

PROJECT MANUAL

L'DOR ASSISTED LIVING

WEST CLARKSTOWN ROAD
NEW CITY, NEW YORK 10956

OWNER:
FRIENDSHIP VENTURES, LLC

32 PINE TREE DRIVE
POUGHKEEPSIE, NEW YORK 12603

ARCHITECT:
HARRIS A. SANDERS, ARCHITECTS, P.C.

252 WASHINGTON AVENUE
ALBANY, NEW YORK 12210

REVISED BID SET
APRIL 12, 2021

L'Dor Assisted Living
West Clarkstown Road, New City, NY

PROJECT MANUAL
TABLE OF CONTENTS

GENERAL CONDITIONS

SUPPLEMENTAL GENERAL CONDITIONS

SPECIFICATIONS

DIVISION 1 - GENERAL REQUIREMENTS

010001	Basic Requirements
019113	General Commissioning Requirements

DIVISION 2 - SITEWORK

DIVISION 3 - CONCRETE

030000	Concrete
--------	----------

DIVISION 4 – MASONRY

041000	Mortar and Masonry Grout
042000	Unit Masonry System
042100	Stone Veneer

DIVISION 5 - METALS

055000	Metal Fabrications
--------	--------------------

DIVISION 6 - WOOD AND PLASTIC

061000	Rough Carpentry
061753	Plate Connected Wood Trusses
062023	Interior Finish Carpentry

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

071600	Basement and Elevator Pit Waterproofing
071900	Vapor and Air Barriers
072100	Building Insulation
073113	Asphalt Roof Shingles
074600	Siding and Related Trim
076200	Sheet Metal Flashing and Trim
078400	Firestopping
079200	Joint Sealers

DIVISION 8 - DOORS AND WINDOWS

081113	Steel Doors and Frames
081416	Wood Doors

L'Dor Assisted Living
West Clarkstown Road, New City, NY

084213	Aluminum Entrances
085313	Vinyl Windows
087100	Door Hardware
088000	Glazing

DIVISION 9 - FINISHES

092900	Gypsum Board Systems
095113	Suspended Acoustical Ceilings
096500	Resilient Flooring
096816	Carpet
099000	Painting

DIVISION 10 - SPECIALTIES

101005	Miscellaneous Specialties
102800	Toilet and Bath Accessories

DIVISION 11 - EQUIPMENT

113013	Residential Appliances
--------	------------------------

DIVISION 12 - FURNISHINGS

122416	Pleated Window Shades
--------	-----------------------

DIVISION 14 - CONVEYING SYSTEMS

142400	Hydraulic Elevator
--------	--------------------

DIVISION 21 – FIRE SUPPRESSION

210500	Basic Fire Suppression Requirements
210523	Valves
210553	Fire Protection Identification
211010	Piping Systems and Accessories
211300	Fire Suppressions sprinkler Systems

DIVISION 22 – PLUMBING

220500	Basic Plumbing Requirements
220523	Valves
220553	Plumbing Identification
220593	Adjusting and Balancing
220700	Insulation
221010	Piping Systems and Accessories
221020	Underground Piping and Accessories
221030	Pumps
223010	Equipment
223400	Water Heaters
224000	Plumbing Fixtures and Trim
224000.10	Supplemental to Fixture Schedule
227010	Natural Gas Systems

L'Dor Assisted Living
West Clarkstown Road, New City, NY

DIVISION 26 - ELECTRICAL

260500	Basic Electrical Requirements
260501	Basic Materials and Methods
260526	Grounding
262000	Electric Distribution
262713	Electric Service
263213	Power Generation – Generator, Automatic Transfer Switch and Accessories
265000	Lighting

DIVISION 27 – COMMUNICATIONS

270510	Communications General
272100	Local Area Network System

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

283102	Analog Addressable Fire Alarm System
--------	--------------------------------------

****END OF TABLE OF CONTENTS****

SECTION 010001

BASIC REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Summary of Work:
 - 1. Contract.
- B. Contract Considerations:
 - 1. Schedule of values.
 - 2. Applications for payment.
 - 3. Change procedures.
- C. Coordination and Meetings:
 - 1. Coordination.
 - 2. Field engineering.
 - 3. Cutting and patching.
 - 4. Meetings.
 - 5. Progress meetings.
 - 6. Examination.
 - 7. Preparation.
 - 8. Cutting and Patching.
- D. Submittals:
 - 1. Submittal procedures.
 - 2. Construction progress schedules.
 - 3. Proposed products list.
 - 4. Shop drawings.
 - 5. Product data.
 - 6. Samples.
 - 7. Manufacturers' installation instructions.
 - 8. Manufacturers' certificates.
- E. Quality Control:
 - 1. Quality assurance - control of installation.
 - 2. Tolerances.
 - 3. References.
 - 4. Special Inspections and testing laboratory services.
 - 5. Manufacturers' field services and reports.
- F. Construction Facilities and Temporary Controls:
 - 1. Temporary electricity.
 - 2. Temporary lighting for construction purposes.
 - 3. Temporary heat.
 - 4. Temporary ventilation.

5. Temporary water service.
6. Temporary sanitary facilities.
7. Barriers and fencing.
8. Water control.
9. Exterior enclosures.
10. Protection of installed work.
11. Security.
12. Maintenance of Traffic.
13. Parking.
14. Progress cleaning and waste removal.
15. Field offices and sheds.
16. Removal of utilities, facilities and controls.

G. Material and Equipment:

1. Products.
2. Transportation, handling, storage, and protection.
3. Products options.
4. Substitutions.
5. Kitchen Equipment

H. Starting of Systems:

1. Starting systems.
2. Demonstration and instructions.
3. Testing, adjusting and balancing.

I. Contract Closeout:

1. Contract closeout procedures.
2. Final cleaning.
3. Adjusting.
4. Project record documents.
5. Operation and maintenance data.
6. Spare parts and maintenance materials.
7. Warranties.

1.2 CONTRACT

- A. Contract Description: AIA Document A 121/CMc Standard Form of Agreement Between Owner and Construction Manager.

1.3 SCHEDULE OF VALUES

- A. Submit schedule on AIA Form G703 or equivalent.

1.4 APPLICATIONS FOR PAYMENT

- A. Submit five copies of each application on AIA Document G702 and G703.
- B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.
- C. Payment Period: 30 days.

1.5 CHANGE PROCEDURES

- A. Stipulated Sum/Price Change Order: Based on Proposal Request and Contractor's fixed price quotation.
- B. Change Order Forms: AIA G701.

1.6 COORDINATION

- A. Coordinate scheduling, submittals, and Work of the various sections of specifications to ensure efficient and orderly sequence of installation of interdependent construction elements.
- B. Verify utility requirement characteristics of operating equipment are compatible with building utilities.
- C. Coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable.
- D. In finished areas, conceal pipes, ducts, and wiring within the construction.

1.7 FIELD ENGINEERING

- A. Employ a Land Surveyor to locate a reference datum and protect survey control and reference points.
- B. Establish elevations, lines, and levels and certify that elevations and locations of the Work conform with the Contract Documents.
- C. Provide a final as-built survey.

1.8 PRE-CONSTRUCTION MEETINGS

- A. Architect will schedule a pre-construction meeting after Notice to Proceed for all affected parties.
- B. When required in individual specification section, convene a pre-installation meeting at Project site prior to commencing work of the section.

1.9 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the Work at weekly and/or bi-monthly intervals.
- B. Preside at meetings, record minutes, and distribute copies within four days to those affected by decisions made.

1.10 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.
- B. Verify that utility services are available, of the correct characteristics, and in the correct location.

1.11 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying new material or substance in contact or bond.

1.12 CUTTING AND PATCHING

- A. Employ a skilled and experienced installer to perform cutting and patching new Work; restore Work with new Products.
- B. Submit written request in advance of cutting or altering structural or building enclosure elements.
- C. Execute cutting, fitting, and patching including excavation and fill, to complete Work, and to:
 - 1. Fit the several parts together, to integrate with other Work.
 - 2. Uncover Work to install or correct ill-timed Work.
 - 3. Remove and replace defective and non-conforming Work.
 - 4. Remove samples of installed Work for testing.
 - 5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.
- D. Cut masonry and concrete materials using masonry saw or core drill. Restore Work with new Products in accordance with requirements of Contract Documents.
- E. Fit Work tight to adjacent elements. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.
- F. Fit Work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- G. Refinish surfaces to match adjacent finishes.

1.13 SUBMITTAL PROCEDURES

- A. Submittal form to identify Project, Contractor, Subcontractor or supplier; and pertinent Contract Document references.
- B. Apply Contractor's stamp, signed or initialed, certifying that review, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.
- C. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work.
- D. Revise and resubmit submittals as required; identify all changes made since previous submittal.

1.14 CONSTRUCTION PROGRESS SCHEDULES

- A. Submit initial progress schedule in duplicate within 15 days after date established in Notice to Proceed for Architect review.
- B. Submit revised schedules as required, identifying changes since previous version. Indicate estimated percentage of completion for each item of Work at each submission.
- C. Submit a horizontal bar chart with separate line for each major section of Work or operation, identifying first work day of each week.

1.15 PROPOSED PRODUCTS LIST

- A. Within 15 days after date of Notice to Proceed, submit list of major Products proposed for use, with name of manufacturer, trade name, and model number of each product.

1.16 SHOP DRAWINGS

- A. Shop Drawings for Review:
 - 1. Submitted to Architect for review for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

- B. Shop Drawings for Information:
 - 1. Submitted for the Architect's benefit as contract administrator or for the Owner.
 - 2. Reports of inappropriate or unacceptable work may be subject to action by the Architect or Owner.
- C. Shop Drawings For Project Close-out:
 - 1. Submitted for the Owner's benefit during and after project completion.

1.17 PRODUCT DATA

- A. Submit the number of copies which the Contractor requires, plus three copies which will be retained by the Architect.
- B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information unique to this project.

1.18 SAMPLES

- A. Submit samples to illustrate functional and aesthetic characteristics of the Product.
- B. Submit samples of finishes from the full range of manufacturers' standard colors, textures, and patterns for Architect's selection.

1.19 MANUFACTURER INSTALLATION INSTRUCTIONS

- A. When specified in individual specification sections, submit manufacturer printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, in quantities specified for Product Data.

1.20 MANUFACTURER CERTIFICATES

- A. When specified in individual specification sections, submit certifications by manufacturer to Architect, in quantities specified for Product Data.
- B. Indicate material or Product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

1.21 QUALITY ASSURANCE - CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions.
- C. Comply with specified standards as minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

1.22 TOLERANCES

- A. Monitor tolerance control of installed Products over suppliers, manufacturers, Products, site conditions, and workmanship, to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply fully with manufacturers' tolerances.

1.23 REFERENCES

- A. Conform to reference standard by date of issue current as of date of Contract Documents.
- B. Should specified reference standard conflict with Contract Documents, request clarification from Architect before proceeding.

1.24 SPECIAL INSPECTIONS & MATERIAL CERTIFICATIONS FOR STRUCTURAL SYSTEMS

- A. The Owner shall employ and pay for the services of an independent firm to perform special inspections as required in the 2020 Building Code of New York State.
- B. Service shall include but are not limited to geotechnical inspections, compaction test, concrete testing, and topsoil chemical composition test. Field Inspections of Welds, Bolted Connections and Periodic Wood Framing Inspections. The Owner and Architect shall receive copies of all test reports.
- C. The Contractor/ CM will coordinate scheduling of all Special Inspections.
- D. All deficient work will be corrected and re-tested.
- E. Material Certification

The Contractor shall submit Material Certifications for the following:

- 1. Foundation Reinforcing Steel
- 2. CMU Certification – ASTM C90, Grade N, Type I
- 3. Mortar Certification – ASTM C270, Type S
- 4. CMU Reinforcing Submittal
- 5. Structural Steel Manufacturer's Certification
- 6. Lumber Grade Certification
- 7. Floor Truss Shop Drawings

1.25 MANUFACTURERS' FIELD SERVICES AND REPORTS

- A. When specified in individual specification sections, require material or Product suppliers or manufacturers to provide qualified staff personnel to observe site conditions and to initiate instructions when necessary.
- B. Report observations and site decisions or instructions that are supplemental or contrary to manufacturers' written instructions.

1.26 TEMPORARY ELECTRICITY

- A. Cost: Contractor provide and pay for power service required from source. Provide power outlets for construction operations, branch wiring, distribution boxes, and flexible power cords as required.
- B. The existing facility may not be utilized.

1.27 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

- A. Provide and maintain temporary lighting for construction operations.
- B. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
- C. Permanent building lighting may be utilized during construction. Repair, clean, and replace lamps at end of construction.

1.28 TEMPORARY HEAT

- A. Provide heating devices and heat as needed to maintain specified conditions for construction operations.
- B. Contractor to pay cost of energy used.
- C. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.
- D. Maintain minimum ambient temperature of 55 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.
- E. Contractor to assure that the building shell be properly enclosed during temporary heat use.

1.29 TEMPORARY VENTILATION

- A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

1.30 TEMPORARY WATER SERVICE

- A. Provide, maintain and pay for suitable quality water service required. Connect to existing water source for construction operations.
- B. The existing facility may not be utilized.

1.31 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. New facilities may not be used.
- B. Maintain in clean and sanitary condition.

1.32 BARRIERS AND FENCING

- A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage.
- B. Construction: Contractor's option.

1.33 WATER CONTROL

- A. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- B. Provide erosion control.

1.34 EXTERIOR ENCLOSURES

- A. Provide temporary insulated weather tight closures to exterior openings to permit acceptable working conditions and protection of the Work.

1.35 PROTECTION OF INSTALLED WORK

- A. Protect installed Work and provide special protection where specified in individual specification sections.
- B. Prohibit traffic or storage upon waterproofed or roofed surfaces.

1.36 SECURITY

- A. Provide security and facilities to protect Work and Owner's operations from unauthorized entry, vandalism, or theft.

1.37 MAINTENANCE OF TRAFFIC

A. DESCRIPTION

1. Maintain vehicular and pedestrian traffic to protect the public from damage to person and property within the limits of and for the duration of the contract work.
2. Construct temporary pavements if required to maintain traffic.
3. Erect and maintain barricades and signs.
4. Provide competent flagmen.
5. Provide lights and flashers where required.
6. Control dust, dirt and other accumulations on roads.
7. Observe local traffic regulation and avoid use of the parking on West Burda Road. Alternate parking areas will be available.

B. REFERENCED STANDARDS, REQUIREMENTS

1. Comply with applicable provisions of New York State Department of Transportation Standard Specifications, January 2, 1985 (NYSDOT), Section 619 - Maintenance and Protection of Traffic.
2. Comply with New York State Department of Transportation Manual of Uniform Traffic Control Devices.

1.38 PROGRESS CLEANING AND WASTE REMOVAL

- A. Collect and maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

1.39 FIELD OFFICES AND SHEDS

- A. Office: Weather tight, with lighting, electrical outlets, heating and air conditioning and equipped with sturdy furniture and drawing display table.
- B. Provide space for Project meetings, with table and chairs to accommodate 12 persons.

1.40 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to Substantial Completion review.
- B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.
- C. Clean and repair damage caused by installation or use of temporary work.
- D. Restore existing facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

1.41 PRODUCTS

- A. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work, but does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work.
- B. Provide interchangeable components of the same manufacture for components being replaced.

1.42 TRANSPORTATION, HANDLING, STORAGE AND PROTECTION

- A. Transport, handle, store, and protect Products in accordance with manufacturer's instructions.

1.43 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Any Product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Products of manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

1.44 SUBSTITUTIONS

- A. Architect will consider requests for Substitutions only within 15 days after date established in Notice to Proceed.
- B. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.
- C. Submit three copies of request for Substitution for consideration. Limit each request to one proposed Substitution.

1.45 STARTING SYSTEMS

- A. Provide seven days notification prior to start-up of each item.
- B. Ensure that each piece of equipment or system is ready for operation.
- C. Execute start-up under supervision of responsible persons in accordance with manufacturers' instructions.
- D. Submit a written report that equipment or system has been properly installed and is functioning correctly.

1.46 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation and maintenance of Products to Owner's personnel two weeks prior to date of Substantial Completion.
- B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- C. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled times, at designated location.

1.47 TESTING, ADJUSTING, AND BALANCING

- A. Contractor will appoint and employ services of an independent firm to perform testing, adjusting, and balancing. This does not include "special inspection services" as noted previously.
- B. Reports will be submitted by the independent firm to the Architect indicating observations and results of tests and indicating compliance or non-compliance with specified requirements and with the requirements of the Contract Documents.
- C. Cooperate with independent firm; furnish assistance as requested.
- D. Re-testing required because of non-conformance to specified requirements will be charged to the Contractor.

1.48 CONTRACT CLOSEOUT PROCEDURES

- A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Architect's inspection. Contractor to correct deficiencies to satisfy requirements of contract document and NYS Department of Health.
- B. Submit final Application for Payment identifying total adjusted Contract Sum/Price, previous payments, and amount remaining due.

1.49 FINAL CLEANING

- A. Execute final cleaning (move-in quality) prior to final inspection.
- B. Clean interior and exterior surfaces exposed to view. Vacuum carpeted and soft surfaces.
- C. Clean debris from site, roofs gutters, downspouts, and drainage systems.
- D. Clean filters of operating equipment.
- E. Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.50 ADJUSTING

- A. Adjust operating Products and equipment to ensure smooth and unhindered operation.

1.51 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of Contract Documents to be utilized for record documents.
- B. Record actual revisions to the Work. Record information concurrent with construction progress.
- C. Specifications: Legibly mark and record at each Product section a description of actual Products installed.
- D. Record Documents and Shop Drawings: Legibly mark each item to record actual construction.
- E. Final As-Built Drawings
 - 1. Final submission of as-built drawings shall be submitted either printed on Mylar Sheets, or on bond paper suitable for permanent storage plus three copies of the documents on flash drive submitted in Adobe PDF format. A preliminary submission of the final drawings printed on bond paper may be submitted for review before producing the final as-built set. Drawing files submitted must comply with the following:
 - a. Include a generic text file that explains the contents of the disk and the format of the drawing files.
 - b. Saved in folders and with file names that correlate to the printed documents.
 - c. Saved in a format that matches the final version of the printed drawings. Provide only information relevant to each drawings and do not include extraneous information and details which are not included in the final documents.
 - d. Include the Certificate(s) of Occupancy in a separate file.
 - 2. Label all drawing sheets with an as-built title and final date. Any sheets with no changes are to have a statement added that no changes have been made from the original drawing sheet.
 - 3. Drawings shall consist of a reproduction of the complete contract drawings updated to reflect changes made during the construction of the project and with added information, as necessary, to explain aspects of the project in further detail than in the contract set.
 - a. Add details to the contract set of drawings issued during construction by the project architect for change orders and supplementary instructions.
 - b. Add sheets which include shop drawings, manufacture data, or details from product submissions issued during construction which explains this information in better

detail. (Boilers, schematics of controls, & piping are good examples of this).

- c. Update the drawing index to denote changes made by adding or deleting drawings from the original contract drawings.
 4. Ensure that special attention is given to explain locations, with dimensions, of buried utilities & structures, utility valves & shut-offs, electrical controls, and other maintenance devices.
 5. Drawings shall be submitted with a cover memo from the project architect stating that he/she has reviewed the set and is satisfied that the set is complete and that included information is well coordinated without inaccuracies or confusing duplications.
- E. Warranties must comply with the following:
6. All components and building systems to have a minimum of one year materials and labor warranty.
 7. All warranties and guarantees listed in the project specifications that have a warranty period greater than one year must be submitted at the project close out. The following items, although not entirely inclusive, must be submitted: roof; doors; door hardware and accessories; windows; flooring; specialties; mechanical system; electrical systems; and plumbing.
 8. Include a copy of each warranty, properly labeled by warranty section, in a separate warranty folder on the flash drive.
- F. Other Submissions:
- In addition to the above, provide copies of the following prior to project closeout at construction completion:
1. Final Certificate(s) of Occupancy
 2. Project Architect's Certificate of Substantial Completion (AIA G704)
 3. Contractor's final application for payment (AIA G703/703) certified by project Architect
 4. Project Architect's Certification in accordance with Appendix C
 5. Contractor's Affidavit of Release of Liens (AIA G706A)
 6. Contractor's Affidavit Payment of Debts and Claims (AIA G706)
 7. Final summary report by the energy consultant
 8. Certification from the energy efficiency program, if applicable
 9. Final summary report by the green building consultant, if applicable
 10. Certification from the green building program, if applicable
- G. Building Systems
- Contractor to record and provide videos of training sessions for HVAC and other building systems for the use of building maintenance staff.

END OF SECTION

SECTION 019113 - GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 OVERVIEW

- A. This section of the specification describes the process for commissioning and defines the responsibilities of the commissioning agent, the contractors, and outlines the duties of other members of the commissioning team.
- B. The commissioning process shall be applied to all equipment, components, and systems as listed in this section, including specific interfaces to and from equipment and systems provided under separate contracts.
- C. Building Commissioning work is a joint team effort to ensure that all systems function together properly to meet the design intent, and to document system performance parameters for fine-tuning of control sequences and operations procedures. The commissioning process shall encompass and coordinate the traditionally separate functions of system documentation, equipment start-up, control system calibration, testing and balancing, training, and performance testing. This section does not supersede other requirements of the specifications. It may, though, expand on some of them.

1.2 COMMISSIONING AGENT

- A. The Commissioning Agent (CA) will be an independent 3rd party engaged by the General Contractor.

1.3 STANDARD AND CODE COMPLIANCE

- A. Commissioning will be accomplished to comply with, and in accordance with the requirements of the following:
 - 1. 2020 Energy Conservation Construction Code of New York State, Section C408 System Commissioning.

1.4 THE COMMISSIONING TEAM

- A. The commissioning team shall consist of:
 - 1. Commissioning Agent (CA).
 - 2. HVAC Contractor (HC).
 - 3. Plumbing Contractor (PC).
 - 4. Electrical Contractor (EC).
 - 5. General Contractor (GC).
 - 6. Fire Protection Contractor (FPC).

7. All appropriate Contractors and Sub-Contractors including but not limited to; temperature controls, sheet metal, testing and balancing, fire alarm fire protection and elevator installer.
8. Approved Representatives of Mechanical, Electrical and Equipment Manufacturers.
9. Design Engineers (DE).
10. Design Architect (ARCH).
11. Facility Staff (FS).
12. Owner's Representative (OR).

1.5 COORDINATION

- A. Project Commissioning Team - The members of the Project Commissioning Team shall consist of the Commissioning Authority and any support personnel, the Owner's facility staff (FS) or designee, the HVAC Contractor, Electrical Contractor, Plumbing Contractor, Fire Alarm Contractor, Fire Protection Contractor, General Contractor, Elevator Vendor, or additional vendors as required, the Architect/Engineer (A/E) and Owner's Representative (OR).
- B. Management - The CA coordinates the commissioning activities through the Owner's Representative (OR). All members shall work together to fulfill their contracted responsibilities and meet the objectives of the contract documents. Refer to Paragraph 1.6 for additional management details.
- C. Scheduling - The CA, through the OR, will provide sufficient notice to the Contractors for scheduling commissioning activities with respect to the Owner's participation. The Contractors will integrate all commissioning activities into the overall project schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.

