sensor must have a demonstrated resistance to degradation by silicones and reduced sulfur gases (hydrogen sulfide).
2. Transmitter shall utilize one infrared light source that is directed through two different wavelength filters. One light beam shall be used as a reference and measure infrared light intensity outside of the hydrocarbon absorption range. The other infrared beam shall be the target gas beam and it shall traverse the gas diffusion volume in the signature wavelength of hydrocarbons. Each light beam shall be directed to its corresponding detector, and the difference in infrared light intensity shall be proportional to the target gas concentration. If not target gas is present, the difference between detectors shall be zero, and the transmitter shall output a zero gas reading.
3. Sensor shall not be susceptible to poisoning by background gases.
4. Transmitter shall utilize humidity and temperature compensation.
5. Sensor performance shall not be affected in low-oxygen environments.
6. NEMA 4X stainless steel housing shall be located outside of the hazardous environment.
7. Display - Sensor/transmitters shall have LCD display for 0 to 100 percent LEL.
8. Each transmitter shall produce a directly proportional 4-20 mA output correlating to 0 value at 4 mA and 100 percent full value at 20 mA.
9. Transmitter shall enable user interaction with a hand-held wireless remote control that utilizes infrared light to communicate with the transmitter and facilitates sensor zeroing and calibration. Magnetic-type interaction with the transmitter is not acceptable.
10. Performance Requirements
 - a. Repeatability – Less than 2 percent full-scale for 0 to 100 percent LEL.
 - b. Operating Temperature - -4 to 122 degrees F.
 - c. Operating Humidity – 0 to 95 percent non-condensing.
 - d. Stability - +3 percent full-scale per year.
 - e. Linearity – Less than +2 percent full-scale.

- f. Response Time – Less than 30 seconds.
- g. Operating Voltage – 24 VDC.

B. Toxics and Oxygen Gas Sensors

1. Toxic gas sensors shall be the electrochemical type. The sensor must not require the periodic addition of reagents.
2. Oxygen depletion sensors shall be the electrochemical fuel cell type. The sensor must not require the periodic addition of reagents.
3. Gas measurement shall be temperature compensated.
4. Shall be a remote diffusion type, resistant to silicone poisoning and hydrogen sulfide poisoning.
5. Housing shall not need to be opened to perform calibration.
6. Each sensor shall have its own input-output amplifier section.
7. A non-intrusive, hand held wireless remote control shall allow the user to perform sensor zeroing and calibration.
8. Display
 - a. Sensor/transmitters shall have LCD display for calibration instructions and for 0 to 100 percent LEL, 0 to 50 ppm of H₂S, or 0 to 25 percent oxygen level.
 - b. Display shall have “unsuccessful calibration”, “time to replace sensor”, and “last successful calibration” indications.
9. Operating Voltage – 24 VDC.
10. Each transmitter shall produce a directly proportional 4-20 mA output correlating to 0 value at 4 mA and 100 percent full value at 20 mA.

C. Transmitter Display

1. There will be a local display indicating the gas type being monitored and the concentration of gas present. The display will alternate between the gas type and gas concentration. The display will be an integral part of the sensor/transmitter enclosure. The display will be visible from a minimum of 5 feet and will be present always, and will not require being turned on or off. This readout will be minimum 3-1/2-inch digit liquid crystal displays (LCD).
2. Sensor/transmitter display shall indicate all diagnostic check/fault conditions with a scrolling message detailing the condition. Error codes shall not be used.
3. Sensor/transmitter will display three levels of alarm. Alarm levels will be adjustable by means of a hand-held wireless controller.
4. Sensor/transmitter shall allow for full range scaling of the 4-20mA-output signal.
5. Sensor/transmitter shall be capable of storing and displaying average, minimum and maximum gas concentrations over selected periods of time.
6. The sensor/transmitter shall give an indication of when sensor is nearing the end of its useful life by means of the front panel LCD. This indication that the sensor is nearing its useful life will be based on the sensor output. It shall not be based on the time the sensor was in service.

D. LED Features

1. Sensor/transmitter shall have high visibility LEDs. The LEDs shall operate as follows:
 - a. Solid Green LED – Normal operation.
 - b. Solid Red LED – Fault condition.
 - c. Blinking Red LED – Alarm condition.
 - d. Blinking Amber LED – Warning condition
2. Sensor/transmitter shall have optional relays. Relays shall be rated at 5 amps at 30 VDC, 5 amps at 220 VAC, single-pole, double-throw and consist of three for alarm levels and one for fault. All relay contact activation will be monitored. If the relay cannot activate for any reason, the trouble relay will change state. All relays

shall be field selectable through a non-intrusive hand-held wireless remote control unit. Selectable features include:

- a. Alarm level
- b. Latching/non-latching
- c. Upscale/downscale
- d. Normally opened/normally closed
- e. Energized/de-energized

E. Power Supply

- 1. Power supplies shall be provided in sufficient quantity to operate all sensors and related accessories. Power supplies shall be rated as NEMA 4X. Input voltage to the power unit shall be 120V, 60 Hertz.

F. Sample Pump Module

- 1. Sample pump module for the Screening area shall be in accordance with the following paragraphs:
 - a. The sample pump module shall be a standard product and shall provide the capability to draw a sample through 1/4-inch OD tubing from a remote pickup location and to present the sample in series to multiple sensor/transmitters. The sample pump module shall be suitable for Class I, Division 1, Groups B, C, and D locations and shall also be rated as NEMA 4X.
 - b. Sensors used with the sample pump module shall be provided with flow caps with inlet and exhaust fittings.
 - c. The sample pump module shall incorporate a built-in low flow switch which shall be capable of activating a SPDT latching relay output in the event of pump failure or clogged sample line.
 - d. A hydrophobic pick-up filter shall be installed on the end of the sample tube in the screening room for the purpose of removing particulates from the sample stream and preventing water from being drawn into the sample tube in the event of flooding.
 - e. The gas detection system shall include a pump reset for the purpose of interrupting power to the pump module in the event of flow failure (pump failure or sample filter/line restriction). The pump reset shall include a latching relay with front-mounted reset button mounted in the monitoring panel, allowing restoration of power to the pump module after a flow failure has been remedied. The relay shall provide one additional SPDT output to be used as a flow failure output for parallel connection with the gas alarm outputs to the central alarm system.

G. Gas Monitoring Panel

- 1. Provide one gas monitoring panel to house all analyzers listed in Table 1, power supplies, and the sample pump.
- 2. Panel shall be NEMA 4X, stainless steel, suitable for wall mounting and shall include all accessories for a complete installation including operation in an indoor environment.
- 3. Panel shall have inputs and the capability to display values for the sensors.
- 4. Panel operation shall be 120 VAC, 60 Hertz. Sensors shall be loop powered.
- 5. Panel shall include high-visibility, LED, top-mounted green "Go" light and red "No-Go" lights.
- 6. Panel shall include dry contact outputs for warning, alarm, trouble, and a go/no-go light status.
- 7. Each sensor/transmitter shall be NEMA 4X and output a 4-20 mA signal.

8. Enclosures and all wiring in accordance with the latest revision of the NEC and NFPA 820.
- H. Remote GAs Alarming
- I. Provide multiple-color light stack in the areas and quantities shown on the Contract Drawings for indication of the status of combustible gases. Light stack shall possess the following features:
 1. Two lights with colored lenses. Lenses shall be red to indicate gas concentration alarm, and green to indicate safe area.
 2. The lights shall be independently energized by a contact closure from the gas detector/controller.
 3. Red unit shall be strobe light installed with an audible horn. Horn is required on the units provided, wired in parallel or integrated with the red light. Green light shall be steady light.
 4. Units shall operate on 120 VAC powered by contact closures to each light and wired to the gas detector/controller.
 5. Enclosures shall be rated NEMA 4X and mounted in a vertically in locations shown on the Contract Drawings. Provide pipe mounted appurtenances and NEMA 4X boxes/enclosures as needed.
 6. 100,000-hour lamp life.
 7. Rated – 31 to 150 degrees F.

2.4 ACCESSORIES

- A. Nameplates - Provide rigid, laminated name tags with 5/16-inch high white letters on black background per Section 26 05 00. Each monitor shall have nametags for the monitor designation and the designations for each of the sensors it monitors.
- B. Mount transmitter and sensor with equipment materials suitable for the mounting locations.
- C. Calibration Kit - Provide one canister of gas as required by each transmitter, a gas delivery module, and any other equipment needed for calibration in an insulated, hard plastic, impact resistant carrying case. Inside of case shall be padded to protect contents.
- D. Hand-Held Programming Unit – Provide two hand-held wireless remote controls that utilizes infrared light to communicate with the transmitter and facilitates sensor zeroing and calibration.

2.5 SOURCE QUALITY CONTROL

- A. Quality Control Criteria

PART 3-EXECUTION

2.6 GENERAL

- A. Install system in accordance with the Manufacturer's printed instructions unless otherwise indicated.
- B. Install equipment in conformance with NEC and all local codes.

- C. Install and interconnect all equipment, devices, electrical hardware, instrumentation and controls and process controller components into, out of and among the enclosures as indicated on the drawings.
- D. Keep enclosures clean at all times. Keep enclosures doors closed except when actually working in the enclosure. Protect all equipment during installation including hole punching for conduit connection. Remove all filings and thread cuttings from enclosures.

2.7 EXAMINATION

- A. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- B. Examine roughing-in of equipment to verify the following:
 - 1. Environmental conditions are within the limitations established by the manufacturer.
 - 2. Locations of external wiring and conduit and equipment connection.
 - 3. Devices which penetrate enclosure shall be constructed/rated/installed to maintain enclosure rating.
- C. Verify that ground connections are in place and that installation of grounding described in Section "Grounding" is complete.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

2.8 INSTALLATION

- A. Install instruments as shown on the Contract Drawings and in accordance with the manufacturer's installation instructions and recommendations.
 - 1. Supply, mount, install, wire, terminate, and configure all instrumentation, instrumentation equipment, and components as specified herein. Provide all necessary brackets and mounting hardware required by the instrument manufacturer for proper installation.
 - 2. Unless otherwise specified or required, supports shall be aluminum or stainless steel. All mounting hardware shall be stainless steel. Equipment mounted on walls in contact with soil or water shall be mounted offset from the wall a minimum of 1/4-inch
 - 3. Dissimilar metals shall not be connected, spliced, or joined.
 - 4. Align, level and adjust for satisfactory operation. Install so that parts are easily accessible for inspection, operation, maintenance and repair. Instrumentation shall be mounted upright, vertical, at eye level, and in locations easily and safely accessible. Minor deviations from indicated arrangements may be made, but only after obtaining approval from the Government's Representative.
- B. Specific attention should be given to the following technical requirements
 - 1. Verify ground rings have been installed according to the manufacturer recommendations.
 - 2. Reduced inlet installations must be accompanied by manufacturer's documented evidence of third party testing and data collection in comparison to a traceable standard.

- C. Electronic low-level signals (analog, discrete, and communications) shall be properly isolated, bundled and supported. These signals shall be routed and separated from AC power wiring.
 - 1. AC power, DC power/signal, and communication cables shall be installed in separate conduit systems, and shall be physically separated by a minimum of 12 inches.
 - 2. All "intrinsically safe" wires and cables shall be kept isolated and installed in separate wire channels and conduit systems from normal power and signal wires - by at least two inches of space. Label wire channels and conduits "Intrinsic Wiring".
- D. Grounding
 - 1. Equipment shall be solidly grounded with an equipment grounding conductor as specified in Section 26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS and as recommended by the manufacturer. Control panels and instruments shall be grounded at the power supply end using a ground wire pulled with the power wires.
 - 2. All instruments and transmitters shall be grounded at the device's power source using a ground wire pulled with the power wires. Metal cases of loop-powered instruments shall be grounded at the control panel powering the loop using a ground wire pulled with the twisted-shielded pair of wires. All transmitters and metal cases shall be grounded at the control panel with a ground wire. Grounding through conduit and fittings and to grounds other than that of the control panel are not acceptable.
 - 3. The shield in twisted-shielded pairs shall be grounded at the power supply end. Meaning, 4-wire transmitters = ground at transmitter end, 3-wire transmitters = ground at power source end, 2-wire transmitters = ground at loop power source end.
- E. Cutting and drilling of existing panels for new instrumentation as shown, specified, or required, shall include repair and touch up painting of panel after installation.

2.9 FIELD QUALITY CONTROL

- A. Prepare for Acceptance Tests as follows:
 - 1. After installing equipment but before power supply is energized, verify that grounding system is completed.
 - 2. Verify that equipment is installed and connected according to the Contract Documents.
 - 3. Verify that electrical wiring installation complies with manufacturer's submittal by means of point-to-point continuity testing.
 - 4. Verify that field-installed power and control wiring complies with the Electrical Specification requirements.
 - 5. Confirm that field wiring is terminated to the proper device, on the proper terminal, and identified with the appropriate wire number according to the drawings.
 - 6. Verify that equipment is ready for pre-commissioning checks in accordance with manufacturer's written instructions.
- B. Acceptance Tests: After installing equipment and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements as follows:

1. Perform visual and mechanical inspection and electrical tests according to NETA ATS, Section 7, as it applies to all installed systems and devices. Certify compliance with the following test parameters:
 2. Verify the proper voltage at each powered circuit and each device.
 3. Each instrument shall provide direct control of totalizer reset functions through the PLC.
 4. Each instrument shall be supported with a device profile permitting direct integration in the PLC.
 5. Analog inputs (transmitters) will be tested using actual process conditions, whenever possible. Verify that scaling is correct and the appropriate value is displayed on the OIT.
- C. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

2.10 MANUFACTURER'S FIELD SERVICES

- A. Engage a factory-authorized service representative to perform the following inspections, checks, and supervision of testing:
- B. Manufacturer representative shall verify installation of all sensors and transmitters.
1. Manufacturer representative shall notify the ENGINEER in writing of any problems or discrepancies and proposed solutions.
 2. Manufacturer representative shall perform field verification at the time of installation for long-term analysis of device linearity, repeatability and electronics health. A comparative report shall be generated for each meter tested
- C. Prepare written report to record the following:
1. Inspections and checks carried out on site.
 2. Test procedures used.
 3. Test results that comply with requirements.
 4. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

2.11 OPERATION & MAINTENANCE MANUALS

- A. Prepare O&M Manuals as specified in Section 40 90 00 INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS and in accordance with the requirements herein.

2.12 DEMONSTRATION AND TRAINING

- A. Final Acceptance – Include 1/2 day of a manufacturer-approved field technician's time to test equipment to demonstrate functionality.
- B. Training – In addition to the training content specified in the Section 40 90 00 INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS, integrate the following training topics into the specified training sessions:
1. Identification of each component of the flow meter.
 2. Identify incoming sources of power and instruct on how to disconnect AC power.
 3. Communication – Demonstrate how to ascertain when discrete signals are energized, when analog signals are open loop, and identifying indicator light functions.