1.6 COMMISSIONING PLAN

- A. The CA will develop the Commissioning Plan which shall be included in the project schedule when approved by the Owner.
- B. The Commissioning Plan shall contain the information necessary to document the commissioning process as it progresses from pre-start checks, to start-up and initial operation, and finally to functional performance verification of all systems.
- C. The Commissioning Plan shall also contain a schedule of commissioning work, integrated with the overall project schedule. This schedule shall show:
 1. Completion dates for each system or systems in each area of the building.
 2. Dates for controls installation completion and point checkout.

3. Dates for carrying out Steps 1 and 2 commissioning work for each system or group of systems.
 4. Submission dates for the documentation required by the Engineer prior to Step 3 verification.
 5. Dates for carrying out Step 3 commissioning work.
- D. The following narrative provides a brief overview of the commissioning tasks that shall be performed during construction and the general order in which they occur.
1. Commissioning during construction begins with an initial commissioning meeting conducted by the CA where the commissioning process is reviewed with the project commissioning team members.
 2. Additional meetings will be required throughout construction, scheduled by the CA, through the Owner or OR, with necessary parties attending to plan, scope, coordinate, schedule future activities and address issues.
 3. Equipment documentation is submitted to the CA, through the Owner, OR, Architect, during normal submittals, including detailed startup procedures.
 4. The prefunctional checklists, developed by the CA are to be completed by the Contractor (or its Subcontractors), before and during the startup process.
 5. Prefunctional checklists, TAB and startup must be completed before performance testing.
 6. Items of non-compliance in material, installation, or setup shall be corrected at no expense to the Owner.
 7. The Contractor ensures that the Subcontractors' prefunctional checklists are executed and documented and that startup and initial checkout are performed. The CA verifies that the TAB, prefunctional checklists and startup were completed according to the approved plans. This includes the CA approving TAB, checklists and startup plans. This also includes witnessing startup of selected equipment. Any testing failure is to be corrected at no additional cost to the Owner, and a re-test is to be performed, observed, and documented.
 8. The CA develops and implements equipment and system functional test procedures. The forms and procedures are approved by the Owner and A/E.
 9. The performance tests are executed by the Contractor under the direction of the CA with the assistance of the facility staff. All documentation is by the CA.
 10. The CA provides the Commissioning Record.
 11. Commissioning is to be completed before substantial completion.

12. Deferred testing and/or seasonal verifications are to be conducted as specified or required.

1.7 COMMISSIONING RESPONSIBILITIES

A. Commissioning Agent:

1. Plan, organize, direct and implement the Commissioning Process as specified herein.
2. Prepare the Commissioning Plan and submit for review by the Owner and Architect.
3. Revise the Commissioning Plan as required during construction.
4. Chair commissioning meetings, prepare and distribute schedules and agendas for the meetings, and prepare and distribute minutes to all Commissioning Team members, whether or not they attended the meeting.
5. Write the prefunctional checklists, initial operation and functional test procedures and submit for review by the Owner. The test procedures and checklists should be designed to verify detailed aspects of the proper operation of all equipment items and overall system performance in accordance with the design intent of the systems.
6. Coordinate commissioning activities among all Contractors, sub-trades, and suppliers, and all related commissioning requirements in the various specifications for all contracts.
7. Carry out all required system readiness checks and document the results as the checks are done.
8. In cooperation with the Controls Subcontractor, ensure all control point checkouts are carried out and the results documented as the checks are done.
9. Observe or verify all start-ups and initial system operations tests and checks, which shall encompass all specified functional performance tests, ensuring the results are documented as the tests and checks are done.
10. Provide periodic site visits as required to observe system installation.
11. Maintain master issues log. Resolution to issues found shall be documented by installing contractor and submitted to CA.
12. At the direction of the Engineer, ensure equipment and systems are operated for functional performance verification purposes.
13. Ensure all required training and demonstrations are provided to the Owner's designated operating staff and that all Operations and Maintenance manuals are submitted, approved and provided to the Owner.

14. Develop a Final Commissioning Record.
15. Coordinate deferred/seasonal commissioning required.

B. Contractors:

1. Within four (4) weeks of the award of the contract, the HC, PC, GC, EC, FPC Contractors and relevant subcontractors shall submit the names of the Project Manager who will be the Commissioning Coordinator for this project, as well as the names, addresses, phone numbers and qualifications of Subcontractors' Representatives and factory trained Manufacturer's Representatives for all equipment and systems required to participate in the Commissioning Process as specified in this Section.
2. Each Contractor and all his sub-trades and suppliers, shall cooperate with the Commissioning Agent in carrying out the Commissioning Process. In this context, each Contractor shall:
 - a. Provide equipment and systems start-up as specified.
 - b. Operate equipment and systems as required for initial systems operations, and witness final functional performance tests as they are performed by the Commissioning Agent, including the on-site participation of approved factory trained Manufacturer's Representatives for equipment.
 - c. Attend commissioning meetings and attend to action items arising from them, as required to allow the Commissioning Process to proceed on schedule.
 - d. Provide instruction and demonstrations for the Owner's designated operating staff, in conjunction with the Commissioning Agent, in order to meet all specified training requirements in this regard.
 - e. The Contractors shall make any and all necessary corrections to systems, equipment, O & M manuals, as built drawings, and procedures as necessary to meet the design intent, contract documents, manufacturer's recommendations or performance requirements if errors are discovered during the Commissioning Process.
 - f. The Contractors shall supply all necessary documentation, such as shop drawings, submittal data, maintenance manuals, etc. required for equipment and systems, to the Commissioning Agent for preparation of the commissioning plan, checklists, and functional performance plans.
 - g. The Contractors shall provide the required names, addresses and qualifications of all specified Manufacturer's Representatives to participate in the Commissioning Process prior to the initial commissioning meeting.

- h. Subsequent installation and performance verifications, made necessary due to required corrections after initial verification, shall be at the respective Contractor's expense.
- i. Carry all commissioning related costs in contract bid price.
- j. Review all documentation provided by CA and provide comments, if required prior to on site commissioning activities.
- k. Engage, at Contractor's cost, any Manufacturer's Representatives required to complete start-up and commissioning activities.
- l. Include cost of all devices and special tools to complete commissioning activities.

C. Manufacturer's Representatives:

- 1. The factory trained and authorized Manufacturer's Representatives shall participate in the commissioning process as specified in this section and as indicated in the technical section of the specifications.
- 2. Each Manufacturer's Representative shall cooperate with the commissioning agent in carrying out the commissioning process. In this context, each Manufacturer's Representative shall:
 - a. Provide equipment start-up as specified.
 - b. On-site participation as required for initial equipment operations and witness final functional performance tests as they are performed by the commissioning agent.
 - c. Attend commissioning meetings, as applicable and attend to action items arising from them, as required to allow the commissioning process to proceed on schedule.
 - d. Provide instruction and demonstrations for the Owner's designated operating staff, as specified in conjunction with the commissioning agent, in order to meet all specified training requirements in this regard.
 - e. Make any and all necessary corrections to equipment, O&M manuals, as-built drawings and procedures as necessary to meet the design intent, contract documents or performance requirements if errors are discovered during the commissioning process.
 - f. Subsequent installation and performance verifications, made necessary due to required corrections after initial verification, shall be at the respective manufacturer's expense.

D. Design Engineers and Architects:

1. Provide "Basis of Design" documentation inclusive of design criteria for CA review.
2. The Design Engineers and Architect shall review the Commissioning Plan, commissioning checklists and functional performance test plans. They shall also participate, as appropriate, in on-site commissioning meetings.
3. During the functional performance phase of the Commissioning Process, the Design Engineers and Architects may be on site to review commissioning documentation, witness functional performance tests, and verify acceptable performance or to declare performance unacceptable, as required.
4. Provide design narrative information to CA as required.
5. Participate in deficiency resolution process of items identified during Commissioning Process.

E. Owner's Representative (User):

1. Provide "Owner's Project Requirements" documentation for CA review.
2. The Owner shall ensure the availability of operating staff for all scheduled training and demonstration sessions. This staff shall possess sufficient skills and knowledge to operate and maintain the installation following attendance at these sessions.
3. Attend commissioning meetings.
4. Sign off of all accepted functional test procedures.
5. Participate in seasonal/deferred testing.

1.8 DESCRIPTION OF WORK

A. The "Systems and Equipment" as referred to in this section of the specifications shall include, but not be limited to, subsystems and components of subsystems; as provided by various contracts as follows:

1. HVAC Systems
2. Domestic Hot Water Equipment
3. Daylight/Dimming Controls
4. Lighting System, Scheduled Lighting Controls and Occupancy Sensors
5. Fire Protection Systems
6. Fire Alarm Systems
7. Plumbing Fixtures and Controls
8. Elevator Controls

1.9 COMMISSIONING PROCESS

- A. The on-site commissioning process shall be organized and carried out in four (4) steps as follows:
 - 1. Step 1 - System readiness and start-up.
 - 2. Step 2 - Initial operation.
 - 3. Step 3 - Functional performance verification.
 - 4. Step 4 - Demonstration and instruction.
- B. Each step is applicable to each separate system and its components, as listed in Part 3, including all related controls and specified interfaces to other divisions and contracts.
- C. The Contractors shall review and verify the commissioning schedule and requirements for the interface between all trades in order to prevent delays in the Commissioning Process.
- D. In some systems, improper adjustments, misapplied equipment, and/or deficient performance under varying loads may result in additional work being required to commission the systems. This work shall be completed under the direction of the General Contractor with input from the Contractors, Equipment Supplier, and Commissioning Agent. Whereas all members shall have input and the opportunity to discuss, debate, and work out problems, the Design Architect or Engineer shall have final jurisdiction over any additional work done to achieve performance.
- E. Corrective work shall be completed in a timely fashion to permit the completion of the commissioning process. Experimentation to demonstrate system performance may be permitted. If the Commissioning Agent deems the experimentation work to be ineffective or untimely as it relates to the Commissioning Process, the Commissioning Agent shall notify the Owner, indicating the nature of the problem, expected steps to be taken, and suggestions for completion of activities. Costs incurred to solve the problems in an expeditious manner shall be the Contractor's responsibility.
- F. Seasonal commissioning is required under full load conditions during peak heating and peak cooling seasons, as well as part load conditions in the spring and fall. Simulations of peak load conditions may be implemented to allow for complete commissioning of the work.
- G. Systems that are not weather dependent shall be tested under full and partial load to the fullest extent possible.

1.10 STEP 1 - SYSTEMS READINESS AND START-UP

- A. Before starting any equipment or systems, the Contractors shall complete the system readiness or pre-start checks in the commissioning plan and the Commissioning Agent shall document the results. The following conditions and items shall be completed as applicable:
 - 1. Piping systems have been pressure tested as specified, found to be tight, with reports submitted.

2. Piping systems have been flushed and cleaned as specified, any required reports submitted, and then filled or charged as applicable.
 3. Equipment has been lubricated to specification.
 4. Air system cleaning is complete, and particulate filters have been installed.
 5. Vibration isolation has been installed to specification and adjusted.
 6. Equipment drives have been aligned.
 7. Electrical, water and fuel services have been installed and checked.
 8. Control point checkouts have been completed.
 9. Safety controls have been installed and operation checked.
 10. Major equipment start-up has been carried out by Manufacturer's Representative when specified and required startup reports completed and submitted.
- B. All checks shall be documented on the relevant checklists as they are carried out. Deficiencies or incomplete work shall be corrected and the checks repeated until the installation is ready for operation before proceeding to Step 2 of the process.

1.11 STEP 2 - INITIAL OPERATION

- A. In Step 2 of the Commissioning Process, the Contractors, with the Commissioning Agent verifying, complete the testing, balancing, and calibration of all components and systems. They also operate all systems through all specified modes of operation and test system responses to specified abnormal or emergency conditions.
- B. Work carried out during this step of commissioning shall include but not be limited to, the following:
1. Air systems balancing, including positioning of all balance dampers, adjustments to diffusers, registers and grilles.
 2. Hydronic systems balancing, including positioning of all balance valves.
 3. Correction of problems revealed during balancing, including changes to fan speeds or blade pitch as necessary.
 4. Setting up and calibrating all automatic temperature controls devices, including adjustments to control valves and damper actuators.
 5. Setting up or programming controls for accurate response and precise sequencing to meet specified performance.
 6. With Commissioning Agent verifying, the Balancing Contractor and Controls Contractor working together setting up airflows and controls calibrations for terminal units and airflow stations.

7. Ensuring final adjustments to vibration isolation are carried out as necessary.
- C. As was done in Step 1, all checks and tests shall be documented on the relevant checklists as they are carried out. Deficiencies or incomplete work shall be corrected, and the checks or tests repeated until correct installation and function has been confirmed and the installation is ready for engineering verification.

1.12 STEP 3 - FUNCTIONAL PERFORMANCE TEST AND VERIFICATION

- A. All equipment and systems shall be operated through the entire specified sequence of operations for witness and verifying acceptable operation, by the Commissioning Agent.
- B. During this step of commissioning, the following checks and test shall be required:
 1. Check the location and accessibility of all access panels.
 2. Operation of all control system devices, both sensors and actuators.
 3. Proper physical response of all controlled devices and components to setpoint changes or other relevant adjustments.
 4. Operation of randomly selected motorized dampers.
 5. Demonstration of acceptable noise and vibration levels from major equipment, under its full range of operational conditions.
 6. Operation of equipment and systems under every specified mode of operation and sequence of control.
 7. Once acceptable performance of systems has been verified, then verification of specified interfaces to/from equipment and systems provided under other divisions and contracts shall be performed.

1.13 STEP 4 - DEMONSTRATION AND INSTRUCTION

- A. The formal demonstration and instruction for operating staff shall commence once the Step 3 commissioning is complete and substantial completion achieved.
- B. Demonstration and instruction in accordance with the "Design Intent" shall cover all equipment and systems and their controls.

1.14 COMMISSIONING START-UP AND COMPLETION

- A. Commissioning of certain systems may be required to be performed during both heating and cooling seasons. Commissioning shall be performed at the earliest such time as possible after substantial completion of each system.

1.15 REFERENCES

- A. Systems commissioning shall be accomplished as specified and in accordance with the latest version of commissioning publications from one the following industry associations:
 - 1. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) Guideline 1.1, HVAC&R Technical Requirements for the Commissioning Process.
 - 2. Associated Air Balancing Council, Commissioning Reference Manual.
 - 3. Building Commissioning Association - The Building Commissioning Handbook.

1.16 DOCUMENTATION

- A. Each Contractor shall provide to the Commissioning Agent three (3) copies of the following items as soon as they become available:
 - 1. Certified and approved start-up and testing report forms for all subsystem equipment that comprise the System. Commissioning documentation shall include control schematics of the total system and all subsystems.
 - 2. Records of required inspections for code compliance, and documentation of approved permits and licenses to operate components of the System.
 - 3. Operating data which shall include all necessary instructions to the Owner's operating staff in order to operate the system to specified performance standards.
 - 4. Maintenance data which shall include all necessary information required to maintain all equipment in continuous operating condition, such as the testing, balancing and adjusting report and the as-built drawings.
 - 5. Written notice that building equipment and systems have been completed, tested and are fully operational.
 - 6. Checklist of all submitted contract deliverables such as; operation and maintenance manuals, spare parts, warranties, training, documentation, etc.

PART 2 - PRODUCTS

2.1 TESTING

- A. The Contractor shall provide any equipment or device required for access such as platforms, scaffolds, and spare filters as may be necessary for all verification and testing.
- B. All standard testing equipment required to perform startup and initial checkout and required performance testing shall be provided by the Contractor for the equipment being tested. This includes, but is not limited to, two-way radios, meters, and data recorders.

- C. Special equipment, tools, and instruments required for testing equipment according to these contract documents shall be included in the Contractor's base bid price and shall be turned over to the Owner at project close-out.
- D. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance within the tolerances specified in the specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration to NIST traceable standards within the past year to an accuracy of 0.5°F and a resolution of $\pm 0.1^\circ\text{F}$. Pressure sensors shall have an accuracy of $\pm 2.0\%$ of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

PART 3 - EXECUTION

3.1 GENERAL

- A. Each Contractor shall coordinate with the Commissioning Team in the construction phase of the project to assure compliance with all system commissioning requirements.

3.2 DESIGN CRITERIA AND INTENT

- A. Design criteria and intent shall be as described in the technical specification sections and contract drawings. The basis of design developed by the Architect and Engineer will be also referenced.

3.3 MEETINGS

- A. Initial Meeting:
 - 1. The CA, through the OR, will schedule, plan and conduct an initial commissioning meeting. The Contractors and their responsible parties are required to attend.
- B. Miscellaneous Meetings:
 - 1. Other meetings will be planned and conducted by the CA as construction progresses. These meetings will cover coordination, deficiency resolution, and planning issues. These meetings will be held to the extent possible following construction meetings to minimize additional travel for all parties.

3.4 STARTUP, CONSTRUCTION CHECKLISTS AND INITIAL CHECKOUT

- A. The following procedures apply to all equipment/systems to be commissioned.
- B. General: Prefunctional checklists are required to verify that the equipment and systems are fully connected and operational. It ensures that performance testing (in-depth system checkout) may proceed without unnecessary delays. The prefunctional checklists for a

given system must be successfully completed and approved prior to startup and formal performance testing of equipment or subsystems of the given system.

- C. **Startup and Checkout Plan:** The CA will assist the Project Commissioning Team members responsible for startup of any equipment. The primary role of the CA in this process is to ensure that there is written documentation that each of the manufacturer recommended procedures has been completed. The CA shall provide prefunctional checklists and startup shall be identified in the commissioning scoping meeting and on the checklist forms.
1. The prefunctional checklists will be developed by the CA and provided to the Contractors. These checklists indicate required procedures to be executed as part of startup and initial checkout of the systems and the party responsible for their execution.
 2. The Contractor shall determine which trade is responsible for executing and documenting each of the line item tasks and transmit the checklists to the responsible subcontractors. Each form may have more than one trade responsible for its execution.
 3. The Contractor/Subcontractor responsible for the purchase of the equipment shall develop the full startup plan by combining the manufacturer's detailed startup and checkout procedures and the prefunctional checklists.
 4. The Contractor/Subcontractor shall submit the full startup plan to the CA for review and approval.
 5. The CA will review and approve the procedures and the documentation format for reporting. The CA will return the procedures and the documentation format to the Contractor.
 6. The Contractor will transmit the full startup plan to the Subcontractors for their review and use.
- D. **Sensor and Actuator Calibration:** All field-installed temperature, relative humidity, CO, CO₂, refrigerant, O₂, and/or pressure sensors and gages, and all actuators (dampers and valves) on all equipment shall be calibrated. Verify that all locations are appropriate and away from causes of erratic operation. Submit to the CA the calibration methods and results. All test instruments shall have had a certified calibration within the last six (6) months to NIST traceable standards, and comply with all local, state and/or federal requirements/certifications, as required. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated. Provide bench testing as required at the direction of the CA.
1. **Sensor Calibration Methods:**
 - a. All Sensors - Verify that all sensor locations are appropriate and away from causes of erratic operation. Verify that sensors with shielded cable, are grounded only at one end. For sensor pairs that are used to determine a temperature or pressure difference, make sure they are

reading within 0.2°F of each other for temperature and within a tolerance equal to 2% of the reading, of each other, for pressure. Tolerances for critical applications may be tighter.

- b. Sensors without Transmitters - Standard Application. Make a reading with a calibrated test instrument within 6 in. of the site sensor. Verify that the sensor reading (via the permanent thermostat, gauge or building automation system (BAS)) is within the tolerances in the table below of the instrument-measured value. If not, install offset in BAS, calibrate or replace sensor.
- c. Sensors with Transmitters - Standard Application. Disconnect sensor. Connect a signal generator in place of sensor. Connect ammeter in series between transmitter and BAS control panel. Using manufacturer's resistance-temperature data, simulate minimum desired temperature. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the BAS. Record all values and recalibrate controller as necessary to conform with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction. Reconnect sensor. Make a reading with a calibrated test instrument within 6 in. of the site sensor. Verify that the sensor reading (via the permanent thermostat, gauge or building automation system (BAS)) is within the tolerances in the table below of the instrument-measured value. If not, replace sensor and repeat. For pressure sensors, perform a similar process with a suitable signal generator.

Tolerances, Standard Applications

Sensor	Required Tolerance (+/-)		Sensor	Required Tolerance (+/-)
Outside air, space air, duct air temps	0.4F		Flow rates, air	10% of design
Watthour, voltage & amperage	1% of design		Flow rates, water	4% of design
			Relative humidity	4% of design
			Oxygen or CO ₂ monitor	0.1% pts
			CO monitor	0.01 % pts
Pressures, air, water and gas	3% of design		Barometric pressure	0.1 in. of Hg

- d. Valve and Damper Stroke Setup and Check EMS Readout: For all valve and damper actuator positions checked, verify the actual position against the BAS readout. Set pumps or fans to normal operating mode. Command valve or damper closed, visually verify that valve or damper is closed and adjust output zero signal as required. Command valve or damper open, verify position is full open and adjust output signal as required. Command valve or damper to a few intermediate positions. If actual valve or damper position doesn't reasonably correspond, replace actuator or add pilot positioner (for pneumatics).

E. Execution of Construction Checklists and Startup:

1. Two (2) weeks prior to the scheduled start up, the Contractor shall coordinate startup and checkout with the Owner, A/E, OR, and CA. The execution and approval of the construction checklists, startup, and checkout shall be directed and performed by the Contractor, Subcontractor or Vendor. Signatures are required of the applicable Subcontractors for verification of completion of their work.
2. The Owner and facility personnel as necessary, shall observe, at minimum, the procedures for each piece of primary equipment, unless there are multiple units, in which case a sampling strategy may be used.
3. For lower-level components of equipment, (e.g., sensors, controllers), the CA shall observe a sampling of the startup procedures.
4. The Contractors, Subcontractors and Vendors shall execute startup and provide the CA with a signed and dated copy of the completed startup and construction checklists.
5. Only individuals employed by the Contractor (Technicians, Engineers, Tradesmen, Vendors, etc.) who have direct knowledge and witnessed that a line item task on the construction checklist was actually performed shall check off that item. It is not acceptable for non-witnessing onsite supervisors to fill out these forms.

F. Deficiencies, Non-Conformance, and Approval of Checklists and Startup (Master Issues Log):

1. The Contractor shall ensure that the Subcontractors clearly list any outstanding items of the initial startup and construction checklist procedures that were not completed successfully, on an attached sheet. The form and any outstanding deficiencies shall be provided, to the CA within two (2) days of test completion.
2. The CA will review the report and issue either a non-compliance report or an approval form, to the Contractor. The installing Contractors or Vendors shall correct all areas that are deficient or incomplete in the checklists and tests in a timely manner, shall notify the CA as soon as outstanding items have been corrected, and resubmit an updated startup report with a Statement of Correction on the original non-compliance report. When satisfactorily completed, the CA will recommend approval of the execution of the checklists and startup of each system.
3. Items left incomplete, which later cause deficiencies or delays during performance may result in backcharges to the Contractor.

3.5 FUNCTIONAL PERFORMANCE TESTING

- A. Requirements: The functional performance testing shall demonstrate that each system is operating according to the documented design intent and contract documents. Functional

performance testing facilitates bringing the systems from a state of individual substantial completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.

- B. Coordination and Scheduling: The Contractor shall provide sufficient notice, regarding their completion schedule for the construction checklists and startup of all equipment and systems to allow the performance testing to be scheduled. The CA shall oversee, witness, and document the performance all equipment and systems. The CA, in association with the Contractor/Subcontractors and Facility Staff, shall execute the tests. Performance testing shall be conducted after the construction checklists, and startup has been satisfactorily completed. The control system shall be sufficiently tested and approved by the CA before it is used to verify performance of other components or systems. The air balancing and water balancing shall be completed and approved before performance testing of air or water-related equipment or systems. Testing proceeds from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems shall be checked.
- C. Development of Test Procedures: Before test procedures are finalized, the Contractor shall provide to the A/E and the CA all requested documentation and a current list of changes affecting equipment or systems, including an updated points list, program code, control sequences, testing parameters, supplemental instructions, and addenda. Using the testing parameters and requirements in the technical specifications, the CA shall update/develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Each Contractor/Subcontractor or vendor, as appropriate, shall provide assistance to the CA in developing the final procedures. Prior to finalization, the A/E shall review and concur with the test procedure.
- D. Test Methods:
 - 1. Performance testing and verification may be achieved by manual testing or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by stand-alone data loggers. The CA may substitute specified methods or require an additional method to be executed other than what was specified, with the approval of the A/E. The CA will determine which method is most appropriate for tests that do not have a specified method.
 - 2. Simulated Conditions. Simulating conditions shall be allowed, though timing the testing to experience actual conditions is encouraged wherever practical.
 - 3. Overridden Values. Overriding sensor values to simulate a condition, such as overriding the outside air temperature reading in a control system to be something other than ambient is acceptable.
 - 4. Simulated Signals. Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overridden values.

5. Altering Sensors. Overriding sensor values and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable.
 6. Indirect Indicators. Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the test parameters, that the indirect readings through the control system represent actual conditions and responses.
 7. Setup. Each functional performance test shall be performed under conditions that simulate actual conditions as closely as is practically possible. The Contractor/Subcontractor(s) assisting the CA in executing the test shall provide all necessary materials, system modifications, etc., to produce the necessary flows, pressures, temperatures, etc., necessary to execute the test according to the specified conditions. At completion of the test, the Contractor/Subcontractor(s) shall return all affected equipment and systems to their approved operating settings.
- E. Problem Solving: The burden of responsibility to solve, correct, and retest malfunctions/failures is with the Contractor, with the CA providing suggestions.

3.6 DOCUMENTATION, NON-CONFORMANCE, AND APPROVAL OF TESTS

- A. Documentation: The CA shall witness and verify/pre-approve the documentation of the results of all performance tests. The CA shall complete all documentation for performance testing.
- B. Non-Conformance:
1. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CA. In such cases the deficiency and resolution will be documented on the procedure form or on an attached sheet. If the correction is made immediately, the item does not need to be added to the issues log.
 2. As tests progress and a deficiency is identified, the CA shall discuss the issue with the Commissioning Team and the Contractor.
 - a. When there is no dispute regarding the deficiency and the Contractor accepts responsibility to correct it:
 - 1) The CA will document the deficiency and the Contractor's response and intentions. After the day's work, the CA will enter the item into the issues log. The Contractor corrects the deficiency, signs the statement of correction at the bottom of the non-compliance form certifying that the equipment is ready to be retested and sends it back to the CA.
 - 2) The Contractor shall reschedule the test; and the test is repeated. The issues log is amended by the CA.

- b. If there is a dispute about a deficiency, regarding whether or not it is a deficiency:
 - 1) The dispute shall be documented on the non-compliance form with the Contractor's response.
 - 2) Resolutions are made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with the A/E.
 - 3) The CA documents the resolution process in the issues log.
 - 4) Once the interpretation and resolution have been decided, the contractor corrects the deficiency, signs the statement of correction on the non-compliance form and provides it to the CA. The contractor shall reschedule the test and the test is repeated until satisfactory performance is achieved.
 - 3. Cost for the CA to retest a functional performance test is borne by Contractor's.
 - 4. The Contractor shall submit in writing to the CA at least as often as commissioning meetings are being scheduled, the status of each outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreement and proposed resolutions.
 - a. The CA retains the original non-conformance forms until the end of the project.
 - b. Retesting shall not be considered a justified reason for a claim of delay or for a time extension by the Contractor.
- C. Failure Due to Manufacturer Defect: If 10% (or three (3), whichever is greater) of identical pieces of equipment fail to perform to the contract documents (mechanically or substantively) due to a manufacturing defect, not allowing it to meet its submitted performance specification, all identical units may be considered unacceptable. In such case, the Contractor shall provide the Owner with the following:
 - 1. Within one (1) week of notification from the Owner, the Contractor or Manufacturer's Representative shall examine all other identical units making a record of the findings. The findings shall be provided to the CA within two (2) weeks of the original notice.
 - 2. Within two (2) weeks of the original notification, the Contractor or Manufacturer shall provide a signed and dated, written explanation of the problem, cause of failures, etc., and all proposed solutions. The proposed solutions shall not significantly exceed the specification requirements of the original installation.
 - 3. The A/E will determine whether a replacement of all identical units or a repair is acceptable.

4. Two (2) examples, where applicable, of the proposed solution shall be installed by the Contractor and the A/E shall be allowed to test the installations for up to one (1) week, upon which the A/E will decide whether to accept the solution.
 5. Upon acceptance, the Contractor and/or Manufacturer shall replace or repair all identical items, at their expense. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts or material can be obtained.
- D. Approval: The CA notes each satisfactorily demonstrated function on the test form. Final acceptance of the functional performance test by the Owner is made after review by the CA, following recommendations by the A/E.

3.7 DEFERRED TESTING

- A. Unforeseen Deferred Tests: If any check or test cannot be completed due to the project completion level, weather conditions, or time of season, execution of checklists and functional performance testing may be delayed upon approval of the CA. These tests will be conducted in the same manner as the seasonal tests as soon as possible. Contractors will not be due any additional compensation.
- B. Seasonal Testing: During the warranty period, seasonal testing (tests delayed until weather conditions are closer to the system's design) shall be completed as part of this contract. The CA shall coordinate this activity through the Owner. Tests will be executed, documented by the CA and deficiencies should be corrected by the appropriate Contractor/Subcontractors with the CA witnessing. Any final adjustments to the O&M manuals and as-built's due to the testing shall be made by the Contractor.

3.8 COMMISSIONING RECORD

- A. The CA is responsible to compile, organize and index the following commissioning data, for all commissioned equipment into labeled, indexed and tabbed, three-ring binders and deliver it to the Owner.
 1. Commissioning Plan.
 2. System reports including available design narratives and criteria including sequences. Each system shall contain the startup plan and report, approvals, corrections, construction checklists, completed performance tests, trending and analysis, training plan and recommended recommissioning schedule.
 3. Complete issues log inclusive of all items and resolutions.
 4. Final Commissioning Report including an executive summary, list of participants and roles, brief building description, overview of commissioning and testing scope and a general description of testing and verification methods. For each piece of commissioned equipment, the report should contain the disposition of the Commissioning Authority regarding the adequacy of the equipment, documentation and training meeting the contract documents in the following areas:

- a. Equipment meeting the equipment specifications.
 - b. Equipment installation.
 - c. Performance and efficiency.
 - d. Equipment documentation and design intent.
 - e. Operator training.
5. All outstanding non-compliance items shall be specifically listed. Recommendations for improvement to equipment or operations, future actions, commissioning process changes, etc. shall also be listed. Each non-compliance issue shall be referenced to the specific performance test, inspection, trend log, etc. where the deficiency is documented. The performance and efficiency section for each piece of equipment shall include a brief description of the verification method used (manual testing, BAS trend logs, data loggers, etc.) and include observations and conclusions from the testing.

3.9 PRE-WARRANTY REVIEW

- A. CA will conduct a pre-warranty review of the project approximately ten (10) months following final completion of the project. CA will provide to the Owner a list of remedial items that are required to be addressed by Contractors prior to warranty expiration. Contractors, at their cost, will address all identified items in their respective trades within thirty (30) day of notification. Upon completion of work, Contractor will notify Owner, Commissioning Authority, and Design Architect/Engineer in writing.

END OF SECTION

SECTION 030000

CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Formwork, reinforcement, accessories, cast-in-place concrete, finishing and curing.

1.2 QUALITY ASSURANCE

- A. Construct and erect concrete formwork in accordance with ACI 301 and 347, unless specified otherwise in this Section.
- B. Perform concrete reinforcing work in accordance with ACI 301 and CRSI 63, 65 and Manual of Standard Practice, unless specified otherwise in this Section.
- C. Perform cast-in-place concrete work in accordance with ACI 301, unless specified otherwise in this Section.

PART 2 PRODUCTS

2.1 FORM MATERIALS

- A. Plywood: PS 1, C Grade Douglas Fir species; structural grade; sound, undamaged sheets with clean true edges.
- B. Lumber: Douglas Fir species; structural grade.
- C. Prefabricated Steel Type: Matched, tight fitting, stiffened to support weight of concrete.
- D. Pan Type: Steel; of size and profile required.
- E. Form Ties: Removable or Snap-off metal type of adjustable length, cone type.
- F. Waterstops: Purpose made rubber, 1 inch wide, maximum possible lengths, profiled as required; manufactured by Volclay or equal.
- G. Form Release Agent: Colorless mineral oil which will not stain concrete or impair natural bonding characteristics of coating intended for use on concrete.
- H. Formed Construction Joints for Slab-on-Grade: Galvanized steel, tongue and groove type profile, knockout holes to receive dowelling.
- I. Slab Edge Joint Filler: ASTM D1751, premolded asphaltic board, 1/2 inch thick.
- J. Vapor Barrier: Stego Wrap 15 mil Class A or equal
- K. Void Forms: Moisture resistant treated paper faces; biodegradable; structurally sufficient to

support weight of wet concrete mix until initial set; 2 inches thick.

2.2 REINFORCEMENT MATERIALS

- A. Reinforcing Steel: ASTM A615, 60 ksi yield grade; plain billet steel bars, plain finish.
- B. Welded Steel Wire Fabric: ASTM A185, plain type, in flat sheets, plain finish.
- C. Fibermesh: ASTM C1116/C equal to fibermesh 150-e3
- D. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for support of reinforcing.
- E. Fabricate concrete reinforcing in accordance with ACI 315.

2.3 CONCRETE MATERIALS

- A. Cement: ASTM C150, Normal-Type I Portland type.
- B. Fine and Coarse Aggregates: ASTM C33.
- C. Water: Clean and not detrimental to concrete.
- D. Air Entrainment Admixture: ASTM C260.
- E. Bonding Agent: Polymer resin emulsion.
- F. Non-shrink Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticising agents.

2.4 COMPOUNDS, HARDENERS AND SEALERS

- A. Chemical Hardener: Lapido-Lith manufactured by Sonneborn.
- B. Sealer: (Exposed Floors Only) Pitt-Loc manufactured by Sonneborn.

2.5 CONCRETE MIX

- A. Mix and deliver concrete in accordance with ASTM C94, Alternative 2.
- B. Provide concrete of the following strength at 28 days:
 - 1. Compressive Strength: 3000 psi, except for exterior horizontal concrete which shall be 4,000 psi.
 - 2. Slump: 3 to 4 inches.
- C. Select admixture proportions for normal weight concrete in accordance with ACI 301 Method 1.
- D. Design Mix
 - 1. FORMULA NAME: 3000# W/2S DESCRIPTION: #2 Stone Max
Slump 5" 5-7% Air

INGREDIENTS

AMOUNTS

CEMENT	488 lbs.
#2 STONE	885 lbs.
#1 STONE	1015 lbs.
FINE	1368 lbs.
COLD WATER	29 gals.
DARVAIR (air entrainment)	.500/100 lbs. cement
HYCOL (plasticizer, water reducer)	0.50 oz./100 lbs. cement
EXCELOORATOR	.00 oz./100 lbs. cement
DARATARD (retarder water reducer)	0.50 oz/100 lbs. cement

2. FORMULA NAME: 4000# W/2S DESCRIPTION: #2 Stone Max
Slump 5" 5-7% Air

<u>INGREDIENTS</u>	<u>AMOUNTS</u>
CEMENT	535 lbs.
#2 STONE	580 lbs.
#1 STONE	1100 lbs.
FINE	1533 lbs.
COLD WATER	31 gals.
DARVAIR (air entrainment)	.500/100 lbs. cement
HYCOL (plasticizer, water reducer)	0.50 oz./100 lbs. cement
EXCELOORATOR	.00 oz./100 lbs. cement
DARATARD (retarder water reducer)	0.50 oz/100 lbs. cement

PART 3 EXECUTION

3.1 FORMWORK ERECTION

- A. Erect formwork, shoring and bracing to achieve design requirements.
- B. Camber slabs and framing to achieve ACI 301 tolerances.
- C. Provide bracing to ensure stability of formwork.
- D. Apply form release agent to formwork in accordance with manufacturer's instructions, prior to placing for accessories and reinforcement.
- E. Do not apply form release agent where concrete surfaces will receive applied coverings which are effected by agent.
- F. Clean forms as erection proceeds, to remove foreign matter.

3.2 INSERTS, EMBEDDED COMPONENTS, AND OPENINGS

- A. Provide formed openings where required for work to be embedded in and passing through concrete members.
- B. Coordinate work of other Sections in forming and setting openings, recesses, chases, sleeves, bolts, anchors, and other inserts.
- C. Install concrete accessories straight, level, and plumb.

- D. Place formed construction joint device in floor slab pattern pouring sequence.
- E. Place joint filler at perimeter of floor slab.

3.3 REINFORCEMENT PLACEMENT

- A. Place reinforcement, supported and secured against displacement.
- B. Ensure reinforcing is clean, free of loose scale, dirt, or other foreign coatings.

3.4 PLACING CONCRETE

- A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Apply bonding agent in accordance with manufacturer's instructions.
- B. Install vapor barrier under interior slabs-on-grade. Lap joints minimum 6 inches and seal watertight. Repair damaged vapor barrier with vapor barrier material; lap over damaged areas minimum 6 inches and seal watertight.
- C. Separate slabs-on-grade from vertical surfaces with 1/2 inch thick joint filler, extended from bottom of slab to within 1/4 inch of finished slab surface.
- D. Place concrete continuously between predetermined expansion, control and construction joints. Do not break or interrupt successive pours such that cold joints occur.
- E. Screed floors, slabs-on-grade and concrete base for toppings level, maintaining surface flatness of maximum 1/8 inch in 10 ft.

3.5 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
- B. Remove form work progressively and in accordance with code requirements.

3.6 FLOOR FINISHING

- A. Finish concrete floor surfaces in accordance with ACI 301.
- B. Uniformly spread, screed, and float concrete.
- C. Wood float surfaces which will receive ceramic tile with full bed setting system.
- D. Steel trowel surfaces, which will receive carpeting, resilient flooring, seamless flooring, thin set ceramic tile or will be left exposed.
- E. Maintain surface flatness, with maximum variation of 1/8 inch in 10 ft.
- F. In areas with floor drains, maintain floor level at walls and pitch surfaces uniformly to drains.

- G. Apply concrete hardener on exposed floor surfaces. Apply in accordance with manufacturer's instructions.

3.7 CURING

- A. Apply sealer on floor surfaces in accordance with manufacturer's instructions.
- B. Immediately after placement, protect concrete from premature drying.
- C. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

3.8 CONCRETE FINISHING

- A. Provide concrete surfaces to be left exposed and concrete walls with smooth rubbed finish.

3.9 FIELD QUALITY CONTROL

- A. Inspection and testing will be performed by firm appointed in accordance with Section 01001.
- B. Three concrete test cylinders will be taken for every 75 cu yds of each class of concrete placed. At a minimum, three concrete test cylinders will be taken for each day's pour of each class of concrete placed.
- C. One additional test cylinder will be taken during cold weather concreting, and be cured on job site under same conditions as concrete it represents.
- D. One slump test will be taken for each set of test cylinders taken.

3.10 DEFECTIVE CONCRETE

- A. Modify or replace concrete not conforming to required lines, details and elevations, as directed by Architect.

END OF SECTION

SECTION 041000

MORTAR AND MASONRY GROUT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Mortar and grout for masonry.

1.2 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 530 and ACI 530.1.

1.3 ENVIRONMENTAL REQUIREMENTS

- A. Cold Weather Requirements: IMIAC - Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.
- B. Hot Weather Requirements: IMIAC - Recommended Practices and Guide Specifications for Hot Weather Masonry Construction.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Portland Cement: ASTM C150, Type I, gray color.
- B. Mortar Aggregate: ASTM C144, standard masonry type.
- C. Hydrated Lime: ASTM C207, Type S.
- D. Mortar Color: Mineral oxide pigment; color as selected.
- E. Grout Aggregate: ASTM C404.
- F. Water: Clean and potable.
- G. Bonding Agent: Latex Epoxy type.

2.2 MORTAR MIXES

- A. Mortar for Load Bearing Walls and Partitions: ASTM C270, Type S using the Property Method.
- B. Mortar for Non-load Bearing Walls and Partitions: ASTM C270, Type S using the Property Method.

- C. Mortar for Reinforced Masonry: ASTM C270, Type S using the Property Method.
- D. Pointing Mortar for Masonry: ASTM C270, Type N, using the Property Method; with maximum 2 percent ammonium stearate or calcium stearate per cement weight.
- E. Stain Resistant Pointing Mortar: One part Portland cement, 1/8 part hydrated lime, and two parts graded (80 mesh) aggregate, proportioned by volume. Add aluminum tristearate, calcium stearate, or ammonium stearate equal to 2 percent of Portland cement by weight.

2.3 MORTAR MIXING

- A. Thoroughly mix mortar ingredients in quantities needed for immediate use in accordance with ASTM C270.
- B. Add mortar color and admixtures in accordance with manufacturer's instructions.
- C. Do not use anti-freeze compounds to lower the freezing point of mortar.

2.4 GROUT MIXES

- A. Bond Beams, Lintels: 3,000 psi strength at 28 days; 8-10 inches slump; premixed type in accordance with ASTM C94, mixed in accordance with ASTM C476 Coarse grout.

2.5 GROUT MIXING

- A. Mix grout in accordance with ASTM C94.
- B. Do not use anti-freeze compounds to lower the freezing point of grout.

2.6 MIX TESTS

- A. Test mortar and grout in accordance with Section 01001.
- B. Testing of Mortar Mix: In accordance with ASTM C780.
- C. Testing of Grout Mix: In accordance with ASTM C1019.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install mortar and grout in accordance with manufacturer's instructions.
- B. Work grout into masonry cores and cavities to eliminate voids. Do not displace reinforcement.

END OF SECTION

SECTION 042000

UNIT MASONRY SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Concrete masonry, reinforcement, anchorage, and accessories.

1.2 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 530 and ACI 530.1.

1.3 ENVIRONMENTAL REQUIREMENTS

- A. Cold Weather Requirements: IMIAC - Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.
- B. Hot Weather Requirements: IMIAC - Recommended Practices and Guide Specifications for Hot Weather Masonry Construction.

PART 2 PRODUCTS

2.1 CONCRETE MASONRY UNITS

- A. Manufacturers:
 - 1. D'Agostino Building Blocks, Inc.
 - 2. Duke Concrete Products, Inc.
 - 3. Zappala Block Co., Inc.
- B. Hollow Load Bearing Block Units: ASTM C90, Grade N, Type I - Moisture Controlled; normal weight.
- C. Size and Shape: Nominal modular size of 8x8x16 inches. Provide special units for 90 degree corners.

2.2 REINFORCEMENT AND ANCHORAGE

- A. Single Wythe Joint Reinforcement: Truss type; steel wire, hot dip galvanized to ASTM A641 Class 3 after fabrication.
 - 1. Manufacturers:
 - a) Durowall
 - b) National Wire
 - c) Wire Bond
- B. Reinforcing Steel: ASTM A615, 60 ksi yield grade, deformed billet bars, uncoated finish.
- C. Wall Ties: Triangle tie 3/16 inch thick, adjustable, hot dip galvanized to ASTM A123 uncoated steel finish.

1. Manufacturers:
 - a) Durowall
 - b) National Wire
 - c) Wire Bond

2.3 MORTAR AND GROUT

- A. Mortar and Grout: As specified in Section 041000.

2.4 FLASHINGS

- A. Plastic Flashings: Sheet polyvinyl chloride.
- B. Lap Sealant: Butyl type as specified in Section 079200.

2.5 ACCESSORIES

- A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, heat fused joints.
 1. Manufacturers:
 - a) Durowall
 - b) Hohmann & Barnard
 - c) Wire Bond
 - d) National Wire
- B. Joint Filler: Closed cell polyethylene foam; oversized 50 percent to joint width; self expanding.
- C. Air Infiltration Barrier - See Section 071900
- D. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials, recommended by masonry unit manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify that field conditions are acceptable and are ready to receive Work.
- B. Coordinate placement of anchors supplied to other Sections.

3.2 COURSING

- A. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- B. Concrete Masonry Units:
 1. Bond: Running.
 2. Coursing: One unit and one mortar joint to equal 8 inches.
 3. Mortar Joints: Concave.

3.3 PLACING AND BONDING

- A. Isolate masonry partitions from vertical structural framing members with a control joint as

indicated.

- B. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.4 REINFORCEMENT AND ANCHORAGE - SINGLE WYTHE MASONRY

- A. Install horizontal joint reinforcement 16 inches oc. Place joint reinforcement continuous in first and second joint below top of walls.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
- C. Reinforce joint corners and intersections with anchors 16 inches oc.

3.5 MASONRY FLASHINGS

- A. Extend flashings horizontally at foundation walls, above ledge or shelf angles and lintels, under parapet caps, and at bottom of walls.
- B. Turn flashing up minimum 8 inches and bed into mortar joint of masonry.
- C. Lap end joints and seal watertight.
- D. Turn flashing, fold, and seal at corners, bends, and interruptions.