2.13 FOLLOW UP SERVICE

- A. Monitoring and Adjusting: After Substantial Completion, but not more than twelve months after Final Acceptance, perform the following monitoring and adjusting tasks:
1. Replace failed and defective equipment (under warranty).
 2. Recalibrate and reconfigure as necessary.
 3. Retest and adjust as necessary.

END OF SECTION

SECTION 40 78 63**ALARM DIALER****PART 1 - GENERAL****1.1 SUMMARY**

- A. This Section includes general requirements for the alarm notification as shown on the Contract Drawings and specified under this specification.
- B. Supply, mount, install, wire, terminate, and configure all instrumentation, instrumentation equipment, and components as specified herein. Provide all necessary brackets and mounting hardware required by the instrument manufacturer for proper installation.

1.2 REFERENCES

- A. Comply with the latest revision of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American National Standards Institute (ANSI)
 - 2. American Society for Testing Materials (ASTM)
 - 3. Institute of Electrical and Electronics Owner's Representatives (IEEE)
 - 4. International Society of Automation (ISA)
 - 5. National Electric Manufacturers Association (NEMA)
 - 6. National Electrical Code (NEC)
 - 7. Underwriters Laboratories, Inc. (UL)
- B. Related Specification Sections
 - 1. Division 01 sections
 - 2. Division 26 sections
 - 3. Division 40 sections
 - 4. Contract Drawings

1.3 COORDINATION

- A. General
 - 1. Review the installation requirements of the materials and equipment specified under Division 40 for installation and interfacing with Plant SCADA.
 - 2. Coordinate the installation and interfacing requirements among the equipment and all control items shown in the Contract Drawings.
 - 3. Coordinate, prepare, assemble and submit all submittals for items furnished and performed under this Contract.
- B. Project Site
 - 1. Coordinate locations with the electrical and controls installation. Provide equipment according to the timeline for working on the respective segment of pipe.

2. Contractor shall be responsible to verify with the supplier that the appropriate ratings and options are provided for each application, taking into account area classification, temperature, etc. limitations.
3. Any deviation from that which is specified shall be brought to the engineers' attention during shop drawing submittals.

1.4 SUBMITTALS

- A. Submit the following in accordance with the Division 01 SUBMITTAL PROCEDURES, Section 40 71 00 INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS and with the requirements specified herein.
- B. Additional Requirements:
 1. Sample procedure, programming and print-out for alarm acknowledgment, and system reset.
 2. Notification List.
 3. Submit Manufacturer's Certificate of proper installation.

1.5 QUALITY ASSURANCE

- A. Comply with all Federal and local laws or ordinances, as well as all applicable codes, standards, regulations and/or regulatory agency requirements including the partial listing below:
 1. Joint Industrial Council (JIC) Standards.
 2. Local and State Building Codes.
 3. Occupational Safety and Health Administration (OSHA) Regulations.
- B. All electrical materials and equipment shall be new and shall bear the label of the Underwriters Laboratory (UL), Inc., Factory Mutual (FM) or equivalent where standards have been established and label service regularly applies.
- C. Equipment not specifically described or identified by manufacturer's catalog numbers shall be designed in conformity with ANSI, IEEE, ISA, JIC, NEMA, and other applicable technical standards. The work shall have neat and finished appearance.
- D. Equipment shall be installed as recommended by the manufacturers. Furnish the services of competent factory trained representatives of the instrumentation manufacturer to supervise the installation for proper assembly, start and operate the equipment, and conduct the field tests.

1.6 DELIVERY AND HANDLING

- A. Temporary storage of instruments shall be in clean dry indoor rooms with a temporary dehumidifier and electric heating to maintain the storeroom between 5 and 40 °C, with humidity less than 90%. Comply with manufacturer's additional written instructions for storing and periodic inspection and testing.
- B. Handle instrumentation materials and equipment in conformance with the manufacturer's written instructions.

1.7 WARRANTY

- A. Provide parts and labor warranty in accordance with the Division 01.
- B. Provide an on-site parts and labor warranty for a minimum period of one year after Substantial Completion for all instruments. In cases where the manufacturer offers a longer warranty period, the longer warranty period shall apply as described by the manufacturer.
- C. All equipment that is not fully functional at the time of Substantial Completion shall have warranties extended to provide minimum one year coverage after making the instrument operational, unless otherwise approved by the Owner's Representative.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. The automatic dialing alarm notification equipment manufacturer and model shall be the following or equal:
 - 1. Raco Verbatim Series
 - 2. No Equal

2.2 PRODUCT DESIGN

- A. The automatic dialing alarm system shall have the capability to monitor up to 48 dry contact, digital or analog inputs. Each of these inputs shall monitor a relay supplying a set of dry contacts (normally-closed or normally-open). In addition, the dialer shall monitor the AC power supplied to it.
- B. The autodialer shall be furnished as a coordinated assembly requiring only field connections of the power and control circuits for a complete and operating installation as specified and shown on the Contract Drawings.
- C. Locate equipment, devices, and hardware so that connections can be easily made and so that there is ample room for servicing each item. Every component in and on the enclosure shall be able to be removed individually without affecting the other components and without the need to move other components. Devices which penetrate enclosure shall be constructed/rated/installed to maintain enclosure rating.
- D. Provide connection of the autodialer to any extension or outside line.
- E. Design Requirements:
 - 1. Electronic system shall interface plant alarms to public telephone system on pre-selected basis.
 - 2. Upon receipt of one or more critical alarm trips, electronic system will automatically dial out onto public phone system (up to 24 specified telephone numbers) with preprogrammed messages.

3. System shall continue calling until call completed and acknowledged.
4. Description & Phone Number Dialing:
 - a. The dialer shall be a solid-state component capable of dialing up to 24 phone numbers, each up to 25 digits in length. Phone numbers are user programmable via the system's keyboard or Touch Tone Phone. Numbers may include "*", "#", delays and dial tone detection.
5. Solid State Voice Message Recording and Playback:
 - a. The unit shall have two different categories of speech message capability, all implemented with permanent non-volatile solid-state circuitry with no mechanical tape mechanisms. The unit shall allow for message recording locally at the front panel for each input channel and Station ID as well as remotely.
 - b. Message storage shall be 5 seconds per input channel and System Identification message.
 - c. Circuit board switches or jumper straps shall not be acceptable means of manipulating any option or function of the unit.
 - d. Permanent built-in messages shall be included to support user-programming operations, to provide supplemental warning messages such as advising that the alarms have been disabled, and to allow the unit to be fully functional even when the installer has not recorded any messages of his own.
6. Nonvolatile Program Memory Retention:
 - a. User-entered programming and voice message shall be kept intact even during power failures or when power is removed for up to fifty (50) years.
7. Acknowledgment:
 - a. The system shall provide acknowledgement of alarms from the front panel, a phone that is called with an alarm condition, or dial-in from a remote location with appropriate access codes. All Acknowledgements will be recorded in the event log with the date/time of the acknowledgement.
8. Input Monitoring Function:
 - a. The unit shall continuously monitor the presence of AC power, backup battery and the status of up to 48 contact closure inputs. AC power failure, or violation of the alarm criteria at any input, shall cause the unit to go into alarm status and begin dial-outs. Each input channel shall also be independently programmable, without need to manipulate circuit board switches or jumpers, as Normally Open or Normally Closed, or for No Alarm (status only).
 - b. Dry Contact/Digital Input cards shall be capable of interfacing directly to dry contacts or digital input signals with voltages up to 25VDC. No switches shall be required for any settings.
 - c. Digital Inputs shall be selectable as latching or non-latching.

9. Alarm Message:
 - a. Upon initiating an alarm phone call; the system is to “speak” only those channels that are currently in “alarm status”.
 - b. Alarm message for power failure, low battery and individual 5-second user recorded messages for each input channel and a single 5-second user-recorded message for the system identification.
 - c. Digitally recorded voice messages plus permanent library.
10. Event Reporting:
 - a. The system shall have the capability of documenting all alarms, dial-out, dial-in, and alarm acknowledgement, and relay activations. The event report shall contain the last 100 events. Each event shall have the date/time of the event and the action performed.
 - b. The event log shall be locally viewable on the display and remotely retrievable via a phone call.
11. Data Logging:
 - a. The system shall have a data log that automatically records daily run-times and cycles for any digital input that has the daily reporting option enabled.
 - b. The user shall be able to view the data log locally via the keypad and display.
 - c. The data log shall store a minimum of 100 records.
12. Inquiry Message and Function:
 - a. Inquiry phone calls can be made directly to the unit at any time from any telephone, locally or long distance, for a complete status report of all variables being monitored, including power status.
13. Status Reporting:
 - a. A report of all current conditions of the system shall be available when the system is called. The report shall include the name of the unit and current state of all channels.
14. Programming:
 - a. The system shall be programmable from the front integral keypad with programming prompts displayed on the integral LCD display.
 - b. The system shall be remotely programmable from a phone call-in. The user shall be able to program the telephone numbers, change the channel mode between Call on Alarm and Status only.
 - c. The system shall be capable of being armed or disarmed manually or remotely. Arming or disarming shall be recorded to the event log.
 - d. Integral microphone shall allow user to listen in to the remote site during call-in.
15. PLC Communication:

- a. Dialer option shall support Modbus RTU communication from direct connect or remote SCADA and HMI software packages without any additional hardware or requiring any visits by any personnel to the dialer to install this option.
- b. The Modbus option shall support reading of all digital and analog inputs, alarm states, acknowledgement states, and reading and writing relays.
- c. Any dialer with the Modbus RTU option shall be able to communicate with any other dialer directly over a phone or cell phone connection to have complete activation and de-activation control of the relays on the called dialer.

F. Dialer:

- 1. Flush mount or sub-panel mount configuration. Optional NEMA 4X enclosure.
- 2. The dialer is to use a standard Touch Tone "dial-up" phone (direct leased line not to be required) and is to be F.C.C. approved. Connection to the telephone is through a 4-pin modular jack (RJ-11).
- 3. Operating Temperature: 32 F to 158 F (0 – 70 C).
- 4. Operating Humidity: 0% to 90% @ 140 F.
- 5. Output: To standard phone line through integral FCC approved alarm coupler.
- 6. Power: 115 VAC 10%, 60 Hz; 5 watts, UL rated power supply included.
- 7. 16-hour battery backup, included.
- 8. All features per manufacturers catalog data.

2.3 ACCESSORIES

A. Accessories

- 1. None

2.4 SOURCE QUALITY CONTROL

A. Quality Control Criteria

PART 3 - EXECUTION

3.1 GENERAL

- A. Install system in accordance with the Manufacturer's printed instructions unless otherwise indicated.
- B. Install equipment in conformance with NEC and all local codes.
- C. Install and interconnect all equipment, devices, electrical hardware, instrumentation and controls and process controller components into, out of and among the enclosures as indicated on the drawings.
- D. Keep enclosures clean at all times. Keep enclosures doors closed except when actually working in the enclosure. Protect all equipment during installation including hole punching for conduit connection. Remove all filings and thread cuttings from enclosures.

3.2 EXAMINATION

- A. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- B. Examine roughing-in of equipment to verify the following:
 - 1. Environmental conditions are within the limitations established by the manufacturer.
 - 2. Locations of external wiring and conduit and equipment connection.
 - 3. Devices which penetrate enclosure shall be constructed/rated/installed to maintain enclosure rating.
- C. Verify that ground connections are in place and that installation of grounding described in Section "Grounding" is complete.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Install instruments as shown on the Contract Drawings and in accordance with the manufacturer's installation instructions and recommendations.
 - 1. Supply, mount, install, wire, terminate, and configure all instrumentation, instrumentation equipment, and components as specified herein. Provide all necessary brackets and mounting hardware required by the instrument manufacturer for proper installation.
 - 2. Unless otherwise specified or required, supports shall be aluminum or stainless steel. All mounting hardware shall be stainless steel. Equipment mounted on walls in contact with soil or water shall be mounted offset from the wall a minimum of ¼-inch
 - 3. Dissimilar metals shall not be connected, spliced, or joined.
 - 4. Align, level and adjust for satisfactory operation. Install so that parts are easily accessible for inspection, operation, maintenance and repair. Instrumentation shall be mounted upright, vertical, at eye level, and in locations easily and safely accessible. Minor deviations from indicated arrangements may be made, but only after obtaining approval from the Government's Representative.
- B. Specific attention should be given to the following technical requirements
 - 1. Verify ground rings have been installed according to the manufacturer recommendations.
 - 2. Reduced inlet installations must be accompanied by manufacturer's documented evidence of third party testing and data collection in comparison to a traceable standard.
- C. Electronic low-level signals (analog, discrete, and communications) shall be properly isolated, bundled and supported. These signals shall be routed and separated from AC power wiring.
 - 1. AC power, DC power/signal, and communication cables shall be installed in separate conduit systems, and shall be physically separated by a minimum of 12 inches.

2. All “intrinsically safe” wires and cables shall be kept isolated and installed in separate wire channels and conduit systems from normal power and signal wires - by at least two inches of space. Label wire channels and conduits “Intrinsic Wiring”.

D. Grounding

1. Equipment shall be solidly grounded with an equipment grounding conductor as specified in Section 26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS and as recommended by the manufacturer. Control panels and instruments shall be grounded at the power supply end using a ground wire pulled with the power wires.
2. All instruments and transmitters shall be grounded at the device’s power source using a ground wire pulled with the power wires. Metal cases of loop-powered instruments shall be grounded at the control panel powering the loop using a ground wire pulled with the twisted-shielded pair of wires. All transmitters and metal cases shall be grounded at the control panel with a ground wire. Grounding through conduit and fittings and to grounds other than that of the control panel are not acceptable.
3. The shield in twisted-shielded pairs shall be grounded at the power supply end. Meaning, 4-wire transmitters = ground at transmitter end, 3-wire transmitters = ground at power source end, 2-wire transmitters = ground at loop power source end.

- E. Cutting and drilling of existing panels for new instrumentation as shown, specified, or required, shall include repair and touch up painting of panel after installation.

3.4 FIELD QUALITY CONTROL

A. Prepare for Acceptance Tests as follows:

1. After installing equipment but before power supply is energized, verify that grounding system is completed.
2. Verify that equipment is installed and connected according to the Contract Documents.
3. Verify that electrical wiring installation complies with manufacturer’s submittal by means of point-to-point continuity testing.
4. Verify that field-installed power and control wiring complies with the Electrical Specification requirements.
5. Confirm that field wiring is terminated to the proper device, on the proper terminal, and identified with the appropriate wire number according to the drawings.
6. Verify that equipment is ready for pre-commissioning checks in accordance with manufacturer’s written instructions.

B. Acceptance Tests: After installing equipment and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements as follows:

1. Perform visual and mechanical inspection and electrical tests according to NETA ATS, Section 7, as it applies to all installed systems and devices. Certify compliance with the following test parameters:
2. Verify the proper voltage at each powered circuit and each device.