3.6 LINTELS

- A. Install loose steel, lintels over openings.
- B. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.
- C. Maintain minimum 8 inch bearing on each side of opening.

3.7 GROUTED COMPONENTS

- A. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
- B. Place and consolidate grout fill without displacing reinforcing.
- C. At bearing locations, fill masonry cores with grout for a minimum 12 inches either side of opening.

3.8 CONTROL AND EXPANSION JOINTS

- A. Do not continue horizontal joint reinforcement through control and expansion joints.
- B. Form control joint with a sheet building paper bond breaker fitted to one side of the hollow contour end of the block unit. Fill the resultant elliptical core with grout fill. Rake joint at

exposed unit faces for placement of backer rod and sealant.

- C. Size control joint in accordance with Section 079200 for sealant performance.
- D. Form expansion joint as detailed.

3.10 BUILT-IN WORK

- A. As work progresses, install built-in metal door and glazed frames, fabricated metal frames, window frames and other items to be built in the work furnished by other Sections.
- B. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.

3.11 TOLERANCES

- A. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
- B. Maximum Variation from Level Coursing: 1/8 inch in 3ft and 1/4 inch in 10ft; 1/2 inch in 30ft.

3.12 CUTTING AND FITTING

- A. Cut and fit for chases, pipes, conduit, sleeves, grounds. Coordinate with other sections of work to provide correct size, shape, and location.

3.13 CLEANING

- A. Remove excess mortar and mortar smears as work progresses.
- B. Clean soiled surfaces with cleaning solution.

END OF SECTION

SECTION 042100

STONE VENEER

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Cultured Stone Units, reinforcement, anchorage, and accessories.

1.2 SUBMITTALS

- A. Samples: Submit four samples of the cultured stone veneer to illustrate color, texture and extremes of color range.

1.3 QUALITY ASSURANCE

- A. Comply with BCNYS 2020.
- B. Comply with all applicable codes, regulations, and standards. Where provision of applicable codes, regulations, and standards conflict with requirements of this section, the more demanding shall govern.
- C. Manufacturer Qualifications:
 - 1. Obtain materials from one manufacturer to ensure compatibility.
 - 2. Obtain materials from company specializing in manufacturing products specified in this section with a minimum 5 years documented experience.

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Cold Weather Requirements: IMIAC - Recommended Practices and Guide Specifications
- B. Hot Weather Requirements: IMIAC - Recommended Practices and Guide Specifications

PART 2 PRODUCTS

2.1 THIN STONE VENEER

- A. Manufacturers: Equal to Stone Craft – 1 1/2" thick
- B. ASTM C 1088, Grade Exterior
- C. Modular Size and Shape: Nominal modular size .Provide special units for 90 degree corners.

2.2 REINFORCEMENT AND ANCHORAGE

- A. Support System: As per Manufacturer's Instructions for Application to Wood Studs. Related accessories including fasteners, thin tech shims, hardware, air vents, flashing and adhesive

2.3 MORTAR

- A. Mortar shall conform to ASTM C 1330 – Standard Specification for Preblended Dry Mortar Mix for Unit Masonry.

- 1. Type N or S

- B. Cold Weather Additives (including accelerators) shall not be used in mix.

2.4 FLASHINGS

- A. Plastic Flashings: Sheet polyvinyl chloride.
- B. Lap Sealant: Butyl type as specified in Section 07900.

2.5 ACCESSORIES

- A. Lath or Mesh in accordance with Manufacturer's Guidelines

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates and foundations as well as rough-in and built-in construction have been properly prepared.
 - 1. Walls must be structurally sound and the substrate system designed with wall deflection not greater than $L/360$.
- B. Verify substrate including, concrete, masonry or framing as well as sheathings, water resistant barriers are properly installed.
- C. If substrate, foundations or flashings are the responsibility of another installer, notify Architect and General Contractor of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation. All surfaces must be free of water, snow, dirt, mud, oil and other foreign materials prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install Eldorado Stone in accordance with manufacturers written installation instructions.
- B. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement joints, returns, and offsets.
 - 1. Avoid using less-than-half-size units, particularly at corners and jambs.

2. Ensure unfinished or cut faces are not exposed to view upon completion.

C. Select and arrange exposed veneer units to produce a uniform blend of color and texture.

1. Mix units from several pallets as they are placed.

3.4 CLEANING

A. In-Progress Cleaning: Clean units as work progresses by dry brushing to remove grout

B. Final Cleaning: After mortar is thoroughly set and cured, clean as follows:

1. Clean veneer units in accordance with manufacturer's written instructions.

2. Protect adjacent stone and non masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.

3. All cleaning practices and product used shall be in accordance with cleaning products manufacturer's written instructions.

END OF SECTION

SECTION 055000

METAL FABRICATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES, BUT IS NOT LIMITED TO:

- A. Elevator Pit Ladder
- B. Concrete inserts and fasteners.
- C. Structural Steel Lintels
- D. Elevator Shaft Hoist Beam
- E. Structural Columns and Beams

1.2 SUBMITTALS

- A. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
- B. Indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld lengths.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Steel Sections: ASTM A36.
- B. Steel Tubing: ASTM A500, Grade B. $F_y = 46$ ksi.
- C. Pipe: ASTM A53, Grade B.
- D. Sheet Steel: ASTM A446, Grade B Structural Quality with galvanized coating.
- E. Bolts, Nuts, and Washers: ASTM A325.
- F. Welding Materials: AWS D1.1.
- G. Touch-Up Primer for Galvanized Surfaces: FS TT-P-64S.

2.2 FABRICATION - GENERAL

- A. Fit and shop assemble in largest practical sections, for delivery to site.
- B. Continuously seal joined members by intermittent welds and plastic filler.

- 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: Flush countersunk screws or bolts, consistent with design of component.
- E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication.
- F. Accurately form components required for anchorage of stairs and landings and railings to each other and to building structure.

2.5 FINISHES

- A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- B. Shop prime items with one coat, two coats on surfaces inaccessible after erection. Do not prime surfaces in direct contact with concrete or where field welding is required.
- C. Exterior Steel Lintels Etc. to be galvanized to ASTM A123.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify that field conditions are acceptable and are ready to receive Work.
- B. Make provisions for erection loads with temporary bracing. Keep Work in alignment.
- C. Supply items required to be cast into concrete or embedded in masonry with setting templates, to appropriate Sections.

3.2 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Allow for erection loads and provide temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components as indicated. Perform field welding in accordance with AWS D1.1.
- D. Obtain Architect/Engineer approval prior to site cutting.
- E. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

END OF SECTION

SECTION 061000

ROUGH CARPENTRY

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Structural floor, wall, and roof framing; built-up structural members; wall and roof sheathing; subfloor sheathing; preservative treatment; sill gaskets.
- B. Blocking in wall and roof openings; wood furring and grounds; concealed wood blocking.

1.2 QUALITY ASSURANCE

- A. A Grade Mark or Trademark of an Agency certified by the Board of Review of the American Lumber Standards Committee is required on each piece of dimension and board lumber (or bundle in bundled stock).
- B. Softwoods: Conform to DOC Simplified Practice Recommendations R-16-53 "American Lumber Standards for Softwood Lumber", PS 20.
- C. Plywood: Conform to U.S. Product Standards PS-1.
- D. Moisture Content shall not exceed:
 - 1. 19% for lumber (S-Dry);
 - 2. 12% for plywood;
 - 3. 15% for blocking adjacent to finish millwork (MC15).
- E. Preservative Treatment to conform to AWPB standards LP-22.
- F. Work that is to be exposed, or finished or painted shall be free from defects or blemishes on surfaces that will be exposed to view.

PART 2 PRODUCTS

2.1 DIMENSION LUMBER

- A. Rough Lumber: Dressed four (4) sides (S4S), air or kiln dried and surfaced Dry (S-Dry), well seasoned, sound and free from splits, cracks, shakes and waness; loose or unsound knots, excessive warp, vermin and decay.
- B. Douglas Fir-Larch, HemFir, Southern Pine or other locally available species of not less than the following design values:

<u>Size</u>	<u>Grade</u>	<u>Fb</u>	<u>Fv</u>	<u>Fc</u>
1. 2" to 4" thick, 2" x 2" & wider	SPF No. 1/No.2	875	70	1100

2. Beams and lintels	SPF	875	70	1100
	No. 1/No.2			

2.2 GLUE LAMINATED GIRDERS AND HEADERS – MICROLLAMS & PARALLAMS

- A. 1 3/4" thick, Fb=2925 psi, E=2,000,000 psi or as noted on the Drawings
- B. Each glue lam shall be identified with the grading trademark of the American Institute of Timber Construction.

2.3 BOARDS

- A. Non-stress rated.
- B. 5/4 and 1 x: No. 3 common pine, fir, spruce.

2.4 TREATED LUMBER

- A. Treated lumber shall be used in all locations where the lumber comes in contact with concrete or other cementitious material.
- B. Southern Yellow Pine
 - 1. Conforming to requirements of dimension lumber and boards.
 - 2. CCA (soluble salt) pressure treated per AWPB standard LP-22 with 0.40 lbs/cf retention.

2.5 FURRING

- A. Merchantable Spruce, 1 x 3 or as indicated.

2.6 FLOOR AND ROOF SHEATHING

- A. Each panel of plywood shall be identified with grade-trademark of the American Plywood Association (APA).
- B. Grades and thicknesses shall be indicated on drawings and generally as follows:
 - 1. Type A: Floor Sheathing - Sub-floor
 - One Layer: Huber Advantech Sub-Flooring 25/32" thick Tongue and Groove edges glue screwed or power nailed to the joists/wood trusses.
 - 2. Type B: Roof Sheathing
 - Huber Advantech Roof Sheathing 5/8" Thick power nailed to Joists/Roof Trusses
 - 3. Type C: Sound Board – (All Wood Floors)
 - Homosote 440 Sound Barrier Flooring 1/2" thick
 - 4. Type D: Floor Underlayment – (All Wood Floors) 5.5 mm Underlayment board approved by the resilient flooring manufacturer and contractor equal to Ultraply Underlayment Manufactured by Moreland Company USA.

2.7 FURRING

- A. Merchantable Spruce, 1x3 or as indicated.

2.8 WALL SHEATHING

- A. Zip System Sheathing, 7/16" thick, with Zip System Tape at all seams.
- B. Each panel shall be identified with grade-trademark.
- C. Grades and thicknesses shall be indicated on Drawings and generally as follows:
Type A: Exterior Wall Sheathing – Zip Sheathing, 7/16" thick

2.9 ACCESSORIES

- A. Fasteners: Galvanized steel for exterior, high humidity, and treated wood locations, plain finish elsewhere.
- B. Die Stamped Connectors: Thickness as required, galvanized steel.
- C. Joist Hangers: Galvanized steel, sized to suit framing conditions.
- D. Anchors: Expansion shield and lag bolt type for anchorage to solid masonry or concrete.
- E. Hurricane Ties: Equal to Simpson H Series.
- F. Sill Gasket on Top of Foundation Wall: Plate width, closed cell foam or glass fiber strip.
- G. Sill Flashing (Under Sill Gasket): Polyethylene sheet.
- H. Subfloor Glue: APA AFG-01, water base, waterproof.
- I. Wall Sheathing Tape: Zip System Tape at all wall sheathing joints
- J. Roof Sheathing "H" Clips

PART 3 EXECUTION

3.1 FRAMING

- A. Erect wood framing members in accordance with applicable code. Place members level and plumb. Place horizontal members crown side up. Align regularly spaced first floor studs, floor trusses, second floor studs and roof trusses.
- B. Place sill gasket directly on foundation.
- C. Frame double joist headers at floor and ceiling openings. Frame rigidly into joists. Frame double joists under wall studding.
- D. Bridge joists framing in excess of 8 feet at mid-span members. Fit solid bridging at ends of members.

- E. Curb all roof openings except where curbs are provided. Construct curb members of single pieces per side.
- F. Install Hurricane Ties 2'-0" O.C. between:
 - 1. First Floor Ext. Studs & 2nd Fl. Framing.
 - 2. Second Floor Framing & 2nd Fl. Ext. Studs.

3.2 SHEATHING

- A. Install subfloor sheathing perpendicular to floor framing with end joints staggered. Secure sheet edges over firm bearing. Attach sheathing with subfloor glue and screws or shank nails.
- B. Install wall sheathing in accordance with the manufacturer's requirements. Secure wall sheathing with ends staggered, over firm bearing. Tape all joints and terminations with Zip System Tape in accordance with the manufacturers requirements.
- C. Place vertical sheathing around entire building.
- D. Use sheathing "H" clips at joints in the plywood roof sheathing between roof framing members.

3.3 SITE APPLIED WOOD TREATMENT

- A. Site apply preservative treatment in accordance with manufacturer's instructions.
- B. Treat site-sawn cuts. Brush apply one coat of preservative treatment on untreated wood in contact with cementitious materials.
- C. Allow preservative to cure prior to erecting members.

END OF SECTION

SECTION 061753

PLATE CONNECTED WOOD TRUSSES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Shop fabricated wood trusses for floor and roof framing.
- B. Bridging, bracing, and anchorage.
- C. Placement of bearing plates.

1.2 SYSTEM DESCRIPTION

- A. Roof Loads
 - Ground Snow Load 50 PSF
 - Top Dead 25 PSF
 - Bottom Dead 15 PSF
- B. Floor Loads – Apartments
 - Top Live 40 PSF
 - Top Dead 10 PSF
 - Bottom Dead 10 PSF
- C. Floor Loads – Corridors and Public Rooms
 - Top Live 100 PSF
 - Top Dead 10 PSF
 - Bottom Dead 10 PSF
- D. Deflection limited to 1/360

1.3 SUBMITTALS

- A. Shop Drawings: Indicate framing system, sizes and spacing of trusses, loads and truss cambers.
- B. Product Data: Provide truss configurations, bearing and anchor details, bridging and bracing.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with the following agencies:
 - 1. Lumber Grading Agency: Certified by ALSC.
 - 2. Plywood Grading Agency: Certified by APA.
- B. Truss Design, Fabrication, and Installation: In accordance with Truss Plate Institute BWT-76, HET-80, PCT-80 including Supplement, TPI-85 including Supplement, QST-88.

- C. Design joists under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State of New York.

PART 2 PRODUCTS

2.1 PLATE CONNECTED WOOD TRUSSES

- A. Manufacturers:
 - 1. Alpine Engineered Products, Inc.
 - 2. Inter-Lock Steel
- B. Lumber Grading Rules: NFPA, WCLIB, WWP.
- C. Wood Members: Stress Group, species, grade, and size classification: as per manufacturer's recommendations. 19 percent maximum and 7 percent minimum moisture content; single top and bottom chord.
- D. Steel Connectors: ASTM A446 steel, Grade A, hot dip galvanized; die stamped with integral teeth; .036 inch thick.
- E. Truss Bridging: Type, size and spacing recommended by truss manufacturer.

2.2 ACCESSORIES

- A. Wood Framing for Openings: In accordance with Section 06100 softwood lumber, S/P/F species, construction grade.
- B. Fasteners: Galvanized steel, type to suit application.
- C. Bearing Plates: Galvanized.

2.3 FABRICATION

- A. Fabricate trusses to achieve structural requirements specified.
- B. Brace wood trusses in accordance with TPI BWT-76.

2.4 WOOD TREATMENT

- A. Wood Preservative (Pressure Treatment): AWP Treatment C1 using water borne preservative with 0.25 percent retainage.
- B. Wood Preservative (Surface Application): Clear.
- C. Shop preservative treat wood materials indicated, in accordance with manufacturer's instructions.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify that supports and openings are ready to receive trusses.
- B. Coordinate placement of bearing support items.

3.2 ERECTION

- A. Install trusses in accordance with manufacturer's instructions. Set members level and plumb, in correct position.
- B. Make provisions for erection loads and temporary bracing.
- C. Do not field cut or alter structural members without approval of Architect.
- D. Place headers and supports to frame openings required.
- E. Frame openings between trusses with lumber in accordance with Section 06100.
- F. Fasten ends of all trusses to exterior wall framing with hurricane clips.

3.3 SITE APPLIED WOOD TREATMENT

- A. Brush apply two coats of preservative treatment on wood in contact with cementitious materials, roofing and related metal flashings. Treat site-sawn cuts.
- B. Apply preservative treatment in accordance with manufacturer's instructions.
- C. Allow preservative to cure prior to erecting members.

END OF SECTION

SECTION 062023

INTERIOR FINISH CARPENTRY

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Finish carpentry items, other than shop prefabricated casework; hardware and attachment accessories.

1.2 DESCRIPTION OF WORK

- A. Furnish and install all finish carpentry and millwork, including related hardware required or implied by drawings and/or specifications including:
 - 1. Wood Trim
 - 2. Interior Windows
 - 3. Handrails
 - 4. Shelving
 - 5. Cabinets and Countertops
 - 6. Installation of Miscellaneous Specialties (Section 101005)
 - 7. Installation of toilet and bath accessories (Section 102800)

1.3 INTENT

- A. It is not the intent of the Specification to define the types, sizes or installation methods for each item of finish carpentry. Installation, joinery, sizes, types of finish, spacings of nailers, and furring strips shall be done generally in accordance with the details on the drawings for the specific areas involved and in accordance with listed standards; and as approved by the Architect.
- B. All Carpentry work and materials not specified elsewhere, but which is implied by the Drawings and/or is required for the work, shall be furnished under the Section whether or not specifically described herein.

1.4 SUBMITTALS

- A. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, finishes, and accessories.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with AWI Custom quality.

1.6 REGULATORY REQUIREMENTS

- A. Conform to applicable code for fire retardant requirements.

PART 2 PRODUCTS

2.1 LUMBER MATERIALS

- A. Softwood Lumber Interior: Graded in accordance with AWI Custom; White Pine species, smooth sawn, maximum moisture content of 6 percent; suitable for good paint finish.
- B. Softwood Lumber Exterior: Graded in accordance with AWI Custom; Cedar species, smooth sawn, maximum moisture content of 8 percent; suitable for paint finish.
- C. Hardwoods
 - 1. Red oak, select as approved, kiln-dried to 9% moisture content.
 - 2. Prefinished or factory sanded ready for field finish as approved.
 - 3. Sizes and configurations as indicated on drawings.

2.2 SHEET MATERIALS

- A. Softwood Plywood: PS 1 Grade A-B; Graded in accordance with AWI, lumber core.
- B. Wood Particleboard: ANSI A208.1 Type 1; AWI standard, composed of wood chips made with waterproof resin binders, sanded faces.

2.3 FINISH MATERIALS

- A. Plastic Laminate: NEMA LD 3 AWI; 0.040 inch Post Forming 0.050 inch General Purpose quality; color, pattern, and surface texture as selected; manufactured by Wilson-Art, Formica or equal.
- B. Laminate Backing Sheet: 0.020 inch Backing Sheet grade, undecorated plastic laminate.

2.4 ACCESSORIES

- A. Fasteners: Size and type to suit application; Hot dipped galvanized steel for exterior, high humidity and treated wood locations, plain finish elsewhere.
- B. Contact Adhesives: Water Base type.
- C. Wall Adhesive: Cartridge type, compatible with wall substrate, capable of achieving durable bond.
- D. Primer: Alkyd primer sealer.

2.5 HARDWARE

- A. Provide all fasteners including nails, screws, bolts, etc. as indicated, noted or detailed on Drawings and as required to produce a safe, substantial and workmanlike job in all respects.
- B. Provide all cabinet and drawer hardware, shelf and other miscellaneous hardware indicated on Drawings.

2.6 FABRICATION

- A. Fabricate to AWI Custom standards.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Prime paint surfaces of items or assemblies in contact with cementitious materials, before installation.

3.2 INSTALLATION

- A. Install work in accordance with AWI Custom Quality Standard.
- B. Set and secure materials and components in place, plumb and level.
- C. Install trim by nails.
- D. Cover exposed edges of shelving with 3/8 inch thick hardwood edging.
- E. Apply plastic laminate finishes with adhesive over entire surface. Apply laminate backing sheet on reverse side of plastic laminate finished surfaces.
- F. Install hardware in accordance with manufacturer's instructions.
- G. Install miscellaneous specialties and toilet/bath accessories in accordance with the manufacturers instructions.

3.3 SITE APPLIED WOOD TREATMENT

- A. Apply preservative treatment in accordance with manufacturer's instructions.
- B. Brush apply two coats of preservative treatment on wood in contact with cementitious materials and roofing and related metal flashings. Treat site-sawn cuts.
- C. Allow preservative to dry prior to erecting members.

3.4 PREPARATION FOR FINISH

- A. Sand work smooth and set exposed fasteners. Apply wood filler in exposed fastener indentations.
- B. Site Finishing: Refer to Section 099000 Painting.

END OF SECTION

SECTION 071600

BASEMENT AND ELEVATOR PIT WATERPROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Liquid Membrane Waterproofing

1.2 QUALITY ASSURANCE

- A. Perform Work in accordance with manufacturer's instructions.

1.3 ENVIRONMENTAL REQUIREMENTS

- A. Maintain temperatures above 40 degrees F degrees for 24 hours before application and continuously until dampproofing has cured.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Fluid Applied Waterproofing
Sonneborn: Type Hydrocide Liquid Membrane(HLM 5000 and complying with ASTM C-836-84)
- B. Expansion Joint Sealant:
Sonneborn Sonalastic NP 1 or NP 2 or SL 2 or SL 1 complying with ASTM C-920.
- C. Joint Filler:
Sonneborn Sonofoam Backer-Rod, closed cell polyethylene foam.
- D. Reducer:
Sonneborn Reducer 990. For cleaning tools and equipment.
- E. Leveling Patcher:
Sonneborn Sonocrete®. An acrylic latex base bonding compound used directly or as an admixture.
- F. Joint Filler Strip:
Sonneborn Sonofles F non-impregnated joint filler strip.
- G. Cant Strips:
45° to substrate, minimum thickness 1 ½", height 4" maximum, or 1" less than topping thickness.
- H. Protection Board:
Sonneborn's Protection Course II premolded protection course or ¼" thick.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify that surfaces are solid, free of matter detrimental to adhesion of dampproofing.
- B. Do not apply waterproofing to damp, frozen, dirty, dusty, or deck surfaces.
- C. Concrete shall be cured for a minimum of 14 days and shall be dry.

3.2 APPLICATION

- A. Apply Work in accordance with manufacturer's instructions.

3.3 PROTECTION

- A. Within 24 hours after visual inspection and/or repairs, cover membrane with protection board. All horizontal and vertical membrane shall be protected.
- B. Cleaning:
Upon completion of this work, all materials, containers, equipment and debris shall be removed. Area shall be left in clean condition.

END OF SECTION

SECTION 071900

VAPOR AND AIR BARRIERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Underslab Vapor Barrier.
- B. Sill and Wall Air Infiltration Barrier.
- C. Flexible Flashing
- D. Attic Vapor Barrier – See Section 07210

1.2 SYSTEM DESCRIPTION

- A. Products of this Section to achieve continuity of building enclosure air and vapor barrier, in conjunction with materials in Section 07210.
- B. Sheet and sealing materials to seal gaps between building enclosure components.