3. Each instrument shall provide direct control of totalizer reset functions through the PLC.
 4. Each instrument shall be supported with a device profile permitting direct integration in the PLC.
 5. Analog inputs (transmitters) will be tested using actual process conditions, whenever possible. Verify that scaling is correct and the appropriate value is displayed on the OIT.
- C. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.5 MANUFACTURER'S FIELD SERVICES

- A. Engage a factory-authorized service representative to perform inspections, checks, and supervision of testing.

3.6 OPERATION & MAINTENANCE MANUALS

- A. Prepare O&M Manuals as specified in Section 40 90 00 INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS and in accordance with the requirements herein.

3.7 DEMONSTRATION AND TRAINING

- A. Final Acceptance – Include 1/2 day of a manufacturer-approved field technician's time to test equipment to demonstrate functionality.
- B. Training – In addition to the training content specified in the Section 40 90 00 INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS, integrate the following training topics into the specified training sessions:
1. Identification of each component of the autodialer.
 2. Programming and setup for call outs.

PART 4 - ALARMS AND NOTIFIATION

4.1 NOTIFICATION LIST

- A. The contractor shall program the system to allow monitoring and annunciation of a minimum of 32 discrete alarms.
- B. Contractor shall coordinate with the Government to establish list during startup.
- C. I/O Annunciation List: Complete the list supplied below, for all I/O to be used for dial-out.

Tag	Description	I/O Type	Call No.	Contact
JA-010	PLC UPS Batter Low	discrete	(123)456-7890	I&C Tech
UA-011	PLC Fault	discrete	(123)456-7890	I&C Tech
YA-110	Screen Fault	discrete	(123)456-7890	Operator
YA-120	Wash/Compact Fault	discrete	(123)456-7890	Operator
LAHH-130C	Wetwell No.1 High-High Level	discrete	(123)456-7890	Operator
LAHH-131C	Wetwell No.2 High-High Level	discrete	(123)456-7890	Operator
YA-130A	Primary Level Device Fault	discrete	(123)456-7890	I&C Tech
YA-131	Pump No.1 SSRV Fault	discrete	(123)456-7890	Operator
PAH-131	Pump No.1 high Pressure	discrete	(123)456-7890	Operator
LAH-131	Pump No.1 Leak	discrete	(123)456-7890	Maintenance
TAH-131	Pump No.2 High Temperature	discrete	(123)456-7890	Maintenance
YA-132	Pump No.2 SSRV Fault	discrete	(123)456-7890	Operator
PAH-132	Pump No.2 High Pressure	discrete	(123)456-7890	Operator
LAH-132	Pump No.2 Leak	discrete	(123)456-7890	Maintenance
TAH-132	Pump No.2 High Temperature	discrete	(123)456-7890	Maintenance
YA-133	Pump No.3 SSRV Fault	discrete	(123)456-7890	Operator
PAH-133	Pump No.3 High Pressure	discrete	(123)456-7890	Operator
LAH-133	Pump No.3 Leak	discrete	(123)456-7890	Operator
TAH-133	Pump No.3 High Temperature	discrete	(123)456-7890	Operator
LSH-141	Station Flood	discrete	(123)456-7890	Operator
YA-210	Mixer Fault	discrete	(123)456-7890	Maintenance
LSHH-210	Tank Leak	discrete	(123)456-7890	Operator
YA-211	Metering Pump Fault	discrete	(123)456-7890	Operator
AA-140	Storage Room Gas Alarm	discrete	(123)456-7890	Operator
AA-142	Stair/Screening Room Gas Alarm	discrete	(123)456-7890	Operator

YZ-144	Station Smoke Alarm	discrete	(123)456-7890	Operator
YLE-145	Station Power Fail	discrete	(123)456-7890	Operator
LSL-146	Standby Generator Leak	discrete	(123)456-7890	Maintenance
LS-146	Standby Generator low Fuel	discrete	(123)456-7890	Maintenance
YA-146	Standby Generator Fault	discrete	(123)456-7890	Maintenance
XA-154	Station Intrusion	discrete	(123)456-7890	Operator

END OF SECTION

SECTION 43 21 16 TESTS ON PUMPING EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements for shop hydrostatic testing, shop performance testing, shop vibration testing and field testing for each pump shown on the Contract Drawings, unless otherwise specified.

1.2 REFERENCES

- A. Comply with the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. International Standards Organization (ISO)
 - 2. Hydraulic Institute Standards (HIS)
 - 3. American National Standards Institute (ANSI)
 - 4. National Institute of Standards and Technology (NIST)

1.3 SUBMITTALS

- A. Submit the following in accordance with the General Conditions/General Requirements:
 - 1. Shop hydrostatic test results, for each pump tested.
 - 2. Shop performance test results, in the form of performance curves, certified with actual test date and witness, for each pump tested.
 - 3. Shop vibration test results, certified with actual test date and witness, for each pump tested.
 - 4. Manufacturer's certification of proper installation.
 - 5. Field vibration test results, for each pump tested, along with a written statement that the measured values comply with ISO 10816 and the manufacturer's requirements.
 - 6. Signed report certifying that final alignment meets or exceeds this specification.
 - 7. Certified test report for the bearing signature analysis.

1.4 QUALITY ASSURANCE

- A. Contractor shall enlist services of an experienced and qualified testing firm independent from and not associated with pump manufacturer or Contractor. Testing firm performing field vibration testing, bearing signature analysis and natural frequency and resonance testing shall be ISO 10816 certified with a minimal category 111 classification.
- B. Testing firm shall submit sample reports including field vibration testing, bearing signature analysis and natural frequency and resonance testing to Engineer for review prior to approval.

PART 2 - PRODUCTS

2.1 TESTING EQUIPMENT

- A. Manufacturer shall furnish all labor, materials and equipment, including drives, required to perform shop tests.
- B. Contractor shall furnish all labor, materials and equipment required to perform field tests.

PART 3 - EXECUTION

3.1 SHOP HYDROSTATIC TESTS

- A. Hydrostatic pressure test shall last a minimum duration of 5 minutes and be at 150% the specified shut-off head or 150 psi.
- B. Pump components shall show no indication of:
 - 1. Undue deflection
 - 2. Sign of weakness
 - 3. Sweating through porous metal
 - 4. Leakage

3.2 SHOP PERFORMANCE TESTS

- A. Centrifugal Pumps
 - 1. Each pump shall be tested at the maximum rated speed over a range of operating conditions to develop its performance curves for:
 - a. Head capacity
 - b. Power input (BHP)
 - c. Total and pump efficiency
 - d. Net positive suction head required (NPSHr)
 - 2. Each pump performance curve shall include a minimum of five equally spaced data points, including shut-off and the minimum head/maximum flow for which the pump is designed to operate at.

3.3 SHOP VIBRATION TESTS

- A. Shop vibration testing shall be performed on each pump in accordance with ANSI/HIS 11.6. Shop vibration test shall demonstrate compliance with both ANSI/HI 11.6 and the manufacturer's requirements. Measured vibration values shall not exceed allowable vibration limits specified in ANSI/HIS 11.6.
- B. Shop vibration test shall be performed in conjunction with shop performance test.
- C. A complete report shall be submitted to the Engineer for review and shall include, at a minimum, the following items:
 - 1. Description of procedures and equipment used to complete testing.
 - 2. Comparison between actual measured vibration values and acceptable vibration limits specified in ANSI/HIS 11.6.
 - 3. Written statement from pump manufacturer that measured values comply with ANSI/HI 11.6 and manufacturer's requirements.

3.4 FIELD TESTS

- A. Field tests shall not commence on any pump assembly until a manufacturer's representative is present and has completed inspection for proper assembly, erection and alignment. Manufacturer's representative shall supply Owner with a certification of installation.
- B. Field Operational Test
 - 1. Prior to acceptance by Owner, an operational test of all pumps and drives shall be conducted for a minimum of four hours and shall determine if installed equipment meets the purpose and intent of the specifications. Tests shall demonstrate all equipment is:
 - a. Properly installed
 - b. Electrically, mechanically, structurally, and otherwise acceptable.
 - c. No producing any undue noise, vibration or other operational problems.
 - d. In proper alignment and has been properly connected.
 - e. Safe and in optimum working condition
 - f. Free from overloading and overheating.
 - g. Conforms to the specified operating characteristics.
 - 2. During operational tests, pump manufacturer's field representative shall provide a report including all test information to the Engineer. During operational tests, pumps shall be operated from zero to maximum capacity.
- C. Field Vibration Test
 - 1. A field vibration test shall be performed on each pump in accordance with ISO 10816 to demonstrate compliance with ISO 10816 and manufacturer's requirements. Vibration measurements shall be made with instruments calibrated and traceable to the National Institute of Standards and Technology (NIST). Testing shall be considered acceptable when results measure good or satisfactory in accordance with the ISO 10816 Vibration Severity Standards, for the specific size pump and the pump is free from undue vibration over the full range of operating conditions. Quantity and location at which vibration readings shall be taken shall be in accordance with ISO 10816 Vibration Severity Standards, for the specific type of pump. Whenever vibration levels exceed ISO 10816 standards, the cause of the vibration shall be determined by the Contractor and the Engineer shall be notified. Vibration monitoring locations shall be clearly and permanently marked for future reference. A certified copy of the test report shall be submitted to the Engineer detailing vibration levels including critical speeds and peak vibrations, and any remarks noted during testing pertaining to the equipment, test conditions, or results. Testing firm shall supply the Engineer with a written statement that measured values comply with ISO 10816 and manufacturer's requirements.
- D. Natural Frequency and Resonance Testing
 - 1. Natural Frequency and Resonance testing shall be conducted after installation. Structural natural frequency measurements shall be made on all pump and motor bearing housings in the horizontal, vertical and axial directions and should be measured as operational or non-operational. Shaft natural frequency measurements shall be made on exposed areas of shaft with equipment offline. Natural frequency measurements shall be made with instruments calibrated and traceable to the NIST. No rotor natural frequencies or structural natural frequencies will be permissible within 15% of the vane pass frequency of the pumping unit. Whenever natural frequencies exceed the above limit, the cause of the natural frequency shall be determined by the Contractor and the

Engineer shall be notified. A certified test report shall be submitted to the Engineer detailing frequency levels and any resultant problems/recommended corrections.

- E. Testing for all pumps shall be performed over the range of anticipated operating speeds. Record motor amperages, suction pressure and discharge pressure using calibrated test gauges, and rotating speed using a strobe tachometer.
- F. Power for testing will be provided by the Owner.

3.5 ACCEPTANCE

- A. Final acceptance of each pumping unit shall depend upon satisfactory operation as demonstrated by the shop tests and the certified performance curves.
- B. Final acceptance of each pumping unit shall depend upon satisfactory operation as demonstrated by the field tests and operation under field conditions.
- C. Prior to final acceptance, the Contractor or pump manufacturer shall correct all deficiencies identified during the shop tests and field tests.

3.6 SCHEDULE

Section	Pump Type	Shop Test				Field Test	
		Hydrostatic	Performance	Vibration	Operational	Vibration	Natural Frequency
43 21 19	Dry Pit Submersible Pump	X	X	X	X	X	X

END OF SECTION

SECTION 43 21 39
DRY PIT SUBMERSIBLE PUMPS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes furnishing and installing submersible, dry pit non-clog pumps and appurtenances for pumping raw wastewater, as shown on the Contract Drawings, as specified herein, and as needed for a complete operating system.

1.2 REFERENCES

- A. Comply with the following codes, standards and specifications, except where more stringent requirements have been specified herein:
1. American National Standards Institute (ANSI)
 2. American Society for Testing and Materials (ASTM)
 3. American Society of Mechanical Engineers (ASME)
 4. American Bearing Manufacturers Association (ABMA)
 5. Hydraulic Institute Standards (HIS)
 6. National Electrical Manufacturers Association (NEMA)

1.3 SUBMITTALS

- A. Submit the following in accordance with the General Conditions and General Requirements.
- B. Product Data: "Catalog cuts" and specification sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.
1. Performance data curves showing head, capacity, horsepower demand, pump efficiency and net positive suction head required over the operating range specified. Indicate the head, capacity, horsepower demand and efficiency at the specified duty point.
 2. Manufacturer's data for all pumps, motors, drives and accessories, including materials of construction and maximum recommended starts per hour.
 3. Certified bearing frame analysis and bearing calculations, verifying compliance with the specified bearing life.
- C. Shop Drawings:
1. Detailed layout drawings of the pumps including dimensions, weights, connection details and appurtenances.
 2. Detailed fabrication, installation and control drawings, including any required or recommended modifications to the proposed suction and discharge piping shown on the Contract Drawings.
 3. Motor performance data, wiring diagrams and one-line diagrams for the Electrical Contractor's use, including curves for torque, current, power factor, Kilowatt and efficiency.
- D. Complete list of spare parts with part number, item number, description and cost.

- E. Manufacturer's equipment warranty.
- F. Manufacturer's list of special tools and test equipment.
- G. Manufacturer's storage requirements and installation recommendations.
- H. Submit certified shop test reports and field test reports for the dry pit submersible pumps.
- I. Closeout Submittals
 - 1. Operation and Maintenance Data: Provide copies of the manufacturer's operation and maintenance manuals in accordance with Section 01 78 23 entitled, "Operations and Maintenance Data."
 - 2. Warranty Documentation: Provide a copy of the manufacturer's warranty.
 - 3. Provide a copy of the manufacturer's certificate of proper installation.
 - 4. Manufacturer's certification that all materials furnished comply with applicable requirements of the referenced standards and this specification.

1.4 QUALITY ASSURANCE

- A. Manufacturer's Qualifications:
 - 1. Manufacturer shall have a minimum of ten (10) years' experience in producing substantially similar equipment and shall be able to show evidence of at least fifty (50) installations in satisfactory operation for at least five (5) years. Installation list shall include the following:
 - a. Facility's name and location
 - b. Facility's average daily and peak flows
 - c. Name of person(s) to contact
 - d. Phone number
 - e. Brief description of system
 - f. Installation date
 - 2. It is the sole responsibility of the Contractor to provide the information necessary for the Engineer to contact these references.
- B. Component Supply and Compatibility
 - 1. All equipment in this Section shall be supplied by a single manufacturer who shall be responsible for the design, coordination and proper operation of the entire system. Pumps shall be fabricated, assembled, erected and placed in proper operating condition in full conformity with the drawings, specifications, engineering data, instructions and recommendations of the equipment manufacturer.
 - 2. All pumps of like size and type shall be of the same manufacturer for the purpose of parts interchangeability.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Following shop testing and before dismantling pump equipment for shipment, all wiring and mechanical connections shall be match-marked or tagged to ensure proper field assembly.
- B. Materials and equipment shall be boxed, crated or otherwise completely enclosed and protected from corrosion and deterioration during shipment, handling, and storage. Such boxes, crates or protection shall be clearly labeled with manufacturer's name, brand or

model designation, type or grade, and color. Machined surfaces shall be flushed with heavy, noncorrosive oil, and gears and bearings shall be lubricated.

- C. Protect materials and equipment from exposure to the elements and keep dry at all times. Unload, handle and store materials and equipment in accordance with the manufacturer's recommendations.
- D. Materials and equipment damaged by handling and storage operations shall be repaired or replaced by the Contractor as directed by the Engineer, at no additional cost to the Owner.
- E. Protect steel, packaged materials and electronics from corrosion and deterioration.

1.6 WARRANTY

- A. The pump manufacturer shall warrant the pumps being supplied to the Owner against defects in materials and workmanship for a period of five (5) years following acceptance of the pumping system by the Owner.
- B. The warranty shall be in published form and apply to all similar units.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The following manufacturers are named to establish a standard of quality necessary for the Project:
 - 1. ABS (Sulzer)
 - 2. Flygt (Xylem)
 - 3. Or approved equal
- B. The Contract Documents depict equipment and materials manufactured by ABS (Sulzer). It is not intended, however to eliminate other products of equal quality performance.
- C. If any other manufacturer listed in this Section, or substitution is proposed by the Contractor for the Work covered in this Section, it shall be the responsibility of the Contractor to perform any required redesign and coordination associated with, but not limited to, mechanical equipment layout, electrical wiring, conduit and controls, and structural/architectural work, at no additional cost to the Owner.
- D. No substitution will be allowed without prior approval by the Engineer.

2.2 GENERAL

- A. Pumps shall be submersible, dry-pit, non-clog, solids-handling, centrifugal pumps, designed specifically for pumping municipal, institutional, commercial and industrial sewage.
- B. Pumps shall be capable of continuously pumping raw wastewater with a liquid temperature up to 104 degrees F and continuously operating in an environment with an air temperature up to 104 degrees F. Motors with a maximum ambient temperature rating below 104 degrees F will not be acceptable.
- C. Pump and motor shall be suitable for continuous operation at full nameplate load. Motor cooling shall be sufficient for continuous operation under full nameplate load in a dry environment. Pump motor shall be inverter duty rated.

2.3 PERFORMANCE REQUIREMENTS

- A. Pumps shall be designed in accordance with the following performance and configuration requirements:

Item	Requirement
No. of pumps	3
Type	Submersible, dry pit, non-clog
Design pumping capacity, each	3,000 gal/min
Design TDH	200 feet
Min. Shut-off Head	272 feet
Max. NPSH required	17 feet @ 3,000 gal/min
Min. hydraulic efficiency	72 %
Pump Suction	10 inch
Pump Discharge	10 inch
Max. Motor HP, each	250 HP
Max. RPM	1800 rpm
Motor characteristics	460 V, 3ph, 60 Hz
Operation	Constant Speed

- B. Pump shall be heavy-duty, capable of handling raw, unscreened sewage without clogging.
- C. Pump shall be capable of operating in a continuous, non-submerged condition in vertical position in a dry pit installation and permanently connected to inlet and outlet pipes.
- D. Pump shall be of submersible construction and will continue to operate satisfactory should the dry pit be subjected to flooding.
- E. Pump head capacity curve shall slope in one continuous curve with no sharp point or reverse slope deflection.
- F. Pump shall be driven by a premium efficiency motor.
- G. Motor shall not overload at any point on head-capacity curve. Pump selections which do not conform to this requirement without requiring a motor with a nameplate rating greater than that listed are not acceptable.

2.4 MATERIALS AND CONSTRUCTION

A. General

- Major pump components, unless otherwise noted, shall be grey cast iron per ASTM A-48, Class 35B, with smooth surfaces devoid of porosity or other irregularities.
- All exposed fasteners, nuts and bolts shall be Type 316 stainless steel.
- All metal surfaces coming into contact with the pumped media other than stainless steel, shall be protected by a factory applied coating.
- Pump shall be equipped with an open lifting hoop suitable for attachment of standard chain fittings. Hoop shall be rated to lift a minimum of four times the pump weight.
- Sealing design for the pump/motor assembly shall incorporate machined surfaces fitting with Nitrile (Buna-N) rubber O-rings. Sealing shall be the result of compression of rubber O-rings. Housing interfaces shall meet with metal-to-metal contact between machined surfaces and sealing shall be accomplished without requiring a specific torque on the securing fasteners.

B. Impeller

1. Impeller shall be of grey cast iron per ASTM A-48, Class 35B of the double shrouded, non-clogging, two-vane design capable of passing a minimum 3-inch diameter solid.
 2. Impeller shall be dynamically balanced to provide smooth, vibration free operation.
 3. Impeller vane leading edges shall be mechanically self-cleaned upon each rotation, maintaining an unobstructed impeller leading edge and sustaining a high level of hydraulic efficiency.
 4. Impellers shall be locked to the shaft, held by an impeller bolt and treated with a corrosion inhibitor. Head of impeller bolt shall be recessed within impeller bore or supporting washer to prevent disruption of the flow stream and loss of hydraulic efficiency.
- C. Wear Ring System
1. A replaceable wear ring of cast iron shall be securely fitted into the pump casing.
- D. Pump Volute
1. Pump volute shall be gray cast iron per ASTM A-48, Class 35B of the non-concentric design with centerline discharge.
 2. Passages shall be smooth and large enough to pass any solids which may enter the impeller.
 3. Discharge flange design shall permit attachment to standard ANSI Class 125 flanged fittings.
- E. Suction and Discharge Connections
1. The pump shall be equipped with a cast iron suction elbow bolted directly to the pump suction flange. Suction elbow shall include a clean-out hand hole with removable cover and 4-inch minimum opening. The inner surface of the handhole cover shall conform to the curvature and radius of the suction elbow.
 2. Pump discharge nozzle shall be drilled and faced to conform with ANSI B16.1, Class 125. Pump discharge shall be oriented as shown on the Contract Drawings.
- F. Shaft
1. Pump and motor shaft shall be an integral, single-piece unit adequately designed to meet maximum torque required during a normal start-up condition or operating point in the system.
 2. Maximum shaft deflection shall not exceed 0.002-inch at the lower seal during normal pump operation.
 3. Each shaft shall be stainless steel with a polished finish with accurately machined shoulders to accommodate bearings, seals, and impeller.
- G. Base Assembly
1. Pump shall be secured to a steel support stand/frame for mounting to cast-in-place concrete pump supports.
 2. Two reinforced, concrete pump supports shall support each pump as shown on the Contract Drawings.
 3. Pump manufacturer shall be responsible for designing and providing a ASTM A-36 steel, custom made base plate designed for a minimum of 6 anchor bolts. Base plate thickness shall be designed by the pump manufacturer and shall be a minimum of 2-inches thick. Base plate shall be rectangular and sized to span the outside limits of the concrete pump supports.

4. Contractor shall mount the pump and base plate to the two-concrete pump supports using 6 anchor bolts. Base plate shall be leveled and grouted in place. Suction elbow shall not touch the foundation upon which the pump is mounted. Contractor shall coordinate the dimensions of the concrete pump supports and location of the anchor bolts with the pump manufacturer and the dimensions of the base plate.

H. Bearings

1. Each pump shaft shall rotate on high quality permanently lubricated, greased bearings.
2. Upper bearing shall be a cylindrical roller bearing electrically isolated from the bearing housing.
3. Lower bearings shall be a matched set of heavy duty bearings, two angular contact bearings and one cylindrical roller bearing, with identical outer diameters to provide maximum bearing load capacity.
4. Bearings shall be sufficiently sized and properly spaced to transfer all radial and axial loads to the pump housing and minimize shaft deflection.
5. Min. L-10 bearing life shall be 100,000 hours at flows ranging from 0.5 of best efficiency point flow to 1.5 of best efficiency point flow.

I. Cable Entry Seal

1. Cable entry seal design shall provide for a watertight and submersible seal. Cable entry shall be sealed by an elastomer grommet and stainless-steel washer system providing cable strain relief. System shall not require replacement during changing of the cable.
2. Cable entry junction chamber shall be isolated and sealed from the motor.
3. An access port shall be located in the center of the motor lid to allow easy access to the electrical connections.

J. Mechanical Seals

1. Each pump shall be provided with a triple seal system consisting of tandem mechanical shaft seals plus a radial lip seal.
2. Mechanical seal system shall consist of two independent seal assemblies operating in a lubricant reservoir.
3. Lower primary seal unit, located between the pump and lubricant chamber, shall contain one stationary, industrial-duty, solid silicon-carbide seal ring and one rotating, industrial-duty, solid silicon-carbide seal ring. Stationary ring shall be installed in a seal holding plate of gray cast iron, ASTM A-48, Class 35B. Seal holding plate shall be equipped with swirl disruption ribs to prevent abrasive material from prematurely wearing the seal plate.
4. Upper secondary seal unit, located between the lubricant chamber and sensing chamber, shall contain one stationary, industrial-duty, solid silicon-carbide seal ring and one rotating, industrial-duty, solid silicon-carbide seal ring. Each seal interface shall be held in contact by its own spring system.
5. A radial lip seal shall be positioned above the sensing chamber to prevent liquid accumulating in the sensing chamber from entering the lower bearing and motor.
6. Seals shall not require routine maintenance or adjustment and shall not be dependent on direction of rotation for proper sealing.
7. Each pump shall be provided with a lubricant chamber for the shaft sealing system. Lubricant chamber shall be designed to prevent overfilling and shall provide capacity for lubricant expansion. Lubricant chamber shall have one drain and one inspection

plug that are accessible from the exterior of the motor unit. Seal system shall not rely upon the pumped media for lubrication.

8. Seal lubricant shall be environmentally safe, non-toxic material.

K. Seal Protection System

1. Primary mechanical seal shall be protected by an active Seal Protection System integrated into the impeller.
2. Back of impeller shall be equipped with a sinusoidal cutting ring which shall spin with the pump impeller and shear large particles or fibrous material attempting to lodge behind the impeller or wrap around the seal.
3. Seal protection system shall operate when the pump operates.

L. Seal Failure Warning System

1. An electrical probe shall be provided in the sensing chamber above the mechanical seals for detecting the presence of water within the chamber.
2. A relay within the control panel shall continuously monitor the conductivity of any liquid within the sensing chamber.
3. Probe shall sense an increase in conductivity of water entering the sensing chamber and signal a relay within the control panel and energize a warning light on the control panel.
4. Moisture sensing probes shall be provided in the electrical connection chamber and the motor chamber.

M. Cooling System

1. Each pump shall have a factory installed, closed loop, integral motor cooling system adequately designed to allow motor to run continuously under full load while in an unsubmerged condition.
2. Motor cooling system shall surround the stator housing. An environmentally safe non-toxic cooling liquid shall be circulated through the cooling jacket by an impeller attached to the motor shaft.
3. Coolant shall be pumped through an integrated heat exchanger in the base of the motor whenever the motor is running.
4. Fans, blowers, or auxiliary cooling systems that are mounted externally to the pump motor are not acceptable. Cooling systems that circulate pumped medium are not acceptable.

N. Vibration Switches

1. Provide each pump/motor assembly with a factory installed vibration detection system. Vibration detectors shall have adjustable time set delays for prevention of false shutdowns resulting from transient vibrations.
2. Provide mechanical type vibration switches to monitor vibration in each of the three perpendicular axes (X-Y-Z) and initiate alarm if high vibration levels are detected.
3. Vibration switches shall have at least one SPDT voltage-free contact rated 1 amp (minimum) at 120 VAC that changes state on high vibration alarm. Alarm setpoint shall be field-adjustable with local setting indicator.
4. Switch housing shall be Type 316 stainless steel and shall be mounted by means of threaded studs. Housings shall be suitable for direct conduit connection.
5. Vibration switches shall be Metrix, PMC/Beta, or equal.

2.5 MOTORS

1. Motors shall be dry pit submersible type, premium efficiency, inverter duty, housed in an air filled, water tight chamber.
2. Motors shall be of the squirrel cage, induction type. Motors shall be designed for the service conditions specified and scheduled herein and on the Contract Drawings.
3. Stator windings shall be insulated with moisture resistant Class H insulation. Bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable.
4. Motor shall be rated for continuous duty pumping liquid with a maximum continuous temperature of 104 degrees F.
5. Motor shall be capable of at least 12 evenly spaced starts per hour without overheating.
6. Motor service factor shall be 1.3.
7. Motor shall have a NEMA Class A temperature rise, providing cool operation under all operating conditions.
8. Thermal switches shall be embedded in the motor windings to monitor the temperature of each phase of the motor. Thermal switches shall be connected to the control panel to provide a high stator temperature shutdown signal and used in conjunction with and supplemental to external motor overload protection.
9. Temperature switches shall be installed in the upper and lower bearing housing to monitor the temperature of bearing and provide high bearing temperature warning signals.
10. Motors shall be of sufficient size so that there will be no overload on the motor above rated nameplate horsepower under any condition of operation from shut-off through run-out.
11. Power cable shall be sized according to NEC standards and shall be of sufficient length to reach the terminal point as indicated on the Contract Drawings without requiring splicing. Outer jacket of the cable shall be oil, water, and UV resistant rubber. Motor and cable shall be capable of continuous submergence without loss of watertight integrity. Contractor shall be responsible for field verification of required cable length.

2.6 ACCESSORIES

A. Miscellaneous

1. All pumps shall be furnished with stainless steel data plates installed in a readily visible location on the pump. Data plates shall contain manufacturer's name, pump size and type, serial number, rated speed, impeller diameter, capacity and head rating, and other pertinent data. A data plate shall be fastened to the pump frame, which shall contain identification of frame and bearing numbers.
2. Anchor bolts shall be Type 316 stainless steel, provided by pump manufacturer. Anchor bolts shall restrain pump while operating at shut-off head. Anchor bolts shall be furnished complete with nuts and sleeves and shall be of sufficient length to permit proper embedment in the foundation concrete.
3. One (1) pump memory unit shall be installed in the junction chamber of each pump furnished under this specification. Pump memory unit shall have a minimum of 32 kb of memory and shall store data plate information, listing of installed sensors and statistical operational data including the number of starts, accumulated running time, service history and histogram data of motor temperature.

4. Monitoring and Status (MAS) unit:
 - a. Pump memory unit, thermal switches, leakage sensors, temperature sensors and other monitoring equipment shall be connected to a Monitoring and Status (MAS) pump monitoring unit.
 - b. MAS units shall be provided by pump manufacturer.
 - c. MAS unit shall be designed to be mounted in the Programmable Logic Controller (PLC), as shown on the Contract Drawings, and be provided with an Operator Panel that is dead-front panel mounted. Control cable shall be long enough to span the distance between each pump and the MAS unit without any splices.
 - d. Operator panel shall have soft touch operator keys and provide local indication of alarm status by means of an LCD screen read-out.
 - e. Remote indication of pump status shall be possible with connection to the Owner's PLC.