PART 2 PRODUCTS

2.1 SHEET MATERIALS

- A. Underslab Barrier: Stego Wrap 15 mil Class A or Equal – See Geotechnical Report
- B. Wall Air Infiltration Barrier: Zip Sheathing System – See Specification Section 06100
- C. Flashing Membrane Material: Equal to Grace Vycor Self Adhering Flashing Systems and Zip Tape System as noted on the Drawings.

2.2 ACCESSORIES

- A. Nails and tape as recommended by the barrier manufacturer.

PART 3 EXECUTION

3.1 UNDERSLAB VAPOR BARRIER

- A. Apply one ply of plastic sheet over subgrade with edges lapped 6 inches (approx).
- B. Cut and fit neatly as required to accommodate all work of other tasks.
- C. Tape all joints and penetrations to provide continuous, unbroken membrane.

3.2 SILL AND WALL INFILTRATION BARRIER

- A. Apply air infiltration barrier in accordance with the manufacturers' recommendations.
- B. All exterior wall penetrations (i.e., outlets, etc.) are to be properly sealed.

3.3 ZIP SHEATHING TAPE & FLASHING MEMBRANE

- A. Prior to the start installation conduct a pre-installation meeting with the builder, flashing membrane manufacturer.
- B. Install flashing membrane at locations indicated on the drawings and at other locations as may be required in accordance with the manufacturers requirements.

END OF SECTION

SECTION 072100

BUILDING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Rigid Foam Insulation
- B. Batt Thermal Insulation in the Attic and Exterior Walls
- C. Poly Iso Insulation – See Section 075323: Single Membrane Roofing
- D. Acoustic Insulation - See Section 092900.

1.2 SYSTEM DESCRIPTION

- A. System performance to provide continuity of thermal and vapor barrier at building enclosure elements in conjunction with vapor and air barrier materials in Section 071900.

1.3 ENVIRONMENTAL REQUIREMENTS

- A. Install insulation adhesives in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 INSULATION MATERIALS

- A. Extruded Polystyrene Rigid Foam Insulation, Exterior Walls: ASTM C578 Type V, Equal to Foamular 250 manufactured by Owens Corning Foam Insulation, LLC, conforming to the following:

Thermal Resistance	R of 5.0 /inch
Thickness	2 inches or as noted
Compressive Strength Minimum	25 psi
Water Vapor Permeance	1.1 perm @ 1 inch
Edges	Square

- B. Batt Insulation, Attic:ASTM C665; preformed glass fiber batt, friction fit; manufactured by Owens-Corning Fiberglass Corp., or Certainteed, conforming to the following:

Thermal Resistance	R-49
Thickness	15 inches
Facing	Kraft Paper

2.2 ADHESIVES

- A. Adhesive: Type recommended by insulation manufacturer for application.

2.3 ACCESSORIES

- A. Vapor and Air Barrier: As specified in Section 07190.
- B. Tape: As recommended by the insulation manufacturer.

- C. XPS Insulation Tape : Joint SealR Foam Joint
- D. Insulation Fasteners: As recommended by the insulation manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation boards are dry and ready to receive insulation, and adhesive.

3.2 INSTALLATION – FOUNDATION PERIMETER – BOARD INSULATION

- A. Adhere a strip of polyethylene sheet over substrate joints with beads of adhesive. Tape seal joints.
- B. Apply same adhesive and install boards on foundation perimeter. Stagger joints. Butt edges and ends tight to adjacent board and to protrusions.

3.3 INSTALLATION - BATT INSULATION

- A. Install insulation in accordance with insulation manufacturer's instructions.
- B. Install in exterior walls, and attic spaces without gaps or voids.
- C. Fit insulation tight in spaces. Leave no gaps or voids.
- D. Exterior Wall, Attic: Install friction fit insulation tight to framing members, completely filling prepared spaces.
- E. Retain insulation in place with wood strapping.
- F. Coordinate vapor and air barrier seal with Section 071900.

END OF SECTION

SECTION 073113

ASPHALT ROOF SHINGLES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Granular surfaced asphalt shingle roofing, underlayment, eave, valley, and ridge protection, with metal flashings.

1.2 SUBMITTALS

- A. Product Data: Provide data indicating material characteristics, and limitations.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with NRCA Steep Roofing Manual.

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Do not install eave ice dam edge protection and shingles when ambient temperatures are below 50 degrees F.

PART 2 PRODUCTS

2.1 ASPHALT SHINGLES

- A. Manufacturers and series equal to:
GAF Timberline 30 (30 Year).
Tamko – Heritage 30 (30 Year).
Certaineed Landmark 30 (30 Year)
- B. Asphalt Shingles: ANSI/ASTM D3018, Class A with Type I - Self Sealing; UL Rating of A and Wind Resistance Label, glass fiber mat base, mineral granule surface type; 250 lb/square; standard self sealing type; square; color as selected.

2.2 SHEET MATERIALS

- A. Eave and Valley Ice Dam Protection: Sheet barrier of rubberized asphalt bonded to sheet polyethylene, 40 mil total thickness, with strippable treated release paper.
- B. Underlayment: 15 pound asphalt paper.

2.3 ACCESSORIES

- A. Nails: Standard round wire shingle hot dipped zinc coated steel type, of sufficient length to penetrate roof sheathing.
- B. Plastic Cement: Asphalt type with mineral fiber components.
- C. Lap Cement: Fibrated cutback asphalt type.

2.4 FLASHING MATERIALS

- A. Sheet Flashings: See Section 07620
- B. Drip Edge Flashing: .032 Break formed aluminum sheet. Standard enamel finish. Color to be selected by the Architect.
- C. Bituminous Paint: Acid and alkali resistant type; black color.
- D. Nails: Standard round wire roofing type, hot dipped zinc coated steel; of sufficient length to penetrate wood substrate.

2.5 FLASHING FABRICATION

- A. Form flashings to protect roofing materials from physical damage and shed water.
- B. Form sections square and accurate to profile, in maximum possible lengths, free from distortion or defects detrimental to appearance or performance.
- C. Hem exposed edges of flashings minimum 1/4 inch on underside.
- D. Apply bituminous paint on concealed surfaces of flashings.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify that plumbing stacks and roof penetrations are flashed to deck surface.
- B. Verify deck surfaces are dry, free of ridges, warps, or voids. Broom clean surfaces.
- C. Fill knot holes and surface cracks with latex filler at areas of bonded eave protection.

3.2 INSTALLATION - EAVE ICE DAM PROTECTION

- A. Place eave and gable edge metal flashings tight with fascia boards. Weather lap joints and seal with plastic cement. Secure flange with nails.
- B. Apply rubberized asphalt/polyethylene sheet eave protection in accordance with manufacturer's instructions.
- C. Extend eave ice dam protection membrane minimum 3 ft minimum upslope beyond interior face of exterior wall, (5' minimum total width).
- D. In areas where the roof pitch is 3 ½ :12 or lower install additional Ice Dam protection as may be required by the shingle manufacturer.

3.3 INSTALLATION - PROTECTIVE UNDERLAYMENT

- A. Place one ply of underlayment over area not protected by eave protection, with ends and edges weather lapped and nailed. Stagger end laps of each consecutive layer.

- B. Install perpendicular to slope of roof.
- C. Weather lap and seal watertight with plastic cement, items projecting through or mounted on roof.

3.4 INSTALLATION - METAL FLASHING

- A. Weather lap joints and seal weather tight with plastic cement. Secure in place with concealed fastenings.
- B. Flash and seal work projecting through or mounted on roofing with plastic cement, weather tight.

3.5 INSTALLATION - ASPHALT SHINGLES

- A. Install shingles in accordance with manufacturer's instructions.
- B. Provide triple course of shingles at eaves.
- C. Place shingles in straight coursing pattern with required weather exposure to produce triple thickness over full roof area.
- D. Project first course of shingles 3/4 inch beyond eave boards.
- E. Extend shingles 1/2 inch beyond face of gable edge fascia boards.
- F. Cap hips and ridges with individual shingles, maintaining weather exposure. Place to avoid exposed nails.
- G. After installation, place one daub of plastic cement, under each individual shingle exposed to weather, to prevent lifting.
- H. Complete installation to provide weather tight service.

END OF SECTION

SECTION 074600

SIDING & RELATED TRIM

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Trims, Brackets, Etc.
- B. Porch soffits
- C. Vinyl Siding, & Trim.
- D. Vinyl Shake Siding
- E. Siding Trim Accessories
- F. Cellular PVC Trim and Mouldings.

1.2 SUBMITTALS

- A. Product Data: Provide data indicating materials, component profiles, fastening methods, jointing details, sizes, surface texture, finishes, and accessories.
- B. Samples: Submit two samples 12 x 12 inch in size illustrating surface texture and color.
- C. Submit two additional samples to Section 09900 for application of paint.

1.3 WARRANTY

- A. Provide five-year warranty.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Soffits (Vented)
Manufacturers: Equal to Certainteed Triple 3 1/3" Invisivent
- B. Vinyl Siding:
 - 1. Siding
Equal to Vertical Certainteed Monogram 46 Double 4" or equal - Color: To be Determined
- C. Vinyl Certainteed Monogram Siding
 - 1. Equal to the Certainteed – Double 7" Board & Batten Shingles or equal. Standard Color
- D. Siding Trim – Accessories
 - 1. Fascia and Trim
Equal to Restoration Millwork smooth finish – thickness and size as indicated on the drawings

2. Door and Window – thickness and size as indicated on the drawings
Lineal Surrounds
Equal to: Restoration Millwork 3 ½” Wide at Sides and under sill, 4 ½” wide with brick mold at head
3. Corner Trim
Equal to: Restoration Millwork 5/4” x 6” x 6”
4. Mounting Blocks
Equal to: Mid-America Mount master Mounting Blocks
Provide mounting blocks for all light fixtures, exterior outlets, hose bibbs, electric meters, etc. Size as required. Color to match siding.
5. Exhaust Vents
Equal to: Mid-America Master Intake/Exhaust Vent
Color to match siding.
6. Rectangular Gable Vents
Equal to: Mid America – Specialty Gable Vent – Size as noted on the building elevations
- Color: white
7. Porch Posts - Wrap
Equal to: Certainteed Column Wraps, 8” x 8” x 9 1/0”, with Classic Trim Kit.
8. Other – Certainteed Restoration Millwork

- F. Cellular PVC Trim and Mouldings Trim
Equal to Certainteed Restoration Millwork Trim and Mouldings

2.2 ACCESSORIES

- A. Nails: Corrosion resistant type, aluminum, non-staining, pre-finished to match siding finish.
- B. Accessory Components: Siding and Soffit: All accessories required by the siding\soffit manufacturer for a complete installation.
- C. Trim and Moulding Adhesive: Type Recommended by the Manufacturer
- D. Prime and Finish Paint: See Section 09900.

2.3 FINISH

- A. Paint Finish – Colors to be selected by the Architect.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install siding, soffits trim and mouldings in accordance with manufacturer's instructions.
- B. Install siding using single course method; with 5 inch exposure. Nail siding at 12 inches o.c. into studs or Zip-R-Sheathing. Miter horizontal joints tight at 45 degrees.
- C. Nail to an aligned pattern.
- D. Install siding for natural watershed.
- E. Align level, and plumb. Locate cut board edges and ends over bearing.

- F. Install metal flashings at internal and external corners sills, head of wall openings and horizontal joints of sheet materials.
- G. Install sealant to prevent weather penetration. Maintain neat appearance.

3.2 PREPARATION FOR SITE FINISHING

- A. Sand work smooth and set exposed nails.

END OF SECTION

SECTION 076200

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Roof flashings.
- B. Roof Drip Edge
- C. Counterflashings over base flashings and vent stacks.
- D. Gutters and Downspouts

1.2 QUALITY ASSURANCE

- A. SMACNA - Architectural Sheet Metal Manual.

1.3 STORAGE AND HANDLING

- A. Stack preformed and pre-finished material to prevent twisting, bending, or abrasion, and to provide ventilation.

PART 2 PRODUCTS

2.1 SHEET MATERIALS

- A. Aluminum Sheet: ASTM B209, 3003 alloy, H14 temper; .05ga thick; mill shop pre-coated with standard coating. Color: Standard color as selected by the Architect.

2.2 GUTTERS AND DOWNSPOUTS

- A. Equal to ATAS 5" "K" Gutters

2.3 ACCESSORIES

- A. Fasteners: Aluminum.
- B. Underlayment: See Section 07525 and Section 07311.
- C. Protective Backing Paint: Zinc chromate alkyd.
- D. Sealant: Acrylic type, specified in Section 07900.
- E. Bedding Compound: Rubber-asphalt type.
- F. Plastic Cement: Asphaltic base cement.

2.4 FABRICATION

- A. Form components true to shape, accurate in size, square, and free from distortion or defects. Form pieces in longest practical lengths.
- B. Fabricate cleats and starter strips of same material as sheet, minimum 4 inch wide, interlockable with sheet.
- C. Hem exposed edges on underside 1/2 inch; miter and seam corners. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.
- D. Fabricate flashings to allow toe to extend 2 inches over roofing. Return and brake edges.
- E. Form material with standing seam.
- F. Fabricate corners in one piece; seam for rigidity, seal with sealant.
- G. Form sheet metal pans with upstand, and flanges. Fill pans watertight with plastic cement.

2.5 FINISH

- A. Backpaint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify roof openings, pipes, sleeves, ducts, or vents through roof are solidly set, cant strips in place, and nailing strips located.
- B. Verify membrane termination and base flashings are in place, sealed, and secure.

3.2 INSTALLATION

- A. Conform to drawing details included in SMACNA manual.
- B. Install starter and edge strips, and cleats.
- C. Secure flashings using concealed fasteners.
- D. Apply plastic cement compound between metal work and felt flashings.
- E. Fit components tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- F. Seal metal joints watertight.
- G. Install Gutters and Downspouts (Leaders) at locations indicated on the Drawings in accordance with the Manufacturer's recommendations.

L'Dor Assisted Living
West Clarkstown Road, New City, NY

Sheet Metal Flashing And Trim
Section 076200 - 3

END OF SECTION

SECTION 078400

FIRESTOPPING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Firestopping systems, materials and accessories.
- B. Fire Stop Sealant & Rated Joint Sealant

1.2 SYSTEM DESCRIPTION

- A. Provide firestop systems consisting of a material, or combination of materials installed to retain the integrity of fire resistance rated construction by maintaining an effective barrier against the spread of flame, smoke and/or hot gases through penetrations, fire resistive joints, and perimeter openings in accordance with the requirements of the Building Code for this project.
- B. Firestop systems shall be used in locations including, but not limited to, the following:
 - 1. Penetrations through fire resistance rated roof assemblies.
 - 2. Penetrations through fire resistance rated wall assemblies.
 - 3. Membrane penetrations in fire resistance rated wall assemblies.
 - 4. Joints between fire resistance rated assemblies.
 - 5. Perimeter gaps between rated roofs and an exterior wall assembly.

1.3 REFERENCES

- A. American Society For Testing and Materials Standards (ASTM):
 - 1. ASTM E 84: Standard Test Method For Surface Burning Characteristics of Building Materials.
 - 2. ASTM E 814: Standard Test Method For Fire Tests of Through-Penetration Firestops.
 - 3. ASTM E 1966: Test Method For Resistance of Building Joint Systems.
 - 4. ASTM E 1399: Test Method for Cyclic Movement and Measuring Minimum and Maximum Joint Width.
 - 5. ASTM E 119: Methods of Fire Tests of Building Construction and Materials.
 - 6. ASTM E 2307: Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-Story Test Apparatus
 - 7. ASTM E 2174: Standard Practice for On-Site Inspection of Installed Fire Stops
 - 8. ASTM E 2393: Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers
- B. Underwriters Laboratories Inc. (UL):
 - 1. UL 263: Fire Tests of Building Construction and Materials.
 - 2. UL 723: Surface Burning Characteristics of Building Materials.
 - 3. UL 1479: Fire Tests of Through-Penetration Fire Stops.
 - 4. UL 2079: Tests for Fire Resistance of Building Joint Systems.

- C. UL Fire Resistance Directory -Volume 2:
 - 1. Through-Penetration Firestop Devices (XHJI)
 - 2. Fire Resistive Ratings (BXUV)
 - 3. Through-Penetration Firestop Systems (XHEZ)
 - 4. Fill, Void, or Cavity Material (XHHW)
- D. Omega Point Laboratories (OPL)
 - 1. Directory of Listed Building Products, Materials & Assemblies – Volume II

1.4 DEFINITIONS

- A. Firestopping: The use of a material or combination of materials in a fire-rated structure (wall or floor) where it has been breached, so as to restore the integrity of the fire rating of that wall or floor.
- B. System: The use of a specific firestop material or combination of materials around a specific penetrant(s) or into a specific joint in conjunction with a specific wall and/or floor construction type.
- C. Barrier: Any bearing or non-bearing wall or floor that has an hourly fire and smoke rating.
- D. Through-penetration: Any penetration of a fire-rated wall that completely breaches the barrier.
- E. Membrane-penetration: Any penetration in a fire-rated wall that breaches only one side of the barrier.
- F. Fire Resistive Joint: Any gap, joint, or opening, whether static or dynamic, between two fire-rated barriers including where the top of a wall meets a floor; wall edge to wall edge configurations; floor edge to floor edge configurations; floor edge to wall configurations.
- G. Perimeter Barrier: Any gap, joint, or opening, whether static or dynamic, between a fire-rated floor assembly and a non-rated exterior wall assembly.
- H. Engineering Judgment: A firestopping assembly proposed for conditions where a tested and listed firestopping system does not exist.

1.5 PERFORMANCE REQUIREMENTS

- A. Penetrations: Provide through-penetration firestop systems that are produced and installed to resist the spread of fire, passage of smoke and other hot gases according to requirements indicated, to restore the original fire-resistance rating of barrier penetrated.
 - 1. Provide and install complete penetration firestopping systems that have been tested and approved by nationally accepted testing agencies per ASTM E 814 or UL 1479 fire tests in a configuration that is representative of field conditions.
 - 2. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, as determined per ASTM E 814 or UL 1479, but not less than one (1) hour or the fire resistance rating of the barrier being penetrated.
 - 3. T-Rated Systems: Provide through-penetration firestop systems with T-ratings indicated,

as well as F-ratings, as determined per ASTM E 814 or UL 1479, where required by the Building Code.

4. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
 5. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
- B. Fire Resistive Joints: Provide joint systems with fire resistance assembly ratings indicated, as determined by UL 2079 (ASTM E 1399 and E 1966), but not less than the fire resistance rating of the construction in which the joint occurs. Firestopping assemblies must be capable of withstanding anticipated movements for the installed field conditions.
1. For firestopping assemblies exposed to view, traffic, moisture, and physical damage, provide products that after curing do not deteriorate when exposed to these conditions both during and after construction.
- C. Firestopping products shall have flamespread ratings less than 25 and smoke-developed ratings less than 450, as determined per ASTM E 84.

1.6 SUBMITTALS

- A. Product Data: For each type of firestopping product selected. Certify that firestopping materials are asbestos free and contain volatile organic compounds (VOCs) within limits of the local jurisdiction.
- B. Design Listings: Submit system design listings, including illustrations, from a qualified testing and inspecting agency that is applicable to each firestop configuration.
- C. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Submit document from manufacturer wherein manufacturer recognizes the installer as qualified.

1.7 QUALITY ASSURANCE

- A. Provide firestopping system design listings from UL or OPL in accordance with the appropriate ASTM Standard(s) per article 1.5.
- B. Contractor Qualifications: An acceptable installer shall meet any two of the following requirements:
1. Trained and approved by the firestop manufacturer,
 2. Shown to have successfully completed not less than 5 comparable scale projects.
- C. Single Source Limitations: Obtain firestop systems, for each kind of penetration and construction condition indicated from a single manufacturer, where possible.
- D. Materials from different firestop manufacturers shall not be installed in the same firestop system or opening.
- E. Firestopping material shall be asbestos and lead free and shall not incorporate nor require the use of hazardous solvents.
- F. Firestopping sealants must be flexible, allowing for normal pipe movement.

- G. Firestopping materials shall not crack or pull back from contact surfaces such that a void is created.
- H. Firestopping materials shall be moisture resistant, and may not dissolve in water after curing.
- I. Materials used shall be in accordance with the manufacturer's written installation instructions.
- J. Label each firestopping system installation with the following information:
 - 1. Firestopping product name
 - 2. System listing number
 - 3. Name and address of manufacturer
- K. Inspection of penetrations through fire rated wall assemblies shall be in accordance with ASTM E 2174, Standard Practice for On-Site Inspection of Installed Fire Stops.
- L. Inspection of fire resistive joints and perimeter barriers shall be in accordance with ASTM E 2393, Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver firestopping products to Project site in original, unopened containers or packages with intact and legible manufacturer's labels identifying product and manufacturer, date of manufacture, lot number, UL or OPL classification marking, and mixing instructions for multi-component materials.
- B. Store and handle materials per manufacturer's instructions to prevent deterioration or damage due to moisture, temperature changes, contaminants, or other causes.
- C. All firestop materials shall be installed prior to expiration of shelf life.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Install firestopping when ambient or substrate temperatures are within limits permitted by the manufacturer's written instructions. Do not install firestopping when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate per the manufacturer's written instructions on the product's Material Safety Data Sheet.
- C. Verify the condition of the substrates before starting work.
- D. Care should be taken to ensure that firestopping materials are installed so as not to contaminate adjacent surfaces.

1.10 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that firestopping assemblies are installed according to specified requirements.

- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.
- C. Do not conceal firestopping installations until the Owner's inspection agency or Authorities Having Jurisdiction have examined each installation.
- D. Schedule firestopping after installation of penetrants but prior to concealing the openings.

PART 2 – PRODUCTS

2.1 FIRESTOPPING, GENERAL

- A. Firestopping products specified in system design listings by UL or OPL may be used providing they conform to the construction type, penetrant type, annular space requirements and fire rating involved in each separate assembly.
- B. Manufacturer of firestopping products shall have been successfully producing and supplying these products for a period of not less than three years and be able to show evidence of at least ten projects where similar products have been installed and accepted.
- C. Accessories: Provide components for each firestop system that are needed to install fill materials and to comply with "Performance Requirements" Article. Use only components specified by the firestopping manufacturer and approved by UL or OPL for the firestop systems indicated. Accessories include, but are not limited to the following items:
 - 1. Permanent forming/damming/backing materials, including the following:
 - i. Mineral wool insulation.
 - ii. Foams or sealants used to prevent leakage of fill materials in liquid state.
 - iii. Fire-rated form board.
 - iv. Polyethylene/polyurethane backer rod.
 - v. Rigid polystyrene board.
 - 2. Temporary forming materials.
 - 3. Substrate primers.
 - 4. Steel sleeves
- D. All firestopping products and systems shall be designed and installed so that the basic sealing system will allow the full restoration of the fire resistance properties of the barrier being penetrated with minimal repair if penetrants are subsequently removed.