2.7 SPARE PARTS

- A. Manufacturer shall furnish the following spare parts on an inventory sheet with part number, item number, description and cost for each part supplied:
 1. One (1) impeller
- B. Spare parts shall be packed in wooden boxes, labeled with the manufacturer's name, address and telephone number; local representative's name, address and telephone number; name of equipment the parts are for, and a list of parts and their cost contained therein.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install pumps and accessories in accordance with the configuration shown on the Contract Drawings and in accordance with the manufacturer's requirements.
- B. Properly align equipment with associated piping and utility connections, without exerting undue stress on connecting piping and utilities. Contractor shall provide flange gaskets, nuts and bolts for pump discharge piping connections.
- C. Contractor shall make all necessary adjustments to equipment to provide complete operational pump installations meeting the requirements of the Contract Documents.
- D. Install equipment plumb and level and demonstrate plumbness and levelness to the Engineer.
- E. No portion of the pump shall bear directly on the pumping station floor. Base assembly shall be installed in accordance with the manufacturer's recommendations. Base assembly shall be grouted after initial fitting and alignment but before final bolting of connecting piping. Contractor shall maintain alignment of pumping unit components. No stresses shall be transmitted to the pump flanges. After final alignments and bolting, pump connections shall be tested for applied stresses by loosening the flange bolts. If any movement or opening of the joints is observed, piping shall be adjusted to proper fit.

3.2 FIELD QUALITY CONTROL

1. Pump manufacturer's representative will supply certification of installation.

- B. Tests shall be conducted by Contractor and pump manufacturer's representative and witnessed by Engineer, and shall demonstrate the following under operating conditions:
 - 1. Pump has been properly installed and has no mechanical defects.
 - 2. Pump is in proper alignment and has been properly connected.
 - 3. Pump is free from undue vibration over the full range of operating conditions.
 - 4. Pump is free from overloading and overheating.
- C. Power for testing will be provided by Owner.
- D. After installing equipment and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements. Tests shall be conducted by Contractor and pump manufacturer's representative and witnessed by Engineer. Perform field tests for the pumping system, including but not limited to, the following:
 - 1. Impeller, motor rating and electrical connections shall be checked for compliance with this specification.
 - 2. Prior to submergence, the pump shall be run dry to establish correct rotation.
 - 3. Pump shall be run submerged in water.
 - 4. Motor and cable insulation shall be tested for moisture content or insulation defects.
 - 5. Demonstrate that the pump is free from undue vibration over the full range of operating conditions.
 - 6. Demonstrate that the pump is free from overloading and overheating.
 - 7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.3 MANUFACTURER'S FIELD SERVICES

- A. Contractor shall engage the services of a qualified factory trained manufacturer's field service engineer to be present at and assist in the startup of each pump supplied under this section. Duration of service shall be as required to complete the successful startup of the pumps.
- B. Tests shall be conducted by Contractor and pump manufacturer's representative and witnessed by Engineer, and shall demonstrate the following under operating conditions:
 - 1. Pump has been properly installed and has no mechanical defects.
 - 2. Pump is in proper alignment and has been properly connected.
 - 3. Pump is free from undue vibration over the full range of operating conditions.
 - 4. Pump is free from overloading and overheating.
- C. Power for testing will be provided by Owner.
- D. After installing equipment and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements. Tests shall be conducted by Contractor and pump manufacturer's representative and witnessed by Engineer. Perform field tests for the pumping system, including but not limited to, the following:
 - 1. Impeller, motor rating and electrical connections shall be checked for compliance with this specification.
 - 2. Prior to submergence, the pump shall be run dry to establish correct rotation.
 - 3. Pump shall be run submerged in water.

4. Motor and cable insulation shall be tested for moisture content or insulation defects.
 5. Demonstrate that the pump is free from undue vibration over the full range of operating conditions.
 6. Demonstrate that the pump is free from overloading and overheating.
 7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- E. Contractor shall correct or replace all defective equipment revealed by or noted during field tests at no additional cost to the Owner and repeat field tests until specified results are acceptable to the Engineer.

3.4 DEMONSTRATION AND TRAINING

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the equipment.
1. Train Owner's maintenance personnel on procedures and schedules for energizing and de-energizing, troubleshooting, servicing, and maintaining equipment and schedules.
 2. Training will include both field and classroom training, and will be conducted in two (2) separate sessions, each session to be no less than two (2) hours in duration. First training session will be conducted immediately following start-up of first pump installed. Second training session will be conducted immediately following start-up of last pump installed.
 3. Review data in Operation and Maintenance manuals.
 4. Schedule training with Owner, with at least fourteen days advance notice.

END OF SECTION

SECTION 43 41 43
POLYETHYLENE CHEMICAL STORAGE TANK AND MIXER

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements for providing a double-wall, high density, cross-linked polyethylene chemical storage tank, mixer, mixer stand, and appurtenances as shown on the Contract Drawings.

1.2 REFERENCES

- A. Comply with the following codes, standards and specifications, except where more stringent requirements have been specified herein:
1. ASTM D618 – Conditioning Plastics and Electrical Insulating Materials for Testing.
 2. ASTM D638 – Tensile Properties of Plastics.
 3. ASTM D790 – Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 4. ASTM D883 – Definitions of Terms Relating to Plastics.
 5. ASTM D1505 – Density of Plastics by the Density-Gradient Technique.
 6. ASTM D1525 – Test Method for Vicat Softening Temperature of Plastics.
 7. ASTM D1693 – Test Method for Environmental Stress-Cracking of Ethylene Plastics.
 8. ASTM D1709 – Impact Resistance of Plastic Film by the Free-Falling Dart Method
 9. ASTM D1998 – Standard Specifications for Polyethylene Upright Storage Tanks
 10. ASTM D2765 – Degree of Crosslinking in Crosslinked Ethylene Plastics as Determined by Solvent Extraction
 11. ASTM D2837 – Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.
 12. ASTM D3892 – Practice for Packaging/Packing of Plastics.
 13. ASTM F412 – Definitions of Terms Relating to Plastic Piping Systems.
 14. ARM (Association of Rotational Molders), Low Temperature Impact Resistance (Falling Dart Test Procedure).
 15. ANSI B16.5 – Pipe Flanges and Flanged Fittings
 16. 29 CFR 1910.106 Occupational Safety and Health Administration, Flammable and Combustible Liquids.
 17. New York State Department of Environmental Conservation (NYSDEC), 6 NYCRR Part 599 – Standards for Chemical Bulk Storage.

1.3 SUBMITTALS

- A. Shop Drawings:
1. Submit the following for approval:

- a. Detailed tank drawings including dimensions, sizes, capacity, weights, wall thickness, materials of construction, anchorage, fittings, piping and details of all required appurtenances. Drawings shall show fabrication, assembly and installation details.
 - b. Manufacturer's literature, specifications, chemical compatibility data, resin data sheet and engineering data.
 - c. Product delivery, storage and handling instructions.
 - d. Manufacturer's warranty.
- B. Manufacturer Qualifications
- 1. When requested by the Engineer, provide a list showing five existing, similar installations for each chemical application, including name of facility, facility address, name and telephone number of contact person at listed facility, chemical being stored, volume, and date of installation.
- C. Certificates:
- 1. Affidavits of compliance with referenced standards and codes.
 - 2. Certificate of Installation from the manufacturer indicating approval of Contractor's installation.
 - 3. Factory test report.

1.4 QUALITY ASSURANCE

- A. Manufacturer's Qualifications:
- 1. Manufacturer shall have a minimum of ten years' experience in producing polyethylene tanks.
- B. Quality Control:
- 1. All dimensions will be taken with the tank in the vertical position, unfilled. Tank dimensions will represent the exterior measurements.
 - a. The tolerance for the outside diameter, including out of roundness, shall be per ASTM D 1998-04.
 - b. The tolerance for fitting placements shall be +/- 0.5 in. in elevation and 2 degrees radial at ambient temperature.
- C. Component Supply:
- 1. All chemical storage tanks of like size and type shall be supplied by one tank manufacturer.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Delivery, unloading, storage and handling of chemical storage tanks shall be in accordance with the manufacturer's recommendation and shall be done in such a manner as to prevent damage.

1.6 WARRANTY

- A. Tank and appurtenances shall carry a one year warranty against defects in workmanship and/or materials. Warranty period shall commence upon final acceptance and approval by the Engineer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The following manufacturers are named to establish a standard of quality necessary for the Project:
 - 1. Poly Processing Company
 - 2. Or equal
- B. The Contract Documents depict equipment and materials manufactured by Poly Processing Company. It is not intended however, to eliminate other products of equal quality and performance. Contractor shall be responsible for making all resulting changes to the layout to accommodate other acceptable manufacturers.

2.2 GENERAL

- A. All chemical storage tanks shall be supplied as a complete package from the manufacturer, who shall be responsible for proper operation of the coordinated system.
- B. All components of like size and type shall be the product of the same manufacturer for purposes of parts interchangeability.
- C. Temperature: Suitable for outdoor installation in New York State, typical temperature range of 0° to 100° F. Chemicals may be delivered at higher or lower temperatures, depending on season.
- D. Maximum temperature: 100°F
- E. Normal internal loads: Hydrostatic based on specific gravity of stored liquid.
- F. External loads:
 - 1. Appurtenances as shown and specified herein.
 - 2. Concentrated top load of 250 pounds distributed over a 4-inch by 4-inch area at the top of the tank.
 - 3. Tanks shall be designed for seismic zone for region of installation.
- G. Floatation: Tanks and tank anchors shall be designed to withstand floatation without damage when tanks are empty with a surrounding hydrostatic head of 4'-5".
- H. Tank volume listed shall be the working or usable volume of tank measured as volume below high level alarm elevation or overflow, whichever is lower.
- I. All materials shall be compatible with the specified chemical service.

2.3 MATERIALS AND CONSTRUCTION

- A. Chemical Storage Tanks:
 - 1. Chemical storage tanks shall be double walled consisting of one cylindrical, closed top inner primary tank and one cylindrical, open top containment outer tank. Each tank is rotationally molded one-piece seamless construction.
 - 2. Tank assembly shall be designed to prevent rainwater and debris from entering the containment tank.
 - 3. Tanks shall be adequately vented per manufacturer's recommendations.
 - 4. Tanks shall be designed for above ground, vertical installation and shall be suitable for

continuous contact with Magnesium Hydroxide slurry.

5. Tanks shall be rotationally molded from High Density Cross-linked Polyethylene (XLPE). The tank material shall be suitable and compatible for the chemical being stored within.
6. Material shall be virgin polyethylene resin as compounded and certified by the manufacturer.
7. All polyethylene resin material shall contain a UV stabilizer as compounded by the resin manufacturer.
8. Chemical storage tanks shall be natural/translucent in color.
9. The finished tank surface shall be free from visual defects such as foreign inclusions, air bubbles, dry spots, pin holes, craters, delamination and cracking that will impair the serviceability of the tank.
10. The minimum required wall thickness for the cylinder straight shell shall be sufficient to support its own weight in an upright position without any external support.
11. Flat areas shall be provided for locating large fittings on cylinder straight shell.
12. Top head shall be integrally molded with cylinder shell. Minimum thickness of top head shall be equal to thickness of cylinder shell.
13. Bottom head shall be integrally molded with cylindrical wall. Knuckle radius shall be a minimum of 1-1/2-inches.

B. Chemical Storage Tank Connections:

1. General
 - a. Provide piping connections as shown on the Contract Drawings and as specified herein. Pipe shall conform to the requirements of Division 40 and applicable sections on chemical piping, pipe supports, fittings, valves and appurtenances.
2. Fittings
 - a. Fittings shall be as indicated in the tank schedule listed below.
 - b. Fittings shall be of the bulkhead type and constructed of PVC.
 - c. Fittings shall be supplied by tank manufacturer.
 - d. Bolted flange fittings shall be constructed of one Class 150 flange with ANSI bolt pattern, one flange gasket and stud bolts with gaskets.
 - e. All flanged fittings shall be provided with 1/4-inch thick Viton gaskets unless otherwise noted.
 - f. Stud bolts shall have chemical resistant polyethylene injection molded heads and gaskets to provide a sealing surface between the bolt head and the interior tank wall.
 - g. Stud bolt shall be color coded (Type 316 Stainless Steel - Green) for identifying the bolt material. All materials shall be compatible with the chemical service.
 - h. All edges associated with the fittings shall be trimmed smooth.
 - i. All materials shall be resistant to the chemical stored within.
 - j. Bottom fittings must be designed to maintain 110% secondary containment integrity. Bottom containment fitting must include PTFE expansion joint designed to accommodate movement of primary tank in design accordance with ASTM-D 1998 tolerances. All secondary containment fittings and parts shall be resistant to

chemical fume corrosion. Fitting shall include the option to connect a secondary containment pipe over primary pipe.

2.4 ACCESSORIES

A. Mixer

1. Top-entry type mixer designed to keep chemical in suspension as a completely mixed tank.
2. Shaft: 1.5-inch diameter, 104-inch length, Type 316 stainless-steel.
3. Motor: 1 HP maximum, TEFC, 115/208-230 V, single phase.
4. Impellers: dual impellers, 42-inch high efficiency impellers, low shear, Type 316 stainless-steel, bolt on blades.
5. Tank manufacturer to provide mixer mount connected to tank lifting lugs and support band.

B. Restraint System

1. Tanks shall be supplied with a restraint system and the design of the system shall be certified by a structural engineer registered in the state of tank installation. Design shall conform to the most recent edition of the IBC for seismic load.
2. Restraint system shall consist of tie-down lugs integrally molded into the top of the tank and tie-down cables. Tie-down lugs and cables shall be Type 316 stainless-steel.
3. Anchor bolts as required shall be Type 316 stainless steel, supplied by the tank manufacturer.

C. Down Pipes and Fill Pipes:

1. Down pipes and fill pipes shall be supported at 6-ft max intervals. Down pipes and fill pipes shall be PVC or material compatible with the chemical stored.

D. U-Vents:

1. Each tank must be vented for the material and flow and withdrawal rates expected. U-vents shall be sized by the tank manufacturer and be furnished complete with insect screen

E. Flexible Connections

1. Fittings on the lower 1/3 sidewall of tanks shall be equipped with 100% virgin PTFE expansion joints. Expansion joints to have a minimum of three convolutions, Type 316 stainless steel limit cables and FRP composite flanges and meet the following minimum performance requirements:
 - a. Axial Compression $\geq 0.67''$
 - b. Axial Extension $\geq 0.67''$
 - c. Lateral Deflection $\geq 0.51''$
 - d. Angular Deflection $\geq 14^\circ$
 - e. Torsional Rotation $\geq 4^\circ$

F. Baffles

1. Tank interior shall be provided with a modular polyethylene baffle system to enhance mixing and prevent vortex formation from mixing.
2. Baffles shall be located 90-degrees apart.