2.2 MIXING

- A. For those products requiring mixing before application, comply with firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

2.3 MANUFACTURERS

- A. Subject to compliance with the requirements, provide products by the following:
 - 1. Equal to Grace Construction Products, 62 Whittemore Ave, Cambridge MA 02140, (866) 333-3726.

2.4 MATERIALS

- A. Intumescent Firestop Sealants and Caulks:
 - 1. Equal to Grace FlameSafe FS1900
- B. Elastomeric Water-Based Sealant
 - 1. Equal to Grace FlameSafe FS1900, FS900+
- C. Elastomeric Silicone Sealant
- D. Equal to Grace FlameSafe Silicone
- E. Firestop Putty:
 - 1. Equal to Grace FlameSafe FSP1000 Putty & FSP1077 Putty Pads
- F. Firestop Devices:
 - 1. Equal to Grace FlameSafe FSWSD Collar, FSIS Intumescent Sleeve, FlameSafe FSD Device
- G. Wrap Strips:
 - 1. Equal to Grace FlameSafe FSWS 100 Wrap Strip, FSWS 150 Wrap Strip
- H. Firestop Mortars:
 - 1. Equal to Grace FlameSafe FSM Mortar
- I. Firestop Bags/Pillows:
 - 1. Equal to Grace FlameSafe Bags, FlameSafe Pillows
- J. Elastomeric Coating:
 - 1. Equal to Grace FlameSafe FS3000

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Verify that all pipes, conduits, cables, and/or other items which penetrate fire-rated construction have been permanently installed prior to installation of firestops.

3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing firestop systems to comply with written recommendations of firestopping manufacturer and the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of firestop systems.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestop systems. Remove loose particles remaining from cleaning operation.

3. Remove laitance and form-release agents from concrete.

3.3 PENETRATION FIRESTOP SYSTEMS

- A. General: Install through-penetration firestop systems to comply with "Performance Requirements" article in Part 1 and firestopping manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Installation of firestopping shall be performed by an applicator/installer qualified as described in article 1.7.
- C. Apply firestopping in accordance with UL or OPL listed system designs or manufacturer's EJ per the manufacturer's installation instructions.
- D. Install forming/damming/backing materials and other accessories required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire resistance ratings required.
- E. Install fill materials for firestop systems by proven techniques to produce the following results:
 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 2. Apply materials so they fully contact and adhere to substrates formed by openings and penetrating items.
 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 JOINT FIRESTOP SYSTEMS

- A. General: Install fire resistive joint firestop systems to comply with "Performance Requirements" article in Part 1 and firestopping manufacturer's written installation instructions and published drawings for products and applications indicated. Fire resistive joint systems to comply with Section 07842 , "Head-of-Wall Joint System" wherever applicable.
- B. Installation of firestopping shall be performed by an applicator/installer qualified as described in article 1.7.
- C. Apply firestopping in accordance with UL or OPL listed system designs or manufacturer's EJ per the manufacturer's installation instructions.
- D. Install joint forming/damming materials and other accessories required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths of installed firestopping material relative to joint widths that allow optimum movement capability and achieve fire resistance ratings required.
- E. Install fill materials for firestop systems by proven techniques to produce the following results:
 1. Fill joint as required to achieve fire-resistance ratings indicated.
 2. Apply materials so they fully contact and adhere to substrates forming the openings.

3. Completely fill recesses provided for each joint configuration.
4. Tool non-sag firestop materials after their application and prior to the time skinning begins. Use tooling agents approved by the firestopping manufacturer.

3.5 PERIMETER BARRIER FIRESTOP SYSTEMS

- A. General: Install perimeter barrier firestop systems to comply with "Performance Requirements" article in Part 1 and firestopping manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Installation of firestopping shall be performed by an applicator/installer qualified as described in article 1.7.
- C. Apply firestopping in accordance with UL or OPL listed system designs or manufacturer's EJ per the manufacturer's installation instructions.
- D. Install metal framing, mechanical attachments, safing materials and firestop materials as applicable within the system design.

3.6 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by firestopping manufacturer(s) and that do not damage materials in which openings occur. Leave finished work in neat, clean condition with no evidence of spillovers or damage to adjacent surfaces.
- B. Provide final protection and maintain conditions during and after installation that ensure firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestop systems immediately and install new materials to produce firestop systems complying with specified requirements.

END OF SECTION

SECTION 079200
JOINT SEALERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Preparing sealant substrate surfaces.
- B. Sealant and joint backing.

1.2 SYSTEM DESCRIPTION

- A. System performance to achieve moisture and air tight joint seals.

1.3 SUBMITTALS

- A. Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and colors available.

1.4 QUALITY ASSURANCE

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform acoustical sealant application work in accordance with ASTM C919.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Maintain temperature & humidity recommended by the sealant manufacturer during & after installation.

PART 2 PRODUCTS

2.1 SEALANTS

- A. Exterior Joint Sealant: Two-part, non-sag low modulus polyurethane rubber sealant; ASTM C-920-87, Type M, Grade NS Class 25.
- B. Exterior Threshold Sealant: Single component, solvent release, non-skinning non-sagging sealant. ASTM C-920.
- C. Interior Joint Sealant: One part, non-sag acrylic latex caulking compound. ASTM C834-91.

2.2 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Backing: ASTM D1056; round, closed cell polyethylene foam rod.
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify that substrate surfaces and joint openings are ready to receive work.
- B. Remove loose materials and foreign matter which might impair adhesion of sealant.
- C. Verify that joint backing and release tapes are compatible with sealant.
- D. Perform preparation in accordance with ASTM C804 for solvent release and ASTM C790 for latex base sealants.

3.2 INSTALLATION

- A. Clean joints in accordance with manufacturer's instructions.
- B. Install sealant in accordance with manufacturer's instructions.
- C. Measure joint dimensions and size materials to achieve required width/depth ratios.
- D. Install joint backing to achieve a neck dimension no greater than 1/3 the joint width.
- E. Install bond breaker where joint backing is not used.
- F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- G. Tool joints concave.

3.3 SCHEDULE

	<u>Location</u>	<u>Type</u>	<u>Color</u>
A.	Window perimeter (Exterior)	A	To match window trim
B.	Vinyl Siding (Exterior)	A	To match siding
C.	Door Frame/Walls-Exterior	A	To match door trim
	Door Frame/Walls-Interior	C	To match door trim
D.	Under Thresholds	B	Black
E.	Toilets, Bathtubs, Showers/Ceramic Tile & Vinyl Flooring	C	White
F.	Joints at Intersections of Dissimilar Materials		To Be Selected by the Architect
	Exterior	A	
	Interior	C	
G.	Countertop Backsplash and Sides	C	To Be Selected by the Architect

END OF SECTION

SECTION 081113

STEEL DOORS AND FRAMES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Steel doors and frames; non-rated and fire rated.

1.2 SUBMITTALS

- A. Shop Drawings: Indicate door and frame elevations, internal reinforcement, cut-outs for glazing, and finish.
- B. Product Data: Indicate door and frame configurations, location of cut-outs for hardware reinforcement.

1.3 QUALITY ASSURANCE

- A. Conform to the following:
 - 1. SDI-100 - Standard Steel Doors and Frames.
 - 2. DHI - Door Hardware Institute - The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.
 - 3. Fire Rated Door and Frame Construction: ASTM E152
 - 4. Handicapped: ANSI A117.1.
- B. Certification: All steel doors and frames shall be delivered to the site bearing the certification label of conformance to Steel Door Institute (SDI) Standards.

PART 2 PRODUCTS

2.1 DOORS AND FRAMES

- A. Manufacturers:
 - 1. Ceco Door Products
 - 2. Benchmark Metal Doors and Frames
 - 3. Curies Hollow Metal Doors and Frames, Series 707N
Style as indicated on the Door Schedule.
- B. Exterior Doors: SDI-100 Grade II. Galvanized.
- C. Interior Doors: SDI-100 Grade II.
- D. Exterior Frames: 16 gage galvanized thick material, core thickness.
- E. Interior Frames: 18 gage thick material, core thickness.
- F. Door Core: As indicated on the Door Schedule
- G. Thermal Insulated Door: Total insulation R value of 15 (Solid Door).

- H. Sound Rated Door: STC of 22, measured in accordance with ASTM E413.

2.2 ACCESSORIES

- A. Silencers: Resilient rubber.
- B. Primer: Zinc chromate.

2.3 FABRICATION - DOORS

- A. Fabricate doors with hardware reinforcement welded in place.
- B. Attach fire rated label to each rated door unit. (See Door Schedule).

2.4 FABRICATION - FRAMES

- A. Fabricate frames as knock down units.
- B. Fabricate frames with hardware reinforcement plates welded in place.
- C. Reinforce frames wider than 48 inches with roll formed steel channels fitted tightly into frame head, flush with top.
- D. Prepare frame for silencers and install.

2.5 FINISH

- A. Steel Sheet: Galvanized to ASTM A525 G60.
- B. Primer: Baked.
- C. Coat inside of frame profile with bituminous coating.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install doors and frames in accordance with ANSI/SDI-100.
- B. Coordinate installation of doors and frames with installation of hardware specified in Section 08710.
- C. Coordinate with wallboard construction for frame anchor placement.
- D. Install door louvers, plumb and level.
- E. Coordinate installation of glass and glazing.

3.2 TOLERANCES

- A. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

L'Dor Assisted Living
West Clarkstown Road, New City, NY

Steel Doors and Frames
Section 081113 - 3

3.3 SCHEDULE - See Door Schedule.

END OF SECTION

SECTION 081416

WOOD DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Wood doors; fire rated and non-rated.

1.2 SUBMITTALS

- A. Shop Drawings: Indicate door elevations and cutouts for hardware and channel edge protectors.

1.3 QUALITY ASSURANCE

- A. Perform work in accordance with the following:
 - 1. ANSI/NWWDA I.S.1.
 - 2. Fire Door Construction: Conform to ASTM E152.
 - 3. Installed Door Assembly: Conform to NFPA 80 for 45-minute fire rating as indicated on the Door Schedule.
- B. Certification: All wood doors shall be delivered to the site bearing the certification label to ANSI/NWWDA I.S.1 Standards.

1.4 WARRANTY

- A. Provide warranty under provisions of Section 010001 to the following term:
 - 1. Interior Doors: Two (2) years.
- B. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.1 WOOD DOORS

- A. Manufacturers
 - 1. Mohawk Door Co., Inc.
 - 2. Fenestra Corporation
 - 3. Doorcraft Doors by Jeld-Wen

2.2 DOOR TYPES

- A. Interior Doors: 1-3/8 inches thick; Hollow Core
- B. Interior Doors: 1-3/8 inches thick Solid Core; Non-Rated

2.3 DOOR CONSTRUCTION

- A. Core
 - 1. Hollow Core: Honey comb Hollow Cellular Paper Core (NWWDA I.S.1)
 - 2. Solid Core: Non-Rated Profiled Particle Board Core
- B. Face
 - 1. Two (2) Panel embossed hardboard Craftmaster Carrara Style – Smooth Finish

2.4 FABRICATION

- A. Fabricate non-rated doors in accordance with ANSI/NWWDA I.S.1 requirements.
- B. Fabricate fire rated doors in accordance with ANSI/NWWDA I.S.1 and to Warnock-Hersey requirements. Attach fire-rating label to door edge.
- C. Fabricate doors with hardware reinforcement blocking in place.
- D. Factory machine doors for finish hardware.
- E. Doors to be pre-finished.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions/NWWDA I.S.1 requirements.
- B. Coordinate installation of doors with installation of frames specified in Section 081113 and hardware specified in Section 087100.
- C. Adjust door for smooth and balanced door movement.

3.2 INSTALLATION TOLERANCES

- A. Conform to ANSI/NWWDA requirements for fit and clearance tolerances and maximum diagonal distortion.

3.3 SCHEDULE - See Door Schedule.

END OF SECTION

SECTION 084213

ALUMINUM ENTRANCES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Aluminum doors, frames and glazed lights.
- B. Glass.

1.2 SYSTEM DESCRIPTION

- A. System performance to provide for expansion and contraction within system components caused by temperature cycling.
- B. Air and Water Leakage: Shall meet requirements of AAMA-HP.
- C. Design and size members to withstand dead loads caused by pressure and suction of wind.
- D. Drain water entering the framing system, to exterior.

1.3 SUBMITTALS

- A. Shop Drawings: Indicate system and component dimensions; components within assembly; framed openings requirements and tolerances; anchorage and fasteners; glass and infills; door hardware requirements; and affected related work.

1.4 WARRANTY

- A. Provide five (5) year warranty under provisions of Section 01001 including coverage for insulated glass units.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Fabricators:
Doors: Kawneer: 500 Series or equal.
Framing Members: Kawneer Trifab II 451 or equal.
- B. Extruded Aluminum: Aluminum alloy, 6063-T5.
- C. Fasteners: Galvanized steel.
- D. Sealant and Backing Materials: As specified in Section 079200.

2.2 FABRICATED COMPONENTS

- A. Frames: See Drawings.
- B. Reinforced Mullion: See Drawings.
- C. Doors: See Drawings.
- D. Infill Panels: See Drawings.

2.3 GLASS AND GLAZING MATERIALS

- A. Glazing Materials: Exterior fixed gasket, system glazed at factory.
1" - 1/4 x 1/2 x 1/4 Low E.

2.4 HARDWARE - See Hardware Schedule – Specification Section 087100

2.5 FABRICATION

- A. Fabricate doors and frames allowing for minimum clearances and shim spacing around perimeter of assembly.
- B. Accurately and rigidly fit and secure joints and corners, flush, hairline, and weatherproof.
- C. Arrange fasteners, attachments, and jointing to ensure concealment from view.
- D. Prepare components with internal reinforcement for door hardware and door operator hinge hardware.

2.6 FINISHES

- A. Exterior Aluminum Surfaces: Standard Color TBD
- B. Interior Aluminum Surfaces: Standard Color TBD

Apply bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.2 INSTALLATION

- A. Install doors, frames, glazing, and flashings in accordance with manufacturer's instructions AAMA - Window, Store Front and Entrance - Guide Specifications Manual.
- B. Use anchorage devices to securely attach frame assembly to structure.

- C. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- D. Coordinate attachment and seal of air and vapor barrier materials. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- E. Install glass and panels in accordance with Section 088000, using exterior dry method of glazing.
- F. Install perimeter type sealant, backing materials, and installation requirements in accordance with Section 079200.

3.3 TOLERANCES

- A. Variation from Plane: 0.03 inches per foot maximum or 0.25 inches per 30 feet; whichever is less.

END OF SECTION

SECTION 085313

PLYGEM WINDOWS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. PlyGem windows.
- B. Glass and framed insect screens.
- C. Grilles

1.2 SYSTEM DESCRIPTION/QUALITY ASSURANCE

- A. Window units are to meet the AAMA/NWWDA 101/I.S.2-97 standard. The standard was created by the American Architectural Manufacturers Association (AAMA) and the national Wood Window and Door Association (NWWDA). The minimum acceptable performance classification being H-C-50. Window units must have a maximum U value of .28 and an air infiltration rate of .3 CFM per sq. ft. of sash area. All operable windows are to be provided with full aluminum mesh screens.
- B. Certification: All vinyl windows shall be delivered to the site bearing the certification label of conformance to AAMA Standards.

1.3 SUBMITTALS

- A. Shop Drawings: Indicate dimensions, relation to construction of adjacent work, air and vapor seal with adjacent construction, component anchorage and locations, anchor methods, shim methods and materials, hardware, and installation details.

1.4 WARRANTY

- A. Provide 25-year warranty under provisions of Section 01001 including coverage for insulated glass units. Five-year factory labor included.

PART 2 PRODUCTS

2.1 WINDOW UNITS

- A. Window Unit Manufacturers: Equal to Ply Gem 1500 series Single Hung Vinyl Windows or equal.
- B. Window Configuration: Single and Twin, Single Hung, Fixed
- C. Color: White.

2.2 FRAME MATERIALS AND ACCESSORIES

- A. PVC Extrusions: .062" nominal wall thickness.

- B. Sills: PVC - sloped for positive wash, one-piece full width of opening and jamb angles to terminate sill length.
- C. Insect Screen Frames: Rolled aluminum, of rectangular sections with aluminum mesh set into frame and secured. Fit frames with adjustable roller hardware.
- D. Grilles: Contoured Grid – White or beige as selected by the Owner.
- E. Weather Stripping: Foam type configured for flexible fit.
- F. Sealant and Backing Materials: As specified in Section 079200.
- G. Anchor Devices: Non-corroding.

2.3 GLASS AND GLAZING MATERIALS

- A. Glass and Glazing Materials in Window Lights: Manufacturer's Argon Filled Insulated Low E Glass, except as noted on the Drawings or required by code.

2.4 HARDWARE

- A. Single Hung Sash: Spiral friction slide cylinder, each sash, each jamb.
- B. Sash lock: Lever handle with cam lock.
- C. Insect Screen Frames: Rolled aluminum, of rectangular sections with aluminum mesh set into frame and secured. Fit frames with adjustable roller hardware.

2.5 FABRICATION

- A. Fabricate framing, mullions and sash members to create a weather tight seal.
- B. Form glass stops of extruded PVC to match cladding sloped for wash. Form weather stop flange to perimeter of unit.
- C. Assemble insect screens of formed aluminum rectangular sections with aluminum mesh set into frame and secured. Fit frame with four spring loaded pin retainers.
- D. Double weather-strip operable units.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify that rough openings are correctly sized and located.
- B. Prepare opening to permit correct installation of frame and achieve continuity of air and vapor barrier seal.

3.2 INSTALLATION

- A. Install frames, glazing, hardware and flashings in accordance with manufacturer's instructions.

- B. Use anchorage devices to securely attach frames to structure.
 - C. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
 - D. Coordinate attachment and seal of air and vapor barrier materials. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
 - E. Install perimeter type sealant, backing materials, and installation requirements in accordance with Section 079200.
 - F. Clean windows.
- 3.3 Schedule – See Window Schedule

END OF SECTION

SECTION 087100

DOOR HARDWARE – (MECHANICAL LOCKSETS)

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Hardware for wood and hollow steel doors.
- B. Thresholds and weatherstripping.

1.2 SUBMITTALS

- A. Shop Drawings: Indicate locations and mounting heights of each type of hardware and electrical characteristics and connection requirements.
- B. Operating and Maintenance Instructions: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with ANSI A117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
- B. Hardware Supplier: Company specializing in supplying commercial door hardware with two years experience approved by manufacturer.

1.4 COORDINATION

- A. Coordinate work of this section with other directly affected sections requiring any integral reinforcement for door hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Package hardware items individually. Label and identify package with door opening code to match schedule.
- B. Deliver keys to Owner by security shipment direct from hardware supplier.

1.6 MAINTENANCE

- A. Provide manufacturer's maintenance services on door closers for one year from Date of Substantial Completion.
- B. Provide special wrenches and tools applicable to each different or special hardware component.

PART 2 PRODUCTS

2.1 SUPPLIERS: Equal to those on the Hardware Schedule.

2.2 KEYING

- A. Door Locks: Master keyed.
- B. Supply 4 change keys for each lock and 8 master keys.
- C. Key Cabinet: Sheet steel construction, enameled finish, hinged door with key lock, internal hooks for 300 keys, identification labeling. Aristocrat by Telkee.

2.3 FINISHES

- A. Finishes are identified in Schedule at end of this Section.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify that doors and frames are ready to receive work and dimensions are as instructed by the manufacturer.
- B. Verify that electric power is available to power operated devices and of the correct characteristics.

3.2 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions.
- B. Use templates provided by hardware item manufacturer.