G. Markings:

1. Tank shall be provided with integrally molded volume markings or a factory installed calibration tape located on the exterior sidewall of the tank.
2. Calibration tape shall indicate multiples of gallons as indicated below.
 - a. Bulk Tank: Markings in 100-gallon increments

H. Tank Identification:

1. Tank shall be provided with a certification label stating the following:
 - a. Name of manufacturer.
 - b. Total capacity of tank.
 - c. Working capacity of tank.
 - d. Date of manufacture.
 - e. Name, concentration and specific gravity of stored chemical.
 - f. Tank identification/serial number as shown on the registration certificate.
2. Certification label shall be provided in accordance with the following:
 - a. Type: Stick-on type, made of all-purpose polyester, single character letters and numbers, chemical resistant
 - b. Color: Black letters and numbers on white background
 - c. Size: Letters and numbers shall be upper case, minimum of 1" in height

2.5 SOURCE QUALITY CONTROL**A. Factory Assembly and Testing**

1. Fabricate and assembly tank system components in the shop to the greatest extent possible to ensure proper assembly in the field.
2. Perform gel and low temperature impact tests in accordance with ASTM D 1998 on condition samples cut from each polyethylene chemical storage tank.
3. Degree of Crosslinking. Use Method C of ASTM D 1998, Section 11.4 to determine the fraction of cross-linked polyethylene gel test. Samples shall test at no less than 60 percent.
4. Hydrostatic test: Following fabrication, the tanks, including inlet and outlet fittings, shall be hydraulically tested with water by filling to the top sidewall for a minimum of one hour and inspected for leaks. Following successful testing, the tank shall be emptied and cleaned prior to shipment.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Contractor shall examine the conditions under which the Work is to be installed and shall notify the Engineer in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.
- B. Inspect tanks prior to installation. If damaged, notify Engineer and manufacturer at once.

- C. Do not install damaged tanks until repairs are made in accordance with the manufacturer's written instructions and approved by the Engineer.

3.2 INSTALLATION

- A. Tanks shall be installed in accordance with the configuration shown on the Contract Drawings and in accordance with the manufacturer's installation procedures.

3.3 MANUFACTURER'S FIELD SERVICES

- A. Engage the service of a qualified manufacturer's representative to assist in the installation, testing and startup of each tank included in this section. The duration of the service shall be as required to complete the successful startup of the tank.
- B. Field Testing:
 - 1. After installation is complete but before piping connections are made, the tank shall be filled to the bottom of the overflow with clean water and left full for a period of 24 hours before the tank is determined to be liquid tight. Should any leakage occur, repairs shall be made in accordance with the manufacturer's specifications and retested. Testing shall be witnessed by the Engineer and repeated until satisfactory performance is demonstrated.
 - 2. If clean water is not available for testing or for any reason it is necessary for the tank manufacturer to return to the site at a later date to perform this water test, the Contractor shall assume all costs incurred.
 - 3. Contractor shall be responsible for all costs should any damage occur to the tank due to delay of water testing.

3.4 CLEANING

- A. After installation is complete and connections made, ensure tank and nozzles are clean and free of dirt and debris. Clean and flush tank as necessary.

3.5 SCHEDULE

Item		Magnesium Hydroxide Storage Tank
Quantity		1
Material		XLPE
Style		Double wall, vertical, flat-bottom
Chemical Stored		Magnesium Hydroxide
Percent Solution		60%
Chemical Formula		Mg(OH) ₂
Nominal Capacity		4,400 gallons
Overall Height		10'-3"
Outside Diameter		10'-3"
Fill connection		
Size		2-inch
Location		Top/Dome
Outlet connection		
Size		2-inch
Location		Tank sidewall, bottom
Vent		
Size		6-inch
Location		Top/Dome
Access Manway		
Size		24-inch
Location		Top/Dome
Ultrasonic Level Sensor		
Size		6-inch
Location		Top/Dome
Level Float Nozzle		
Size		2-inch
Location		Top/Dome
Mixer Shaft Entry		As required per mixer manufacturer

END OF SECTION

SECTION 46 21 16
FLEXIBLE RAKE BAR SCREEN AND WASHER COMPACTOR

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes heavy duty, front-cleaning, front-return link driven mechanically cleaned bar screen and washer compactors as shown on the Contract Drawings.
- B. A mechanical bar screen shall be provided in the influent channel within the Crotonville Pumping Station as shown on the Contract Drawings.

1.2 REFERENCES

- A. Comply with the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American Society for Testing and Materials (ASTM)
 - 2. American National Standards Institute (ANSI)
 - 3. American Bearing Manufacturer's Association Standards (ABMA)
 - 4. American Gear Manufacturer's Association Standards (AGMA)
 - 5. National Electrical Manufacturers Association (NEMA)
 - 6. National Electric Code (NEC)
 - 7. American Iron and Steel Institute (AISI)
 - 8. American Welding Society (AWS)
 - 9. American Institute of Steel Construction (AISC)
 - 10. Underwriters Laboratory (UL)

1.3 COORDINATION REQUIREMENTS

- A. Coordinate layout and installation of mechanically cleaned bar screens with electrical equipment.

1.4 SUBMITTALS

- A. Submit the following in accordance with the General Conditions and General Requirements.
- B. Product Data: "Catalog cuts" and specification sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data.
 - 1. Sizing and headloss calculations shall be included.
 - 2. Detailed motor and drive data.
- C. Shop Drawings:
 - 1. Detailed plans, elevations sections, and details indicating the dimensions, materials of construction, size and weight of equipment, locations of anchor bolts, and location of connections to other work. Catalog cuts are not acceptable for shop drawings.

2. Wiring diagrams, single-line diagrams and control diagrams detailing connections of power, field mounted devices, control schematics, and SCADA interfaces.
 3. Control panel drawings showing dimensions, component locations, wiring and nameplate titles.
 4. Control narrative describing equipment operation and function of controls.
- D. Certificates:
1. Manufacturer's certification that all materials furnished comply with the applicable requirements of the reference standards and this Specification
 2. Certification of motor submergence test.
- E. Manufacturer's storage requirements and installation instructions.
- F. Suggested spare parts and special tools list and current price information.
- G. Closeout Submittals
1. Operation and Maintenance Data: Provide copies of the manufacturer' operation and maintenance manuals in accordance with Section 01 78 23 entitled, "Operations and Maintenance Data."
 2. Warranty Documentation: Provide a copy of the manufacturer's warranty.
 3. Provide a copy of the manufacturer's certificate of proper installation.

1.5 QUALITY ASSURANCE

- A. Qualifications:
1. The manufacturer of the equipment specified herein shall be regularly engaged in the design and manufacture of the type of screening equipment described herein for at least five years. Manufacturer's experience shall include at least 25 installations of the specified type of mechanically cleaned bar screen equipment that have been in successful operation for at least 5 years. Installation list shall include the following:
 - a. Facility's name and location
 - b. Facility's average daily and peak flows
 - c. Name of person(s) to contact
 - d. Phone number
 - e. Brief description of system
 - f. Installation date
 2. It is the sole responsibility of the Contractor to provide the information necessary for the Engineer to contact these references.
 3. All equipment in this Section shall be supplied by a single manufacturer who shall be responsible for the proper application, engineering, testing, operation and start-up of the equipment as specified herein. Mechanical bar screening system shall be fabricated, assembled, erected and placed in proper operating condition in full conformity with the drawings, specifications, engineering data, instructions and recommendations of the equipment manufacturer.
 4. Mechanically cleaned bar screens shall be fully assembled and shop tested at the manufacturing facility prior to shipment. Shop testing shall include a minimum of 4 hours of run time. The contractor, the engineer, the owner or the owner's designated

representative reserves the right to witness the shop test. A minimum three (3) week notice shall be provided prior to the test to allow for travel coordination.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Materials and equipment shall be boxed, crated or otherwise completely enclosed and protected from corrosion and deterioration during shipment, handling, and storage. Such boxes, crates or protection shall be clearly labeled with manufacturer's name, brand or model designation, type or grade, and color. Machined surfaces shall be flushed with heavy, noncorrosive oil, and gears and bearings shall be lubricated.
- B. Protect materials and equipment from exposure to the elements and keep dry at all times. Unload, handle and store materials and equipment in accordance with the manufacturer's recommendations.
- C. Materials and equipment damaged by handling and storage operations shall be repaired or replaced by the Contractor as directed by the Engineer, at no additional cost to the Owner.
- D. Protect steel, packaged materials and electronics from corrosion and deterioration.
- E. Before dismantling the mechanical bar screening system for shipment, all wiring and mechanical connections shall be match-marked or tagged to ensure proper field assembly.

1.7 WARRANTY

- A. Mechanical bar screening system, including washer compactor, motors, control equipment and appurtenances shall have a one-year warranty against defects in workmanship and/or materials. Warranty period shall commence upon final acceptance and approval by the Engineer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The following manufacturers are named to establish a standard of quality necessary for the Project:
 - 1. Duperon Corporation
 - 2. Or equal
- B. The Contract Documents depict equipment and materials manufactured by Duperon Corporation. It is not intended however, to eliminate other products of equal quality and performance.
- C. If any other manufacturer listed in this Section, or substitution is proposed by the Contractor for the Work covered in this Section, it shall be the responsibility of the Contractor to perform any required redesign and coordination associated with, but not limited to, mechanical equipment layout, electrical wiring, conduit and controls, and structural/architectural work, at no additional cost to the Owner.
- D. No substitution will be allowed without prior approval by the Engineer.

2.2 GENERAL

- A. All mechanically cleaned bar screen components and ancillary equipment shall be supplied as a complete package from the manufacturer, who shall be responsible for proper operation of the coordinated system.
- B. All components of like size and type shall be the product of the same manufacturer for purposes of parts interchangeability.
- C. A stainless-steel channel bottom plate shall be an integral part of the bar screen assembly to fully engage scrapers in the bar screen at the base of the unit and assure that the raking mechanism reaches the bottom of the screen to prevent debris accumulation.
- D. Bar screen shall be front-cleaned by a traveling rake mechanism transported on a climbing carriage.
- E. All wetted materials and fasteners shall be Type 316/316L stainless steel, unless otherwise specified.
- F. All submerged stainless-steel members shall have a minimum thickness of 1/4-inch.
- G. All cast steel shall conform to ASTM Specification A27.
- H. All rotating parts, shall be fully enclosed or properly guarded in accordance with ANSI Standard B15.1.
- I. Greased fittings shall be standardized in accordance with this Section.

2.3 PERFORMANCE REQUIREMENTS

- A. Mechanical bar screen shall be designed in accordance with the following performance and configuration requirements:

Item	Requirement
Peak design capacity (total)	6.5 MGD
No. of units	1
Clear bar spacing	1-inch
Type	Flexible rake, full penetration
Channel width	2'-6"
Channel depth	3'-6"
Angle of incline	30 degrees from vertical
Operating floor height above channel invert	3'-6"
Discharge height above operating floor	3'-6"
Maximum headloss at peak flow (clean)	1.5-inches ±
Maximum headloss at peak flow (25% blinded)	2.5-inches ±
Materials of construction	Type 316 stainless steel

- B. Mechanically cleaned bar screen shall be designed so that there are no chains, sprockets, bearings, shafting, or other moving parts permanently below the maximum water surface in the channel. All maintenance to the mechanism shall be accomplished at the influent

channel floor level. Any screen which uses chain, chain links, chain parts, cog rails, or gear racks is not acceptable. Reversing of the drive shaft shall be allowed for emergency conditions only. In addition, the rake mechanism must be designed to be completely removable as one piece from the upstream side of the bar screen.

- C. Mechanically cleaned bar screen shall be designed to run continuously (24 hours/day), without an operator.
- D. Equipment shall have multiple scrapers on the bar screen at one time cleaning continuously from bottom to top, the entire width of the bar screen. The drive output shaft rotation shall be constant and in one direction in order to reduce maintenance and increase product life. Units which have single raking arms or that require cycle times shall not be allowed. Cleaning mechanisms that utilize shock absorbers, springs or other dampening or hydraulic actuations are unacceptable.
- E. Link system shall have jam evasion capability by flexing around and collecting large objects and surges of solids at peak loading times without overloading and shutting down the unit. The link system shall be such that it bends in one direction only which allows it to become its own lower sprocket and frame and shall have a 1,000 lb. lifting capacity.
- F. Designs employing the use of endless moving media or cables and hydraulic cylinders to remove debris from the channel and units utilizing proximity or limit switches for reverse cycles are not acceptable.

2.4 MATERIALS AND CONSTRUCTION

A. Bar Rack

- 1. Bars shall be Type 316L stainless steel and be rectangular shaped with minimum dimensions of 0.25-inch x 1.00-inch. Bars shall be individually replaceable without welding.
- 2. Bar spacing shall be 1-inch clear opening between bars.
- 3. Rack shall span the full width and depth of the channel.
- 4. Bar rack shall be designed to be anchored to the channel invert and sidewalls. Designs that mount the bar rack to the machine side frames are not acceptable.
- 5. Bar rack shall extend a minimum of 8 inches above the design maximum water level.
- 6. Structural calculations shall be submitted to verify that the bar rack will withstand a differential head of 3.5 feet.

B. Side Frames

- 1. Side frames shall be fabricated from Type 316 stainless steel bent plate with minimum of 3/16-inch cross section. Horizontal members shall be of stainless steel bent plate or stainless steel pipe. Support members and frame shall adequately support the required loads.
- 2. Side frames shall be designed such that they do not extend into the channel.
- 3. Side frames shall contain access plates to facilitate replacements of the drive shaft bearings without removal of the carriage assembly.
- 4. No part of the side frame shall be used as a tracking surface or to anchor the bar rack.
- 5. An access door shall be provided in each side frame for access to and to facilitate removal of the rake carriage.