3.3 SCHEDULE

A. Set 1

Bedroom Door Type A (Bedroom Entrance Door)

Bedroom Nos.: 101-118, 201-222

Each Doorway to have:

Hinge: (3) Stanley FBB179 4 ½ x 4 ½ US26D

Closer: Norton 850/BRALUM

Lockset: Schlage Jupiter L9453

Stop: Stanley CD7090 US26D

Peep Hole: Baldwin No. 0155

Silencers: (3) Ives No. 20

B. Set 2

Apartment Door Type B (Bathrooms)

Apartment Nos: 101-118 & 201-222

Each Doorway to have:

Hinges: (3) Stanley FBB 179 4 ½ x 4 ½ US26D

Lockset: Schlage Jazz F40N (Privacy Set) US26D

Stop: Ives 069 US26D
Silencers: Ives 581 US26D

C. Set 3

Bedroom Door Types C (Sliding Closet Doors)
Bedroom Nos.: 101,108,109,110,117,118,201,209,210,213,221,222
Each Doorway to have:
Sliding Door Hardware: Stanley 405665
Sliding Door Pulls: (2) Ives No. 22 – US26D

D. Set 4

Apartment Door Type D (Bedroom)
Apartment Nos.: 101-118, 201-222
Each Doorway to have:
Hinges: (3) Stanley F179 3 ½ x 3 ½ US26D
Lockset: Schlage Jazz F40N (Privacy Set) US26D
Stop: Ives 069 US26D

E. Set 5

Door Nos.: B01,B20,106,148
Each Doorway to have:
Hinges: Door Manufacturer's Standard
Exit Device: Von Duprin 88L-07 US26D
Closer: Norton 8501 BF ALUM
Weatherstripping: Door Manufacturer's Standard
Sweep: Door Manufacturer's Standard
Threshold: Door Manufacturer's Standard

F. Set 6

Door Nos.: B02,B03,B04,B13,B15,102,103,104,143,146,202,203,204,205,226,227,228,230
Each Doorway to have:
Hinges: Door Manufacturer's Standard
Lockset: Schlage Jupiter AL80 PD US26D (Storeroom Function)
Closer: Norton 8501 BF ALUM with backcheck
Stop: Baldwin 4028 US26D

G. Set 7

Door No.: B05
Each Doorway to have:
Hinges: (6) Stanley FBB179 4 ½ x 4 ½ US26D
Lockset: Schlage Jupiter AL 80 PD US26D (Storeroom Function)
Flush Bolt: Ives FB32 US26D
Closer: Norton 8501 BF ALUM with backcheck
Silencers: (6) Ives No. 20 Rubber

H. Set 8

Door Nos.: B06, B12
Each Doorway to have:
Hinges: (6) Stanley FBB179 4 ½ x 4 ½ US26D
Exit Device: (2) Von Duprin 8827L-07 US26D
Closer: (2) Norton 8501 BF ALUM
Weatherstripping: Pemko 303 AV

Sweep: Pemko 315 SNN
Threshold: Pemko 253 X 3 AFG
Silencers: (3) Ives No. 20 Rubber

I. Set 9

Door Nos.: B07,B10,B10A,B16,108,124,125,126,208,210,211,212,215,219,222

Each Doorway to have:

Hinges: (3) Stanley F179 4 ½ x 4 ½ US26D
Lockset: Schlage Jupiter AL70 PD US26D (Classroom Function)
Closer: Norton 8501 BF ALUM with backcheck
Stop: Baldwin 4028 US26D
Silencers: (3) Ives No. 20 Rubber

J. Set 10

Door Nos.: B08,114,127,128,129,132,217

Each Doorway to have:

Hinges: (3) Stanley FBB179 4 ½ x 4 ½ US26D
Lockset: Schlage Jupiter AL 50 PD US26D (Office Function)
Stop: Ives WS406 CCV US26D
Silencers: (6) Ives No. 20 Rubber

K. Set 11

Door Nos.: B11,138,139,220,221,229

Each Doorway to have:

Hinges: (3) Stanley F179 4 ½ x 4 ½ US26D
Lockset: Schlage L9486XL583-370-07 Lever – US26D (Privacy Function with Occupancy Indicator)
Closer: Norton 8501 BF ALUM
Stop: Ives WS102 CXV US26D
Hook: Ives 581 US26D
Silencers: (3) Ives No. 20

L. Set 12

Door No.: B14

Each Doorway to have:

Hinges: (3) Stanley F179 4 ½ x 4 ½ US26D
Lockset: Schlage Jupiter AL80 PD US26D (Storeroom Function)
Closer: Norton 8501 BF ALUM with backcheck
Stop: Baldwin 4028 US26D
Silencers: (3) Ives No. 20 Rubber

M. Set 13

Door Nos.: B17,B18,131,214

Each Doorway to have:

Hinges: (3) Stanley F179 4 ½ x 4 ½ US26D
Lockset: Schlage L9486XL583-370-07 Lever – US26D (Privacy Function with Occupancy Indicator)
Stop: Baldwin 4276 US26D
Hook: Baldwin 0783 US26D
Silencers: (3) Ives No. 20

N. Set 14

Door No.: B19

Each Doorway to have:

Hinges: Door Manufacturer's Standard

Lockset: Schlage Jupiter AI 70 PD US26D (Classroom Function)

Closer: Norton 8501 BF ALUM

Weatherstripping: Door Manufacturer's Standard

Threshold: Handicap Type – by Door Manufacturer

O. Set 15

Door Nos.: 101,105,140,142,147,201,206,222,225,231

Each Doorway to have:

Hinges: (3) Stanley FBB179 4 ½ x 4 ½ US26D

Exit Device: Von Duprin 88L-07-US26D

Closer: Norton 8501 BF ALUM with backcheck

Silencers: (6) Ives No. 20 Rubber

Stop: Baldwin 4028 US26D

P. Set 16

Door Nos.: 107,141,207,224

Each Doorway to have:

Hinges: (6) Stanley F179 4 ½ x 4 ½ US3

Exit Device: (2) Von Duprin 8827L-07 Lever – US26D

Closer: (2) Norton 8501 BF GB

Stop: Baldwin 4028 US3

Mag Hold: By FA Contractor

Q. Set 17

Door Nos. 109,113,115,116,121,122,130,135,136,209

Each Doorway to have:

Hinges: (3) Stanley 179 4 ½ x 4 ½ US26D

Lockset: Schlage Jupiter AL70 PD US26D (Classroom Function)

Stop: Baldwin 4028 US26D

Silencers: (3) Ives No. 20 Rubber

R. Set 18

Door Nos.: 110,123

Each Doorway to have:

Hinges: (6) Stanley F179 4 ½ x 4 ½ US3

Exit Device: (2) Von Duprin 8827L-07 Lever – US26D (Classroom Function)

Closer: (2) Norton 8501 BF GB

Stop: Baldwin 4028 US3

Mag Hold: By FA Contractor

S. Set 19

Door Nos.: 111,112

Each Doorway to have:

Hinges: (3) Stanley FBB179 4 ½ x 4 ½ US26D

Deadbolt: Schlage B 460P with thumb turn US26D

Pull Plate: Baldwin 2365 US26D

Push Plate: (1) Baldwin 2103 US26D

Closer: Norton 8501 BF AL with holdopen

Silencers: (3) Ives No. 20

T. Set 20

Door Nos.: 117,119,120

Each Doorway to have:

Hinges: Manufacturer's Standard Offset Pivot - #14 Clear Anodized

Exit Device: (2) Von Duprin 88L-07 US26D (Classroom Function)

Closer: Norton 8501 BF AL with backcheck

Weatherstripping: Manufacturer's Standard

Sweep: Manufacturer's Standard

Threshold: Manufacturer's Standard

U. Set 21

Door No.: 118

Each Doorway to have:

Hinges: Manufacturer's Standard Offset Pivot - #14 Clear Anodized

Push Bar: Manufacturer's Standard

Pull Bar: Manufacturer's Standard

Closer: Norton 8501 BF AL with backcheck

V. Set 22

Door Nos.: 133,134,137,144,145

Each Doorway to have:

Hinges: (3) Stanley FBB179 4 ½ x 4 ½ US26D

Lockset: Schlage Jupiter AL 50 PD US26D (Office Function)

Closer: Norton 8501 BF ALUM with backcheck

Silencers: (3) Ives No. 20 Rubber

END OF SECTION

SECTION 088000

GLAZING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Glass and glazing for Sections referencing this Section for Products and installation.

1.2 SYSTEM DESCRIPTION

- A. Glass and glazing materials of this Section shall provide continuity of building enclosure vapor and air barrier.
- B. Size glass to withstand dead loads and positive and negative live loads acting normal to plane of glass.

1.3 SUBMITTALS

- A. Product Data on Glass Types Specified: Provide physical and environmental characteristics, size limitations, and special installation requirements.
- B. Product Data on Glazing Compounds: Provide chemical characteristics, limitations, special application requirements. Identify available colors.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with FGMA Glazing Manual, FGMA Sealant Manual for glazing installation methods.

1.5 WARRANTY

- A. Provide five(5) year warranty under provisions of Section 010001 including coverage for sealed glass units from seal failure, interpane dusting or misting, and replacement of same.

PART 2 PRODUCTS

2.1 FLAT GLASS MATERIALS

- A. Manufacturers:
 - 1. Libby-Owens Ford Co.
 - 2. PPG Industries, Inc.
 - 3. Guardian Industries, Inc.
- B. Float Glass: Clear, 1/4 inch thick.

- C. Safety Glass: Clear; fully tempered; conforming to ANSI Z97.1; 1/4 inch thick minimum.
- D. Fire Rated Glass: Clear, Fire Rated, Safety Rated Glass Ceramic Equal to Fire Lite Plus Manufactured By: Technical Glass Products. 5/16 inch thick.
- E. Mirror Glass: Clear float type with copper and silver coating, organic overcoating, beveled edges, 1/4 inch thick minimum. See Bathroom Details for mirror sizes.

2.2 SEALED INSULATING GLASS MATERIALS

- A. Manufacturers:
 - 1. Libby-Owens Ford Co.
 - 2. PPG Industries, Inc.
 - 3. Guardian Industries, Inc.
- B. Insulated Glass Units: Double pane with silicone sealant edge seal; outer pane of heat strengthened or tempered glass, inner pane of heat strengthened or tempered glass; total unit thickness of 5/8 to 1 inch.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify that openings for glazing are correctly sized, within tolerance, and glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

3.2 EXTERIOR - DRY METHOD (PREFORMED GLAZING)

- A. Cut glazing tape to length; install on glazing pane. Seal corners with butyl sealant.
- B. Place setting blocks at 1/4 points.
- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.
- D. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.
- E. Trim protruding tape edge.

3.3 INTERIOR

- A. Cut glazing tape to length and install against permanent stops, projecting 1/16 inch above sight line.
- B. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.
- C. Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.

- D. Install removable stops, spacer shims inserted between glazing and applied stops at 24 inch intervals, 1/4 inch below sight line.
- E. Fill gaps between pane and applied stop with sealant to depth equal to bite on glazing, to uniform and level line.
- F. Trim protruding tape edge.

3.4 INSTALLATION – MIRRORS

- A. Set mirrors with clips. Anchor rigidly to wall construction.
- B. Place plumb and level.

3.5 INSTALLATION – FIRE RATED GLASS

- A. Install Fire Rated Safety Glass in accordance with the Manufacturer's Requirements.
- B. Place plumb and level.

3.6 CLEANING

- A. Remove glazing materials from finish surfaces.
- B. Remove labels after Work is complete.
- C. Clean glass and mirrors.

3.7 SCHEDULE - See Door Schedule and Interior Elevations.

END OF SECTION

SECTION 092900
GYPSUM BOARD SYSTEMS









PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Acoustic insulation.
- B. Gypsum board with taped and sanded joint treatment.

1.2 SYSTEM DESCRIPTION

- A. Acoustic Attenuation for Identified Interior Partitions: 50 STC in accordance with ASTM E90.
- B. Conform to applicable code for fire rated assemblies as follows:
 - 1. Partition and Wall Systems

Type	Description
 A-1 A-2	VINYL SIDING / STONE VENEER 7/16" ZIP SHEATHING 5-1/2" UNFACED BATT INSUL (R-21) 2"x6" WOOD STUDS @ 12" O.C. (BASEMENT) 2"x6" WOOD STUDS @ 24" O.C. (1ST & 2ND FLOOR) 5/8" GYP BD. - TYPE X CORE ONE HOUR FIRE RATING (UL DESIGN U356)
 A-1 A-2	SIDING EXT. 1 HR. RATED
 B-B B-1 B-2	5/8" GYP BD. TYPE X CORE TO CLG. BOTH SIDES. 5 1/2" SOUND INSUL. 2"x6" WOOD STUDS @ 12" O.C. (BASEMENT) 2"x6" WOOD STUDS @ 24" O.C. (1ST & 2ND FLOOR) ONE HOUR FIRE RATING (UL DESIGN U309)
 C	5/8" GYP BD. TYPE X CORE TO CLG. BOTH SIDES. 5 1/2" SOUND INSUL. 2"x6" WOOD STUDS @ 24" O.C. FULL HT. PARTITION TO UNDERSIDE OF FLOOR/ROOF TRUSSES ONE HOUR FIRE RATING (UL DESIGN U309)
 D-1 D-2 D-3	5/8" GYP BD. 2" x 6" (2 x 4 AS NOTED) WOOD STUDS @ 12" O.C. (BASEMENT) 2" x 6" (2 x 4 AS NOTED) WOOD STUDS @ 24" O.C. (1ST & 2ND FLOOR PLAN) 8" REINF. CMU 1 HR RATING PER 2015 IBC TABLE 721.1(2)
 D-1 D-2 D-3	INT. STUD & CONCRETE BLOCK
 E	5/8" GYP BD. TYPE X CORE TO CLG. BOTH SIDES. 5 1/2" SOUND INSUL. (3 1/2" AS NOTED) 2"x6" WOOD STUDS @ 24" O.C. (2x4 AS NOTED) (2"x4" AS NOTED)
 F	5/8" TYPE X GYP BD. TO CEILING BOTH SIDES. 2"x4" WOOD STUDS @ 24" O.C. (2"x6" AS NOTED) W/ DOUBLE TOP PLATE. SEE DETAIL A/A1
	UNIT TYPICAL INT.

Note: All bathrooms, laundry rooms, and other wet areas to receive 5/8" moisture resistant Gypsum Board.

2. Floor/Ceiling and Ceiling/Roof Assembly Types

- Type 1. Assembly at Wood Trusses (1 hr Rating UL Design L528): 5/8" Gypsum Board F.C. Type C applied at right angles to resilient furring channel with 1" Type S drywall screws 12" oc and 1-1/2" from edges and joints located mid-way between continuous channels 16" oc secured with 1 1/4" long No.6 Type S Bugle Head screws to parallel chord wood trusses 24" oc supporting 3/4" nominal floor sheathing with exterior glue, T&G edges, perpendicular to trusses, joints staggered 4' with construction adhesive and No. 6d ring shank nails 12" oc. Adhesive applied to each top chord and grooved edges of plywood. 6" sound attenuating insulation.
- Type 2. Assembly at Wood Joists (1 hr Rating UL Design L501): 5/8" Type X Gypsum Board ceiling, 3/4" floor sheathing with exterior glue screwed and glue to 2x joists, 6" sound attenuating insulation between joists.
- Type 3. Suspended Gypsum Board Ceiling (Not-Rated): 5/8" Gypsum Board applied to drywall suspended grid system equal to Armstrong SI8945.6" sound attenuating insulation.
- Type 4. Ceiling Roof Assembly (1 hr Rating – UL Design P533) Gypsum Board, Wood Joists, Roof Covering: One Layer 5/8" Type C gypsum wallboard applied at right angles to resilient furring channels 12" OC with 1 1/8" Type S drywall screws 8" OC. Gypsum board end joints attached with screws 8" OC to additional pieces of channel 60" long located 3" back on either side of end joint. Resilient channels applied at right angles to bottom chord of wood roof trusses 24" OC with 1 1/4" Type S or W screws. Glass fiber or mineral fiber with kraft paper facing applied directly over gypsum board. Trusses supporting 15/32" plywood or OSB roof sheathing applied at right angles to trusses with construction adhesive and 6d ring shank nails 12" OC.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with ASTM C840, GA-600 - Fire Resistance Design Manual.

PART 2 PRODUCTS

2.1 GYPSUM BOARD SYSTEM

- A. Manufacturers:
1. U.S. Gypsum Co.
 2. Domtar Gypsum
 3. Gold Bond Gypsum
- B. Gypsum Board Types: See Sections 1.2.1, 1.2.2, and 1.2.3. All Gypsum Board to be maximum permissible length; ends square cut, tapered edges; unless noted otherwise as follows:
1. Standard Type: ASTM C36.
 2. Fire Rated Type: ASTM C36 fire resistive, UL rated.
 3. Moisture Resistant Type: ASTM C630.

4. Gypsum Sheathing: ASTM C79

2.2 ACCESSORIES

- A. Sound Insulation: ASTM C665, preformed mineral wool, friction fit type, thickness as indicated.
- B. Acoustical Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board; manufactured by U. S. Gypsum Co., or equal.
- C. Corner Beads: Metal.
- D. Edge Trim: GA 201 and GA 216, Type LC L bead U shape exposed reveal bead.
- E. Joint Materials: GA 201 and GA 216, reinforcing tape, joint compound, adhesive, and water.
- F. Fasteners: ASTM C1002 Type S12 hardened screws.
- G. Drywall Suspended Grid System: Equal to Armstrong Drywall Grid System
- H. Ceiling Furring – ASTM C645, 7/8" Resilient Furring Channels
- I. Soffit Framing: 1 5/8" Light Gauge Metal Studs – Marino or Equal
- J. "Z" Furring Channels – US Gypsum or Equal

PART 3 EXECUTION

3.1 INSTALLATION – SOFFIT FRAMING

- A. Install studding in accordance with ASTM C754.
- B. Metal Stud Spacing: 16 inches o.c. – See Partition Types on Drawings.
- C. Partition Heights: As indicated on dwgs. Install additional bracing for partitions extending above ceiling.

3.2 INSTALLATION – CEILING FRAMING

- A. Install in accordance with ASTM C754.
- B. Coordinate location of hangers with other work. Install ceiling framing independent of walls, columns, and above ceiling work.
- C. Reinforce openings in ceiling suspension system which interrupt main carrying channels or furring channels, with lateral channel bracing.
- D. Laterally brace entire suspension system.

3.3 INSTALLATION – ACOUSTICAL ACCESSORIES

- A. Install resilient channels at maximum 24 inches on center. Locate joints over framing members.
- B. Place acoustical insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions, and tight to items passing through partitions.

- C. Install acoustical sealant within partitions in accordance with manufacturer's instructions.

3.4 INSTALLATION - GYPSUM BOARD

- A. Install gypsum board in accordance with manufacturer's instructions.
- B. Fasten gypsum board to furring or framing with screws.
- C. Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.
- D. Treat cut edges and holes in moisture resistant gypsum board, with sealant.

3.5 JOINT TREATMENT

- A. Tape, fill & sand exposed joints, edges & corners to produce smooth surface ready to receive finishes.
- B. Feather coats onto adjoining surfaces so that camber is maximum 1/32 inch.
- C. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile.
- D. Erect pre-decorated gypsum board vertically, with exposed batten fastening system.
- E. Erect in accordance with manufacturer's instructions.

3.6 TOLERANCES

- A. Maximum Variation from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 095113

SUSPENDED ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Acoustical tile.

1.2 SYSTEM DESCRIPTION

- A. Install system capable of supporting imposed loads to a deflection of 1/360 maximum.
- B. Conform to applicable code for combustibility requirements for materials.

PART 2 PRODUCTS

2.1 SUSPENSION SYSTEM – TYPE A

- A. Manufacturers: Armstrong; Prelude 15/16" Exposed Tee Grid – Type A Ceiling
- B. Grid: ASTM C635, intermediate duty, non-fire rated, exposed T configuration; components die cut and interlocking.
- C. Accessories: Stabilizer bars, clips, splices, edge moldings as required for suspended grid system.
- D. Grid Materials:
 - 1. Prelude Commercial quality cold rolled steel with galvanized coating.
 - 2. Al Prelude Plus XL: Commercial Quality Aluminum
- E. Grid Finish: White.
- F. Support Channels and Hangers: Galvanized steel, size and type to suit application.

2.2 ACOUSTICAL UNITS – TYPE A

- A. Manufacturers:
Armstrong Dune No. 1774
- B. Acoustical Tiles: Conforming to the following:
 - 1. Size: 24 x 24 inches.
 - 2. Thickness: 5/8 inches.
 - 3. Surface Finish: Non-directional fissured.
 - 4. Edge: Angled Tegular Lay-In
 - 5. Grid: Armstrong Prelude 15/16" exposed tee grid

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that layout of hangers will not interfere with other work.

3.2 INSTALLATION - SUSPENSION SYSTEM

- A. Install system in accordance with manufacturer's instructions.
- B. Coordinate the location of hangers with other work. Where components prevent the regular spacing of hangers, reinforce the system to span the extra distance.
- C. Hang system independent of walls, columns, ducts, pipes and conduit.
- D. Locate system according to reflected plan.
- E. Install edge molding at intersection of ceiling and vertical surfaces, using longest practical lengths.
- F. Install grid so that no tiles are less than 1/2 width.

3.3 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units level, free from damage, twist, warp or dents.

3.4 TOLERANCES

- A. Variation from Flat and Level Surface: 1/8 inch in 10 feet.

END OF SECTION

SECTION 096500

RESILIENT FLOORING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Resilient Sheet Flooring (SV-1)
- B. Luxury Vinyl Tile (LVT)
- C. Vinyl Composition Tile (VCT)
- D. Vinyl Base
- E. Stair Treads and Nosing

1.2 SYSTEM DESCRIPTION

- A. Floor Materials: Conform to applicable code for flame/smoke rating requirements in accordance with ASTM E84.

PART 2 PRODUCTS

2.1 SHEET VINYL AND VINYL COMPOSITION TILE MATERIALS

- A. Sheet Vinyl (SV-1) – ASTM E648 and 662, color and pattern through total thickness:
 - 1. Sheet Width: 79 inches
 - 2. Manufacturers: Equal to Forbo Eternal Material
- B. Luxury Vinyl Tile (LVT) – ASTM E648 and 662, color and pattern through total thickness:
 - 1. Tile Size: Manufacturers Standard
 - 2. Manufacturers: Equal to Forbo Allura Wood LVT HQ
- C. Vinyl Composition Tile: (VCT) ASTM F1066:
 - 1. Size: 12 x 12 inch
 - 2. Thickness: 1/8 inch
 - 3. Design: marbleized
 - 4. Manufacturers:
 - a) Armstrong Style Standard Excelon
 - b) Tarkett Basic or Expressions
 - c) Azrock – Vinyl Composition Tile

2.2 BASE MATERIALS

- A. Base: FS SS-W-40, Vinyl; top set coved toe at resilient flooring, toeless at carpeting; premolded external corners:
 - 1. Height: 4 inch in all areas except lavatories, bathrooms, and laundry room where 6 inch high base is required

Thickness: .080 gauge

2. Manufacturers:
 - a) Armstrong Style Standard Vinyl Base
 - b) Tarkett Standard Cove Base
 - c) Roppe Vinyl Cove Base
 - d) Johnsonite Vinyl Base

- B. Base Accessories: Premolded end stops & external corners, of same material, size & color as base.

2.3 STAIR TREADS AND RISERS

- A. Stair Treads and Risers: ASTM E648; full width and depth of stair tread in one piece; Full width and height of Stair Riser in one piece suitable for installation over Wood Treads and Risers.

Material: Rubber

Thickness: 1/8 Inch

Pattern: Heavy Duty Diamond Tread – Round Nose

Manufacturers: Johnsonite or Equal

2.4 ACCESSORIES

- A. Subfloor Filler: Type recommended by floor material manufacturer.

- B. Adhesives

1. All adhesives used for installation of flooring material shall be those recommended by the flooring manufacturer to suit the grade level, subfloor conditions and usage conditions.
2. All adhesives shall be low VOC or no VOC rated
3. Adhesive Wet Areas
The following rooms are to be considered WET AREAS: Bathrooms, Lavatories, Mechanical Rooms, Laundry and Janitor's Closets. An adhesive rated for wet area installation shall be utilized.

- C. Vinyl Composition Tile (VCT) – Waterproof, Type recommended by floor material manufacturer. (Low VOC)

- D. Edge Strips: Vinyl Snap in type equal to Roppe #152 Snap Down Divider with #178 Flexi-Track. Color to be selected by the Architect.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify wood floor underlayment type and installation are in accordance with the manufacturers recommendations for the specific flooring type that is being installed.
- B. Verify concrete floors are dry to a maximum moisture content of 7 percent, and exhibit negative alkalinity, carbonization, or dusting.
- C. Fill minor or local low spots and other defects with subfloor filler.
- D. Vacuum Clean Substrate

3.2 INSTALLATION - SHEET MATERIAL

- A. Install in accordance with manufacturer's instructions.
- B. Spread adhesive and set flooring in place. Press with heavy roller to attain full adhesion.
- C. All sheet flooring seams in kitchen, restrooms, bathrooms and laundry to be heat welded. (Note: SV Installation to be seamless)
- D. Tile Flooring
Install tile flooring with joints and seams parallel to building lines. Allow minimum 1/2 full size tile width at room or area perimeter.
- E. Terminate flooring at centerline of closed door at openings where adjacent floor finish is dissimilar. Install edge strips where flooring terminates.
- F. Scribe flooring to appurtenances to produce tight joints.

3.3 INSTALLATION - BASE MATERIAL

- A. Adhere base tight to wall and floor surfaces.
- B. Fit joints tight and vertical. Miter internal corners. At external corners, V cut back of base strip to 2/3 of its thickness and fold.