C. Discharge Apron

1. Shall be a minimum of 11-gauge Type 316 stainless steel with stiffeners as required and extend from the top of the bar rack to the discharge point.
- D. Dead Plate
1. Shall be 1/4-inch thick Type 316 stainless steel, flat and true, span the entire width of the unit, and transition from bar screen to discharge point.
- E. Link Slides
1. Shall be provided per the manufacturer's standard design and shall be constructed of UV stable UHMW PE rollers and Type 316 stainless steel supports and components.
- F. Return guide/closeouts
1. Shall be Type 316 stainless steel and shall assure proper alignment of scrapers as they enter the bar screen and assure that there is no space wider than the clear opening between the bars to prevent passage of larger solids than allowed through the screen.
- G. Link system
1. Shall be stainless steel castings and have a minimum ultimate strength of 60,000 lbs. with a minimum cross section of 1.5 inches and weighing a minimum of 4.5 lbs. each.
 2. 316 stainless steel system includes 316 stainless steel retaining rings and 316 stainless steel pins.
- H. Scrapers
1. Scrapers shall be spaced 21 inches apart.
 2. Scrapers shall move at a speed no greater than 28 inches per minute at standard operating speed of 0.5 rpm allowing for approximately 1 debris discharge per minute.
 3. Scrapers shall be 1-inch thick, UV stable UHMW-PE, and shall fully penetrate the bar screen, cleaning all three sides of the bars as well as through to the cross members.
- I. Debris Blade
1. A Type 316 stainless steel and UV stable UHMW-PE debris blade assembly, which does not require a separate drive, shall be installed to assist in removing debris from the scraper on the bar screen unit.
- J. Limit Switches
1. Shall be rated for a Class I, Division 1, Group D environment, and prewired to a NEMA 7 junction box. Wiring shall be in accordance with applicable Division 26 Sections. The limit switches shall be as follows:
 - a. End of travel limit switch shall stop rake assembly to dewater prior to discharging.
 - b. Reverse motion limit switch shall stop rake assembly at top of screen when operated in reverse motion.
 - c. Overload limit switch shall cause screen overload alarm.
- K. Bearings
1. Shall be greased ball bearing type, non-self-aligning, sealed and lubricated and shall have a 24/7/365 L10 life of 20 years.
- L. Safety Guard
1. An expanded metal guard of Type 316 stainless steel, height as required per approved shop drawings, shall be provided to enclose the open screen sides of the screen channel

at the middle level operating floor. Method of attachment is the responsibility of the manufacturer.

2.5 WASHER COMPACTOR

A. General

1. Washer compactor shall have dual augers to provide positive displacement action. Augers shall be oriented on top of each other and rotate in opposing directions. Augers shall be intermeshed, with one left-hand and one right-hand lead. Augers shall be designed with a limited float on top of a strainer to allow for the accommodation of irregular debris.
2. Washer compactor shall have a wash water manifold integrated into the main housing. Two ports inside the unit shall emit a medium pressure stream. Wash water shall run continuously when the Washer Compactor is in motion. Equipment shall be capable of continuous operation (24 hours/day) without an operator. Filling and batching equipment shall not be acceptable.
3. Washer compactor shall be equipped with a self-regulating, active pressure zone designed to accept nonstandard wastewater debris. Washer Compactor shall have the ability to process variable volumes of debris and unprocessed raw sewage. Washer Compactor shall have the ability to run intermittently in conjunction with upstream equipment.
4. Washer compactor shall be capable of discharge compacted screenings vertically to a floor above the operating level as shown on the Contract Drawings.

B. Performance Requirements

1. Washer compactor shall be designed in accordance with the following performance and configuration requirements:

Item	Requirement
No. of units	1
Peak capacity (intermittent operation)	10 cf/hour
Average capacity (continuous operation)	6 cf/hour
Hopper height above operating floor	38-inches
Hopper length	43-inches
Discharge height above operating floor	20'-0"
Volume reduction (min.)	70%
Wash water usage	3 – 10 gal./min.
Wash water pressure (min.)	40 – 60 psi
Materials of construction	Type 316 stainless steel

C. Materials and Construction

1. Main Housing

- a. Main housing shall be constructed of 11-gauge Type 316 stainless-steel. Support and flange connections shall be 3/8 inch.
2. Hopper
 - a. Hopper shall be constructed of 11-gauge Type 316 stainless-steel.
3. Auger
 - a. Augers shall be of Type 316 stainless steel with 8-inch diameter flights, 3/8-inch-thick, with 4-inch flight pitch. Augers shall be coupled to a transmission at the drive end and be supported at the compaction end with UHMW plane bearings accommodating irregular debris. Auger shaft shall be a minimum 2-inch stainless steel schedule 40 pipe with 2-inch solid stainless-steel stub shaft.
4. Compaction Housing
 - a. Compaction housing shall be 1/4-inch Type 316 stainless-steel and shall house a spring and gate assembly providing resistance for compaction. Compaction housing shall contain the auger supports.
5. Discharge Chute
 - a. Discharge shall be constructed of a minimum 14-gauge Type 316 stainless-steel. Support and flange connections shall be 1/4-inch. Discharge chute shall be tapered outward toward the discharge end. A discharge extension shall be provided as required to ensure sufficient chute length to reach the discharge location shown on the Contract Drawings.
6. Water Supply
 - a. Water supply shall connect at a single point with a 1/2-inch NPT female connector. A NEMA 7/9 Explosion proof solenoid valve shall limit wash water flow to only when the washer compactor is running. Separate ball valves shall be provided to distribute flow to the washing and trough sprayer connections.
7. Strainer
 - a. A strainer shall be located beneath the lower auger to filter washed solids.
 - b. Strainer shall be removable via drain trough and pressed against the lower auger with spring pressure.
 - c. Strainer shall be self-cleaning through continuous, even contact with the lower auger. Strainers requiring auger-mounted brushes will not be accepted.
8. Drain Trough
 - a. A removable pan shall be provided beneath the main housing to collect wash water. Wash water shall be drained through a 3-inch NPT male drain port.
 - b. Drain trough shall be constructed of a minimum of 11-gauge Type 316 stainless steel.
9. Bagger
 - a. Bagger system attached to the discharge chute to collect compacted debris. Latch and bag holder shall be constructed of Type 316 stainless-steel.
 - b. Bags shall be a minimum 1.3 thick polyethylene.

2.6 MOTORS AND DRIVES

A. Mechanical Bar Screen Motor

1. Motor shall be 230-460 volts, 60 Hertz, 3 phase, AC induction type motor, inverter duty rated for Class I, Division 1, Group D hazardous areas and shall be in accordance with the Division 26 Section "Common Motor Requirements".
 2. Motor shall be closed coupled to the reducer, and shall have an efficiency not less than 88.5 percent.
 3. The motor shall be UL listed and designed for continuous operation.
 4. Motor shall have built in, normally closed, thermostat to protect from overheating that shall be field wired to corresponding terminal in control panel for redundant (ambient) overload protection.
 5. Motor shall have an EPNV enclosure, NEMA design B with a 56C frame size.
 6. Motor shall be 1/2 HP minimum.
 7. Speed Reduction Units
 - a. Shall be a double-reduction, cycloidal style.
 - b. Shall be capable of a 4/1 speed range with variable output speeds between 0.50 to 2.2 output RPMs (in high flow conditions).
 - c. Service factor rating of 1.25 based on design running load.
 - d. Rated for a maximum design output torque of 11,417-inch pounds and have a gear ratio of 809:1.
 - e. Shall comply with appropriate AGMA standards.
 8. Drive Head shall be located at the top of the mechanically cleaned bar screen.
 9. Drive Unit: Each mechanically cleaned bar screen unit shall operate independently and shall have its own drive unit and driven components.
 10. Drive Sprockets shall be Type 316 stainless steel.
 11. Drive Shaft shall be AISI 1018 steel
 12. Gearbox shall be shaft-mounted, right angle type and include spiral bevel gearing. The output shaft speed shall be controlled by a vector type inverter or per rake manufacturer's recommendation. It shall have at least a 1.52 or greater service factor based on machine torque requirements. The gearbox shall not be vented to the outside atmosphere. The gearbox shall be grease filled. Oil filled gearboxes are not allowed.
 13. Motor shall operate continuously in forward direction during normal operation, motor reversal and/or stopping during wiping operation is not acceptable.
- B. Washer Compactor Motor
1. Motor shall be 230-460 volts, 60 Hertz, 3 phase AC induction type motor, inverter duty rated for Class I, Division 1, Group D hazardous areas and shall be in accordance with the Division 26 Section "Common Motor Requirements".
 2. Motor shall be mounted to the gear reducer by use of a C-face mounting style quill.
 3. Motor shall be 3/4 HP maximum.
 4. Speed Reduction Unit
 - a. Gearbox shall be right angle type incorporating cycloidal and spiral bevel gearing.
 - b. Gear reducer output shaft speed shall be 0.5 RPM minimum to a maximum output of 2.2 RPM with an 809:1 reduction ratio with 18,900-inch pounds of output torque.
 - c. Gearbox shall not be vented to outside atmosphere.

- d. Gearbox shall be grease lubricated and designed for a minimum of 20,000 hours of operation between recommended cleaning and re-grease servicing.
- 5. Auger Transmission
 - a. Drive assembly shall be couple to a dual gear transmission driving the augers in a counter-rotation.
 - b. Spur gears shall be contained in a stainless-steel housing and supported by a plane bearing.
 - c. Grease fittings shall be located outside transmission housing to provide lubrication of gears.
- 6. Thrust bearings shall be self-lubricating, capable of withstanding a minimum thrust load of 2000-pounds at maximum speed output.
- 7. Screw supports shall be UHMW plane type, self-lubricating and fastened with stainless-steel fasteners.

2.7 CONTROLS

- A. Control logic shall be by the mechanically cleaned bar screen manufacturer. Equipment control system shall be by programmable logic controller located within the mechanical bar screen control panel. Controls shall include all devices as specified and as recommended by the screen manufacturer.
- B. Mechanical Bar Screen Control Panel
 - 1. Control panel for mechanically cleaned bar screen shall be installed as located on the Contract Drawings.
 - 2. Enclosure shall be NEMA 4X, floor mounted, free-standing type.
 - 3. Control panel shall have all operator interfaces mounted on exterior door to prevent operators from being exposed to live parts.
 - 4. Control panel shall include to the following:
 - a. Single point 480 volt, three phase, 60 Hertz input power connection with lockable main disconnect switch or circuit breaker. Overcurrent protective devices operating at 480 volts shall have a short circuit interrupting rating of 65,000 amps RMS symmetrical.
 - b. Variable frequency drive for screen motor
 - c. Control power transformer
 - d. Differential level control logic and adjustable timer logic for screen operation
 - e. Operator interface devices as shown on the Drawings and as recommended by the screen manufacturer.
 - f. Circuitry for local mounted emergency stops to shut down the screen in all modes of control.
 - g. Alarm Reset Pushbutton - Alarm shall be reset before operation can continue.
 - h. One set of contacts for connection to the SCADA system for each of the following conditions:
 - 1) Bar screen system fault - Motor overload based on starter overloads (shall cause screen to stop) and/or Mechanical Overload based on overload limit

switch (shall cause rake assembly to reverse and stop at top of screen). System fault contact shall also be actuated by channel high level or level sensor fail.

- 2) Bar screen on/off indication based on motor operation.
 - 3) Washer compactor system fault.
 - 4) Washer compactor on/off indication based on motor operation.
 - 5) Additional parameters as shown on the Contract Drawings.
 - i. Equipment shall be configured to automatically restart after a power failure upon resumption of normal power.
 - j. A true "on-line", line interactive, double inverting Uninterruptible Power Supply with true sine-wave output. The UPS shall be capable of powering 100% load for at least 15-minutes during power outages and power transfers to emergency power. The minimum size shall be 700VA. The UPS shall include a maintenance-bypass breaker to permit temporary operation while UPS is removed. The manufacturer shall be Liebert (GXT3 Series), APC, or Equivalent
- C. Ultrasonic Differential Level Control System
1. Provide control for activation of screen upon high differential level across the screen.
 2. Provide upstream and downstream level sensors and differential level transmitter. Sensors shall be suitable for Class I, Division 1, Group D hazardous areas.
 3. Coordinate instrument mounting requirements with field conditions and provide appropriate mounting brackets and hardware suitable for corrosive environment.
 4. Transmitter shall be installed in the mechanical bar screen control panel.
 5. For each control panel, the following features shall be provided:
 - a. 4-20 mA output signal representing differential level.
 - b. "Loss of echo" contact.
 - c. Two programmable contact closures.
 6. Manufacturer shall be Pulsar or approved equal.
- D. Provide a channel high level sensor and switch with control panel mounted relay and indicating light. Sensor shall be suitable for Class I, Division 1, Group D hazardous areas.
- E. Provide remote mounted local control stations located at the screen and washer compactor each including:
1. NEMA 7/9 enclosure with pushbutton and selector switch for Emergency Stop and Forward-Off-Jog Reverse.

2.8 SHOP FINISHES

A. Mechanical Bar Screen

1. All non-stainless bar screen components shall be coated in strict accordance with the paint manufacturer's specification. Surface Preparation shall be done in accordance with SSPC-SP-10 Near White. The three-part coating system shall be manufactured by Tnemec as follows: Prime Coat Series 90-97 Tnemec Zinc at 2.5-3.5 mils DFT, Intermediate Coat Series 27 F.C. Typoxy at 3.0-5.0 mils DFT, and Top Coat Series 1075U Endura-Shield II at 2.0-3.0 mils DFT. Standard color is 11SF Safety Blue. Material shall meet all state and federal VOC and other regulatory requirements.

B. Washer Compactor

1. All non-stainless washer compactor components shall be coated in strict accordance with the paint manufacturer's specification. Surface preparation shall be done in accordance with SSPC-SP-10 near White. The three-part coating system shall be manufactured by Tnemec as follows: Prime Coat Series 90-97 Tnemec Zinc at 2.5-3.5 mils DFT; Intermediate Coat Series Typoxy at 3.0-5.0 mils DFT; and Top Coat Series 1075U EnduraShield II at 2.0-3.0 mils DFT. Standard color is 11SF Safety Blue. Material shall meet all State and Federal VOC and other regulatory requirements.

2.9 SPARE PARTS

- A. Furnish the following spare parts for the specified equipment:
 1. Mechanical Bar Screen
 - a. (1) Drive clevis pin
 - b. (10) Snap rings
 - c. (4) Link clevis pins
 - d. (4) Hex head cap screw
 - e. (4) Scraper nut
 - f. (1) 3 oz. tube of Never Seez
 - g. (1) Snap ring tool
 - h. (1) 14 oz. tube of Shur Stick
 2. Washer Compactor
 - a. (2) Side screw supports
 - b. (2) Upper screw supports
 - c. (2) Lower screw supports
 - d. (24) 1/4 20 x 1.00 long flat head socket cap screws
 - e. (24) 1/4 flat SAE washers
 - f. (24) 1/4 20 Nylock nuts
 - g. (1) 1 oz. tube of Never-Seez
- B. Manufacturer shall provide one tube of multi-purpose grease which is equivalent to a 5-year supply of lubrication required for maintaining all bar screen components.
- C. Package spare parts in wooden boxes, labeled with the manufacturer's name, address and telephone number; local representative's name, address and telephone number; name of equipment the parts are for and list of parts contained therein.

PART 3 - EXECUTION

3.1 PREPARATION

- A. To minimize field erection and installation problems, the units shall be factory assembled to ensure good fit of all components.

3.2 INSTALLATION

- A. Install mechanically cleaned bar screen and ancillary equipment as shown on the Contract Drawings and in accordance with the manufacturer's installation instructions.
- B. Provide all programming, adjustments and calibration necessary for a fully functioning installation.
- C. All anchor bolts and nuts shall be Type 316 stainless steel.

3.3 FIELD QUALITY CONTROL

- A. Contractor shall satisfactorily perform both a preliminary field test and a final acceptance test on the bar screen and ancillary equipment. After the equipment has been installed, operated and initial adjustments have been made, a preliminary field test shall be performed. Preliminary test shall be performed without water in the channel and the bar screen equipment shall operate without excess noise, vibration, overheating, or overloading. A qualified manufacturer's representative shall supervise the test.
- B. After the preliminary field test has been performed satisfactorily and there is wastewater flow available, a final acceptance test shall be performed. Screenings from wastewater shall be allowed to accumulate until at least one-half of the submerged bar screen area is plugged with debris. Headloss will be measured by the manufacturer's representative at this condition. Bar screen and washer compactor shall then be started and operate effectively to remove, convey and discharge the screenings from the bar rack. Bar screen and washer compactor equipment shall operate during the final acceptance test for a minimum of two hours without excess noise, vibration, overheating, or overloading.

3.4 MANUFACTURER'S FIELD SERVICES

- A. Engage a factory-authorized service representative to perform the following inspections, checks, and supervision of testing:
 - 1. Inspect field-assembled components, equipment installation, and electrical connections for compliance with the manufacturer's installation recommendations and requirements.
 - 2. Set field-adjustable settings to the values recommended by the equipment manufacturer.
 - 3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and components.
 - 4. Perform start-up, performance testing, and equipment commissioning services.
 - 5. Prepare written report to record the following:
 - a. Inspections and checks carried out on site.
 - b. Test procedures used.
 - c. Test results that comply with requirements.
 - d. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
 - e. Certification of proper installation.

3.5 DEMONSTRATION AND TRAINING

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the equipment.

1. Train Owner's maintenance personnel for a minimum of 8 hours on procedures and schedules for energizing and de-energizing, troubleshooting, servicing, and maintaining equipment and schedules.
2. Review data in Operation and Maintenance manuals.
3. Schedule training with Owner, with at least fourteen (14) days advance notice.

3.6 PAINTING

- A. Perform field painting in accordance with the Section "Field Painting".

3.7 IDENTIFICATION

- A. Identify equipment as specified in Section "Identification for Process Piping".

END OF SECTION

SECTION 46 33 44 PERISTALTIC CHEMICAL FEED PUMPS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes chemical feed pumps, complete with pumps, motors, control equipment and appurtenances, preassembled, as shown on the Contract Drawings.

1.2 REFERENCES

- A. Comply with the following codes, standards and specifications, except where more stringent requirements have been specified herein:
 - 1. American Bearing Manufacturers Association, (ABMA).
 - 2. American Gear Manufacturers' Association (AGMA).
 - 3. American National Standards Institute (ANSI).
 - 4. American Society for Testing and Materials (ASTM).
 - 5. Institute of Electrical and Electronics Engineers (IEEE).
 - 6. National Electrical Code (NEC).
 - 7. National Sanitation Foundation (NSF).
 - 8. American Water Works Association (AWWA).
 - 9. National Electrical Manufacturers' Association (NEMA).

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Submit the following for approval:
 - a. Manufacturer's literature, specifications, chemical compatibility data and engineering data including: dimensions, materials of construction, sizes, weights, mounting details, fitting locations, and performance data
 - b. Assembly, installation and wiring diagrams
 - c. Instructions for handling, storing, and installing equipment
- B. Manufacturer Qualifications:
 - 1. When requested by the Engineer, provide a list showing five existing, similar installations for the chemical application, including name of facility, facility address, name and telephone number of contact person at listed facility, chemical being pumped and date of installation.
- C. Certificates:
 - 1. Manufacturer's certification that all materials furnished are in compliance with the applicable requirements of the referenced standards and this specification.
 - 2. Certificate of installation for the peristaltic chemical feed system.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

1. Manufacturer shall have a minimum of five years of experience in producing substantially similar equipment, and shall be able to show evidence of at least five similar installations for the chemical application in satisfactory operation for at least five years.

B. Component Supply and Compatibility:

1. Pumps, motors and appurtenances shall be supplied by a single pump manufacturer who shall be responsible for the proper application, engineering, testing, operation and start-up of the equipment as specified herein.
2. All pump components of like size and type shall be the product of the same manufacturer for purposes of parts interchangeability.
3. Materials and equipment shall be fully compatible with the specified chemical and service conditions, and shall be integrated into the overall assembly by the transfer pump manufacturer.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Delivery of material including unloading, storage and handling of the peristaltic chemical feed system shall be in accordance with the manufacturer's recommendation.
- B. Peristaltic chemical feed system shall be factory assembled and shipped as a complete system. Tubing shall be shipped separately for field installation and process line connection by Contractor.
- C. Pack all additional spare parts in containers bearing labels clearly designating contents and pieces of equipment for which intended.
- D. Contractor to inspect and inventory items upon delivery to site.
- E. During storage, materials and equipment shall be elevated above the ground using pallets, platforms or other supports.
- F. Protect steel, packaged materials, and electronics from corrosion and deterioration.

1.6 WARRANTY

- A. Peristaltic chemical feed pump motor and electronics shall be warranted for a period of five (5) years. Pumps and appurtenances shall have a two-year warranty against defects in workmanship and/or materials. Warranty period shall commence upon final acceptance and approval by the Engineer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The following manufacturers are named to establish a standard of quality necessary for the Project:
 1. Watson-Marlow, Inc. (Model 530)
 2. Blue-White Industries (M-Series)
 3. Or approval equal

- B. The Contract Documents depict equipment and materials manufactured by Watson-Marlow, Inc. It is not intended however, to eliminate other products of equal quality and performance. Contractor shall be responsible for making all resulting changes to the layout to accommodate other acceptable manufacturers.

2.2 SYSTEM DESCRIPTION

- A. Provide peristaltic chemical feed pumps, complete with pump head, flexible extruded tube and integral variable speed drive. Pumps shall be mounted on a pre-assembled skid with the appropriate equipment and accessories necessary for a complete and functional pump system.

2.3 GENERAL

- A. All chemical feed pumps shall be supplied as a complete package from the manufacturer, who shall be responsible for proper operation of the coordinated system.
- B. All components of like size and type shall be the product of the same manufacturer for purposes of parts interchangeability.
- C. All wetted surfaces of the pumps and appurtenances shall be suitable for continuous exposure to Magnesium Hydroxide.

2.4 PERFORMANCE REQUIREMENTS

- A. Design Criteria:

Chemical Service	Magnesium Hydroxide
Chemical Formula	Mg(OH) ₂
Chemical Concentration	60%
Specific Gravity	1.45
Liquid Temperature Range (°F)	40 to 100
Number of Pumps	2 (1 duty, 1 shelf spare)
Average Day Feed Rate, each (gal./hr.)	20
Maximum Discharge Pressure (psi)	30
Input Power Characteristics (volts/phase/hertz)	120/1/60
Tube Material	Marprene/Flex-A-Prene
Tube Bore	1/2-inch
Tube Wall Thickness	1/8-inch

2.5 MATERIALS OF CONSTRUCTION

- A. General
1. All wetted surfaces of the pumps and appurtenances shall be suitable for continuous exposure to Magnesium Hydroxide.
- B. Pump:
1. Pump head shall consist of a fixed track with a hinged or removable guard door or front cover and a roller rotor assembly.
 2. At all times, one roller shall be fully engaged with the tubing providing complete compression and preventing back flow or siphoning. A maximum of two rollers shall be

provided. Tube occlusion shall be factory set to accommodate the wall thickness of the tubing and shall not require adjustment.

3. Rotor shall be capable of rotating in either direction without damaging the pump or tubing. Pump shall be capable of operating in either direction at full rated pressure. Direction of rotation shall be visible.
 4. Pump shall have a method of containing leaks in the event of tube failure or contain an electronic liquid detection system that immediately shuts down the pump and outputs an alarm in the event of tube failure.
 5. Pump heads shall be rated for 24-hr continuous duty operation and be constructed of high corrosion/impact materials.
 6. Pumps shall be dry, self-priming with suction lift capability of 25 feet of water and capable of being run dry without damaging effects to the pump or tube.
 7. Pump shall be capable of accepting different diameter tubing.
 - a. Tubing shall be replaceable with no disassembly of pump head and without using special tools.
 - b. Rotor rotation shall be manual or operate at a maximum speed of 6 rpm during tube loading and replacement.
 8. Pump shall not require use of check valves or dynamic seals that would be in contact with the pumped fluid.
 9. Pump drive shall be completely contained within an integral enclosure. Enclosure finish shall provide long-term protection from environmental conditions. Unpainted enclosures are not acceptable.
 10. Each pump shall have a stainless-steel nameplate with the manufacturer's name, model, serial number, rating, range, speed, and other pertinent data.
 11. Equip rotor with a central handgrip hub and manually activated clutch to disengage the rotor from the drive for manual rotor rotation during tube loading. Clutch shall automatically reengage rotor to gearbox upon one complete revolution.
- C. Tubing:
1. During normal operation, the tubing's inner wall shall be the only surface in contact with the pumped fluid.
 2. Tubing shall be extruded from a material compatible with the pumped fluid.
 3. Tubing shall be replaceable without the use of tools or disassembly of the pump head.
 4. Fittings:
 - a. Tubing may be supplied with molded quick release connectors or M/NPT fittings.
 - b. Clear, flexible reinforced PVC tubing shall be installed between the pump fittings and the suction and discharge piping. For molded fittings, quick release connectors to NPT adapters shall be used to connect the pump fittings to the reinforced PVC tubing.
- D. Drive:
1. Pumps shall be driven by a direct current, variable speed motor with integral gearbox and tachometer feedback.
 2. Circuitry shall be microprocessor controlled with pulse width modulation, and with temperature and load compensation and protection.

3. Drive Speed: Infinitely variable to meet or exceed associated pump flow rate specified herein. Turn down ratio shall be a minimum of 10,000:1
4. Enclosure: NEMA 4X
5. Rating: Continuous 24-hour per day operation, 40 degrees C ambient temperature, maximum speed of 125 rpm.
6. Power Supply: 110/120-volt, single phase, 60 Hertz. Supply a minimum ten-foot length main power cord with standard 120-volt three-prong plug.
7. Housing: Pressure cast aluminum with exterior grade corrosion resistant polyester powder coat.
8. Mounting: Drive shall be self-supporting and shall not require anchoring.
9. Minimum requirements for operator interface functionality:
 - a. Backlit graphical liquid crystal display (LCD) capable of up to four lines of text to display pump speed, running status, flow rate, and programming instructions.
 - b. Keypad for start, stop, speed increment, speed decrement, forward/reverse direction, rapid prime, and programming.
 - c. Menu-driven, on-screen programming of manual or auto control, flow, and remote signal calibration, and general programming.
 - d. Programmable "Auto Restart" feature to resume pump status after power outage.
 - e. Programmable "Keypad Lock" to allow operator lockout of all keys except emergency start/stop.
 - f. Programmable "Maximum Speed" to allow operator to set maximum speed of pump.
10. Controls shall have manual override. Feed pumps shall be capable of automatic flow proportioned control. Provide interface for the following signals:
 - a. Analog Input: 4-20 mA speed command signal
 - b. Digital Input (dry contact closure): Pump direction, start/stop signals, and auto/manual mode control.
 - c. Digital Output (dry contact closure): Auto/manual status, stop/run status, forward/reverse status, general alarm status and leak detected status.
11. Factory-mount a leak sensor to the drain port of the pump head. Leak sensor shall shutdown the pump in the event of a detected leak.

2.6 APPURTENANCES

- A. Ball Valves:
 1. Ball valves shall be provided in accordance with Section 40 05 23.93 entitled "Misc. Valves, Traps & Accessories."
- B. Piping
 1. Piping shall be provided in accordance with Section 40 05 13 entitled "Process Piping Systems."
- C. Manufacturer Fabricated Skid and Enclosure
 1. Peristaltic chemical feed system including pumps, piping and appurtenances shall be arranged and secured to a fabricated polypropylene skid with back panel, unless otherwise approved by the Engineer.

2. Pump skid shall be equipped with all piping and appurtenances required for an operational pumping system with only field assembly of suction and discharge piping connections.
3. Skid shall be fabricated from a minimum ½" thick polypropylene sheet stock and be equipped with a 1" containment lip around the skid perimeter.
4. Skid shall be mounted within an enclosure as indicated on the Contract Drawings.

2.7 SPARE PARTS

- A. Furnish the following spare parts for the specified equipment:
 1. One complete peristaltic chemical feed pump for use as a shelf spare.
 2. Six (6) tubing assemblies.
- B. Spare parts shall be packed in sturdy containers with clear identification markings and shall be stored in a dry, warm location until transferred to the Owner at the completion of the project.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be in complete accordance with the manufacturer's instructions and the approved Shop Drawings.
- B. Contractor shall accurately set equipment in location, alignment and elevation.
- C. Piping connections shall be made in accordance with the Contract Documents.
- D. Piping and appurtenances shall be supported independently of the peristaltic chemical feed pumps.
- E. Prior to energizing electric motor drive equipment, rotate drive motor by an external source to demonstrate free operation of mechanical parts. Do not energize equipment until safety devices are installed, connected and functional.

3.2 MANUFACTURER'S FIELD SERVICES

- A. Engage the services of a qualified manufacturer's representative to assist in the installation, testing and startup of the peristaltic chemical feed system included in this section. The duration of the service shall be as required to complete the successful startup of the equipment.
- B. Conduct a running test for each pump in the presence of the Engineer to determine its ability to operate within the performance limits specified and to deliver its rated capacity. Equipment and controls shall be field tested in local and automatic mode. Testing in automatic mode shall be a minimum of 24 hours, continuous and uninterrupted. Contractor shall demonstrate that each part individually and all parts together function properly in the manner intended. All testing equipment and labor shall be by the Contractor.
- C. Perform initial testing using potable water to ensure the system operates as specified, prior to testing with the chemical service.
- D. Correct or replace all defective equipment revealed by or noted during field tests at no additional cost to the Owner and repeat field tests until specified results are acceptable to the Engineer.

- E. Prepare written report to record the following:
 - 1. Inspections and checks carried out on site.
 - 2. Test procedures used.
 - 3. Test results that comply with requirements.
 - 4. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

3.3 DEMONSTRATION AND TRAINING

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the equipment.
 - 1. Train Owner's maintenance personnel as described in Section "Demonstration and Training" for a minimum of 4 hours on procedures and schedules for energizing and de-energizing, troubleshooting, servicing, and maintaining equipment and schedules.
 - 2. Review data in Operation and Maintenance manuals.
 - 3. Schedule training with Owner, with at least fourteen days' notice.

3.4 IDENTIFICATION

- A. Identify peristaltic chemical feed pumps as specified in Section "Identification of Process Piping and Equipment".

END OF SECTION