3.4 INSTALLATION – RUBBER TREADS AND RISERS

- A. Install in accordance with the manufacturers instructions.
- B. Adhere materials tight to wall at stair surfaces.

3.5 CLEANING

- A. Vinyl Composition Tile – Clean, strip, seal and wax surfaces in accordance with manufacturers instructions.
- B. Remove excess adhesive from surfaces without damage.
LVT Flooring – wash and dry buff as recommended by the manufacturer.
- C. Clean and Finish all other Resilient Flooring in accordance with the manufacturers requirements.

END OF SECTION

SECTION 096816

CARPET

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Carpet
- B. Entrance Mat

1.2 SYSTEM DESCRIPTION

- A. Carpet Materials: Conform to applicable code for flame/smoke rating requirements in accordance with ASTM E84.
- B. HUD Requirements: Carpet shall comply with HUD Use of Materials Bulletin No. 44d, including the labeling requirements. Type II Class 2 carpeting shall be used in all areas to receive carpeting.
- C. Green Label – All carpeting shall be Green Labeled

1.3 SUBMITTALS

- A. Samples: Submit two samples 18 x 18 inch in size illustrating color and pattern for each carpet material specified.

1.4 MAINTENANCE

- A. Provide one (1) roll width by 50' length of each carpeting of each color selected.

PART 2 PRODUCTS

2.1 CARPET MATERIALS

A. CPT-1: Sleeping Rooms

- | | | |
|----|----------------------|-----------------------------------|
| 1. | Carpet Construction: | Textured |
| 2. | Manufacturer: | Shaw Carpets |
| 3. | Pile fiber: | Nylon |
| 4. | Style: | Shaw Carpets, Ultimate Yield |
| 5. | Color: | 00731 Falcon Wing |
| 6. | Pile face weight: | Minimum 25 ounces per square yard |
| 7. | Dye method: | Solution Dyed |
| 8. | Installation Method: | Direct Glue |
| 9. | Transition strips: | Brushed Chrome |

B. CPT-2: Common Areas & Stairs

- | | | |
|----|-------------|----------|
| 1. | Rating: | Class A. |
| 2. | Pile Fiber: | Nylon |

3. Manufacturer: Shaw Philadelphia
4. Style: Level loop "Camden Harbor", color to be determined
5. Carpet Accent/Border: Philadelphia, "Empathic", color to be determined
6. Backing: Polypropylene
7. Pile Face Weight: Minimum 28 ounces per square yard
8. Die Method: Solution
9. Installation Method: Direct Glue Down over concrete or underlayment

C. Entrance Mats, Elevator Carpeting - Equal to the following criteria:

1. Manufacturer: Van Dijk Carpet
2. Style: Hercules – Needle punch Texture
3. Color: Selection by the Architect
4. Installation: Lay-In, Glue Down

2.2 ACCESSORIES

- A. Subfloor Filler: Type recommended by carpet manufacturer.
- B. Adhesive: Latex adhesive for direct gluedown installation.
- C. Carpet Gripper: Type recommended by carpet manufacturer to suit application, with attachment devices.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify that substrate surfaces are smooth and flat with maximum variation in 1/4 inch in 10 ft are ready to receive work.
- B. Fill minor or local low spots and other defects with subfloor filler.
- C. Vacuum floor surfaces.

3.2 INSTALLATION – CARPET ADHESIVE APPLIED

- A. Apply carpet and adhesive in accordance with manufacturers' instructions.
- B. Verify carpet match before cutting to ensure minimal variation between dye lots.
- C. Double cut carpet, to allow intended seam and pattern match. Make cuts straight, true, and unfrayed. Edge seam carpet at public areas.
- D. Locate seams in area of least traffic.
- E. Join seams by hot adhesive tape method. Form seams straight, not overlapped or peaked, and free of gaps.
- F. Lay carpet tight and flat on subfloor, well fastened at edges, with a uniform appearance. Provide monolithic color, pattern, and texture match within any one area.
- G. Do not change run of pile in any room where carpet is continuous through a wall opening into another room. Locate change of color or pattern between rooms under door centerline.

- H. Cut and fit carpet around interruptions.
- I. Fit carpet tight to intersection with vertical surfaces without gaps.
- J. Install carpet continuously to stair treads and risers, full width. Install in one piece. Adhere over entire surface. Fit accurately and securely, tight to treads and risers. Adhere carpet on treads and risers and butt tight to nosing.

3.4 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 099000

PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Surface preparation and field application of paints and coatings.

1.2 SYSTEM DESCRIPTION

- A. Finish Materials: Conform to applicable code for flame/smoke rating requirements.

1.3 SUBMITTALS

- A. Product Data: Provide data on all finishing products.

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Store and apply materials in environmental conditions required by manufacturer's instructions.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Manufacturers:
 - 1. Pratt and Lambert, Inc.
 - 2. Benjamin Moore Company.
 - 3. The Glidden Company.
 - 4. The Sherwin-Williams Company
- B. All paint shall be low VOC or no VOC rated
- C. Material quality: Provide best quality grade of various types of coatings as regularly manufactured by acceptable paint materials manufacturers. Materials not displaying manufacturer's identification as a standard, best-grade product will not be acceptable.
- D. Coatings: Ready mixed except field catalyzed coatings of good flow and brushing properties, capable of drying or curing free of streaks or sags.
- E. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials required to achieve the finishes specified.

2.2 FINISHES

- A. Refer to finish schedule on Drawing Sheet A10.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify that substrate conditions are ready to receive work.
- B. Measure moisture content of porous surfaces using an electronic moisture meter. Do not apply finishes unless moisture content is less than 12 percent.

- C. Correct minor defects and clean surfaces which affect work of this Section.
- D. Remove electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- E. Gypsum Board Surfaces: Fill minor defects w/ latex compounds. Spot prime defects after repair.
- F. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- G. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove foreign matter. Remove oil and grease with a solution of tri-sodium phosphate, rinse well and allow to dry.
- H. Uncoated Ferrous Surfaces: Remove scale by wire brushing, sandblasting, clean by washing with solvent. Apply treatment of phosphoric acid solution. Prime paint after repairs.
- I. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust, clean surfaces with solvent. Prime bare steel surfaces.
- J. Interior Wood Items Scheduled to Receive Paint Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.
- K. Interior Wood Items Scheduled to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats.
- L. Exterior Wood Scheduled to Receive Paint Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior caulking compound after prime coat has been applied.
- M. Exterior Wood Scheduled to Receive Transparent Finish: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior caulking compound after sealer has been applied.

3.2 APPLICATION

- A. Apply products in accordance with manufacturer's instructions.
- B. Sand transparent finishes lightly between coats to achieve required finish.
- C. Where clear finishes are required, tint fillers to match wood.
- D. Back prime interior and exterior wood work scheduled to receive paint finish with primer paint.
- E. Back prime interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.

3.3 CLEANING

- A. As work proceeds, promptly remove finishes where spilled, splashed, or spattered.

3.4 SCHEDULE - EXTERIOR SURFACES

- A. Wood and PVC Trim Pieces - Painted (Opaque):
 - 1. One coat of acrylic latex primer sealer.
 - 2. Two coats of acrylic latex satin finish.
- B. Wood - Transparent:
 - 1. One coat of stain.
 - 2. Two coats of sealer.
- C. Steel - Shop Primed:
 - 1. Touch-up with alkyd primer.
 - 2. Two coats of latex semi-gloss.
- D. Steel - Galvanized:
 - 1. One coat of galvanize primer.
 - 2. Two coats of latex semi-gloss.

3.5 SCHEDULE - INTERIOR SURFACES

- A. Wood - Painted:
 - 1. One coat of latex primer sealer.
 - 2. Two coats of latex enamel, semi-gloss.
- B. Wood - Transparent:
 - 1. Filler coat for open grained wood only.
 - 2. Two coats of stain.
 - 3. One coat of sealer.
 - 4. Two coats of polyurethane satin.
- C. Concrete, Concrete Block:
 - 1. One coat of primer sealer alkyd.
 - 2. Two coats of latex, flat.
- D. Steel - Unprimed:
 - 1. One coat of alkyd primer.
 - 2. Two coats of latex enamel, semi-gloss.
- E. Steel - Primed:
 - 1. Touch-up with original primer.
 - 2. Two coats of latex enamel, semi-gloss.
- F. Steel - Galvanized:
 - 1. One coat of galvanize primer.
 - 2. Two coats of latex enamel, semi-gloss.
- G. Plaster, Gypsum Board:
 - 1. Provide one coat LATEX Primer Sealer and two (2) coats Flat Latex Paint to all interior walls and ceilings except in bathrooms, kitchens, and public spaces where one coat LATEX primer and Two (2) coats scrub able eggshell latex paint shall be used.
 - 2. Public corridors and rooms receiving a chair rail shall be painted two colors – one below the chair rail and another above the chair rail.

L'Dor Assisted Living
West Clarkstown Road, New City, NY

Painting
Section 099000 - 4

3.8 SCHEDULE - COLORS - As Selected by the Architect

END OF SECTION

SECTION 101005

MISCELLANEOUS SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Closet Shelving and Storage System
- B. Fire Extinguisher Cabinets – Fire Rated
- C. Fire Extinguishers
- D. Cabinets
- E. Quartz Countertops
- F. Vanity Countertops
- G. Corner Guards
- H. Access Panels
- I. Stair Handrails
- J. Signage
- K. FRP Wainscot Panel
- L. Corridor Handrails

1.2 SYSTEM DESCRIPTION

- A. Provide all materials to complete the following as indicated or implied in the Drawings and Specifications. Installation of all materials noted in this Section will be by the Finish Carpentry Contractor.

1.3 SUBMITTALS

- A. Shop Drawings: Indicate component locations, dimensions, details of blocking and attachment, and anchors.
- B. Product Data: Provide data on product, accessories, and method of attachment.
- C. Operating and Maintenance Instructions: Include relevant instructions.
- D. Submit manufacturer's installation instructions.
- E. Include maintenance information on regular cleaning and stain removal.

1.4 QUALITY ASSURANCE

- A. Perform all work in accordance with manufacturer's recommendations.
- B. Fire Extinguisher: Conform to NFPA 10.

PART 2 PRODUCTS

2.1 CLOSET SHELVING AND STORAGE SYSTEM

- A. Manufacturer:
Closet Maid
Lee/Rowan
Stanley
- B. Product: Vinyl clad wire shelving and mounting accessories.
Description
Pole & Shelf – 12" Deep, Normal Mesh
Shelving Only – 16" Deep, Fine Mesh
Linen Closet Shelving – 12" Deep, Normal Mesh

2.2 FIRE EXTINGUISHER CABINETS

- A. Manufacturer – Equal to: Larsens; Model FS 2409-6R.
- B. Product: White baked enamel fire rated steel cabinet with horizontal duo door.
- C. Quality: Provide Twelve (12) Fire Extinguisher Cabinets.
- D. Locations: As indicated on the floor plans.

2.3 FIRE EXTINGUISHERS

- A. Manufacturer: Larsens; Model MP10 or equal.
J.L. Industries; Cosmic 10E
- B. Dry Chemical Type: Steel tank, with pressure gage 4A-60B:C; Model MP10 manufactured by Larsens.
- C. Quality: Provide Twelve (12) Fire Extinguishers
- D. Locations: As indicated on the floor plans.

2.4 CABINETS

- A. Manufacturer equal to Merillat Classic Series Cabinets – Portrait w/Solid Drawer Front painted finish.
- B. Product: Base and wall cabinets as indicated on the Drawings with all accessories required for a complete installation.
- C. Cabinet Description:
Frames: All frames are built of solid 3/4" hard wood, kiln-dried rails, joined by mortise and tenon

w/glue.

End Panels: 1/2" hardwood veneer plywood fastened to front frame with full 1/2" tongue and groove, recessed 1/8" from edge.

Backs: 1/8" hardboard, recessed in sides.

Bottoms: 3/16" hardwood, dadoed into sides and power nailed into supporting strips.

Mounting Strips: 3/4" x 1-1/2", located at top.

Corners: Wood blocks glued and power nailed.

Toe Kick: 3/4" x 3-1/2" pine.

Shelf: 1/2" plywood core 11" deep dadoed into sides, with a wood grain-printed wrap and rounded front edge.

Doors – Solid Hardwood Door Frame with recessed flat panel.

Hardware: Self-closing hinges, which are interlocking and self-adjusting. 4" Wire

Pulls on all drawers and doors (US 260 Finish). Submit sample to Architect for approval.

Finish: Paint finish factory applied.

Color: As selected by the Architect.

- D. Certification: All kitchen cabinets shall be delivered to the site bearing the certification label of conformance to the Kitchen Cabinet Manufacturers Association Standards.
ANSI/KCMA A161-1.

2.5 QUARTZ COUNTERTOPS

- A. Manufacturer equal to: Cambria Quartz Surfaces
- B. Product: Quartz Countertops and 4" Backsplash, 2 cm thick, standard color as selected by the Architect.

2.6 VANITY TOPS

- A. Manufacturer equal to: RYNONE – 30 Series
- B. Product: Cultured Marble top with integral center bowl, size as indicated on the drawings, standard color as selected by the Architect.

2.7 ACCESS PANEL

- A. Manufacturer equal to: Bar-Co Fire Rated Access Door.
Cesco Type FB.
Karp - KRP - 150FR.
- B. Fire Rated: Quantity (2) Access Panels 22" x 30" – 60 minute rating
- C. Non Rated Panels: 24" x 24" non rated access panels in each apartment to access ERV unit. Verify specific location with HVAC contractor.

2.8 STAIR HANDRAIL

- A. Bracket Manufacturer: Stanley CD80-4100
EconoRail - Cast brass 1-1/2" round
J.G. Braun Co - No. 4402

- B. Product: 1-1/2" diameter oak handrail, mounting brackets 48" o.c. with ends returning to the wall. Polyurethane finish – See Section 09900.

2.9 INTERIOR SIGNAGE

- A. Manufacturer equal to Mohawk Sign Systems Inc.
- B. Product: Standard ADA Signs - Mohawk Series 200 A Type B Format.
- C. ADA Requirements: All standard signage shall conform to all ADA requirements. All sign lettering to be in Braille as well as normal lettering.

2.10 FRP PANEL – KITCHEN AREA

- A. Manufacturer: Kemlite Fire-X Glassboard.
- B. Product: Fiberglass reinforced plastic panels (Class A Fire Rated) and all required moldings, adhesive, etc. for a complete installation. Color to be selected by the Architect.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify that surfaces and internal wall blocking are ready to receive work and opening dimensions are as indicated on shop drawings.

3.2 INSTALLATION - CLOSET SHELVES AND POLE SYSTEM

- A. Install shelving in accordance with manufacturer's instructions. Shelving mounting brackets to be attached to wood blocking or wood studs. Finish screws are to be used to attach brackets to wall.
- B. Secure units level and plumb.

3.3 INSTALLATION - FIRE EXTINGUISHER CABINETS

- A. Install cabinets in accordance with manufacturer's instructions at locations determined by the Architect.
- B. Secure units level and plumb.

3.4 INSTALLATION - FIRE EXTINGUISHERS

- A. Install extinguishers in accordance with manufacturer's instructions.
- B. Install units level and plumb in cabinets and surface mount as indicated on the drawings.

3.5 INSTALLATION - CABINETS

- A. Install cabinets and accessories in accordance with manufacturer's instructions.
- B. Product: Cabinets and accessories as indicated on the Detail Drawing No. A7 and A8

3.6 INSTALLATION – QUARTZ COUNTERTOPS AND BACKSPLASH

- A. Install Quartz countertops & backsplash in accordance with manufacturers instructions
- B. Secure tops level & plumb
- C. Caulk between top & wall

3.7 INSTALLATION – VANITY TOPS

- A. Install vanity tops in accordance with manufacturers instructions
- B. Secure tops level & plumb
- C. Caulk between top & wall

3.8 INSTALLATION - ACCESS PANELS

- A. Install attic access panels in accordance with manufacturer's instructions.
- B. Furnish and install access panels at locations approved by the Architect.

3.9 INSTALLATION - HANDRAIL

- A. Install stair handrail in accordance with manufacturer's instructions.
- B. Handrail to be installed as indicated on the Detail Drawing.

3.10 INSTALLATION – CORRIDOR HANDRAIL

- A Handrail to be installed as indicated on the Detail Drawing.

3.11 INSTALLATION – SIGNAGE

- A. Install signage in accordance with manufacturer's instructions.
- B. Interior Signage Schedule

<u>Door Location</u>	<u>Sign to Read</u>
Next to Apartment Doors	101-118 201-222
B02, 227	Mechanical
B03	Electric Room
B05, B09, B13, 102, 104, 146, 203, 205, 223, 230	Storage
B04, 113	Pantry

B07, B10	Physical Therapy
B10A	Beauty Parlor
B11, 131, 214	Lavatory
B08, 114, 213, 216, 221	Office
B15	Water Room
B16	Staff Locker Room
110, 123	Dining
122	Private Dining
121, 125, 124	Medical Office
126	Administration
128, 133	Conference
144	Therapy
145	Doctor Office
210	Library
211	Computer Lounge
212	Television Room
218	Activities
229	Tub Room
Next to Elevator Doors (2 – Required)	IN FIRE EMERGENCY DO NOT USE ELEVATOR USE EXIT STAIRS (WITH SYMBOL)
Inside Stairways at Doors	STAIR 1 BASEMENT EXIT THIS LEVEL
	STAIR 1 FLOOR 1 EXIT ON BASEMENT
	STAIR 1 FLOOR 2 EXIT ON BASEMENT
	STAIR 2 BASEMENT EXIT ON THIS LEVEL
	STAIR 2

FLOOR 1
EXIT ON BASEMENT

STAIR 3
BASEMENT
EXIT ON THIS LEVEL

STAIR 3
FLOOR 1
EXIT ON BASEMENT

STAIR 3
FLOOR 2
EXIT ON BASEMENT

STAIR 4
FLOOR 1
EXIT ON THIS LEVEL

STAIR 4
FLOOR 2
EXIT ON 1

STAIR 5
FLOOR 1
EXIST ON THIS LEVEL
STAIR 5
FLOOR 2
EXIT ON 1

B18, 138 WOMEN'S LAVATORY WITH HANDICAP SYMBOL

B17, 139 MEN'S LAVATORY WITH HANDICAP SYMBOL

NEXT TO STAIR DOOR
201, 206, 222, 225, 231 Exit Stair with symbol

B01, B19, B20, 106, 148 Exit

108, 208 Laundry

109, 202, 209, 226 Linen Closet

103, 116, 143, 204, 228 Janitor Closet

3.11 INSTALLATION - FRP PANEL

- A. Install FRP panels in accordance with manufacturer's instructions.
- B. Install top edge "J" molding and T moldings at all panel butt joints. Caulk between panels, floor, and service sink.

END OF SECTION

SECTION 102800

TOILET AND BATH ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Toilet and bath, shower, washroom accessories.
- B. Grab bars.
- C. Section 06100 - Rough Carpentry: Placement of concealed anchor devices.

1.2 SYSTEM DESCRIPTION

- A. Conform to applicable code for installing work in conformance with ANSI A117.1.

1.2 SUBMITTALS

- A. Product Data: Provide data on accessories describing size, finish, details of function, attachment methods.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Manufacturers: American Specialties, Inc., or equal.
 - A&J Washroom Accessories
 - Bobrick Washroom Accessories
- B. Sheet Steel: ASTM A366.
- C. Stainless Steel Sheet: ASTM A167 Type 304.
- D. Tubing: ASTM A269 stainless steel.
- E. Plastic Laminate: General Purpose; 1/16 inch thick, finish, color, pattern, as selected.
- F. Adhesive: Two component epoxy, waterproof.
- G. Fasteners, Screws, and Bolts: Hot dip galvanized steel.

2.2 FABRICATION

- A. Form surfaces flat without distortion. Weld and grind joints smooth.
- B. Shop assemble components and package with anchors and fittings.
- C. Back paint components to prevent electrolysis.
- D. Provide steel anchor plates, adapters, and anchor components for installation.
- E. Hot dip galvanize exposed and painted ferrous metal and fastening devices.

2.3 FINISHES

- A. Anchors: Galvanize to 1.25 oz/sq yd.
- B. Ferrous Metals - Shop Primed: Pre-treat and clean, spray apply one coat primer and bake.
- C. Enamel: Pre-treat, one coat primer and two coats electrostatic baked enamel.
- D. Chrome/Nickel Plating: ASTM B456, Type SC 2; satin polished finish.
- E. Stainless Steel: No. 4 satin luster finish.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify exact location of accessories for installation.
- B. Deliver inserts & rough-in frames to site. Provide templates & rough-in measurements as required.

3.2 INSTALLATION

- A. Install fixtures, accessories and items in accordance with manufacturers' instructions.
- B. Install plumb and level, securely and rigidly anchored to substrate.

3.3 ACCESSORIES SCHEDULE

MK	Name	Description	MFR	Cat. No.	Remarks
MC	Medicine Cabinet	Surf. Mtd.	Jensen	18x30 SS8 WB/ST	18" x 30" surface mount, single door, medicine cabinet
M-1	Mirror	Surf. Mtd.	-	-	18"x36", Beveled Edge, Provide cutout Soap Dispenser
TPH-1	Tissue Holder	Single Roll -Surf Mtd	A & J	UC41	
TPH-2	Tissue Holder	Double Roll-Surf Mtd	A & J	U804	Lock
GB-18	Grab Bar	1 1/2" dia. x 18" L	A & J	UG130A	Provide Blocking
GB-36	Grab Bar	1 1/2" dia. x 36" L	A & J	UG130A	Provide Blocking
GB-42	Grab Bar	1 1/2" dia. x 42" L	A & J	UG130A	Provide Blocking
TB-12, 18, 24	Towel Bar	Towel Bar Length as Indicated	A & J	UC31	Provide Blocking
H	Towel Hook	Double Towel Hook	A & J	UC12	Provide Blocking

CR	Curtain Rod	1" dia. x 60" L	A & J	UX163	Provide Blocking
SD	Sensor Activated Soap Dispenser	Surf. Mtd	A & J	U135 EA	Provide Batteries & Blocking
PTD	Sensor Activated Paper Towel Dispenser	Surf. Mtd	A & J	U199	Provide Batteries & Blocking

END OF SECTION

SECTION 113013
RESIDENTIAL APPLIANCES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Washer, Dryer

1.2 SYSTEM DESCRIPTION

- A. Equipment: Conform to applicable code for UL approval.

1.3 SUBMITTALS

- A. Product Data: Provide data on equipment and accessories.
- B. Operating and Maintenance Instructions: Include relevant instructions.
- C. Submit manufacturer's installation instructions.

1.4 WARRANTY

- A. Provide twelve-month warranty under provisions of Section 01001.

PART 2 PRODUCTS

2.1 WASHER AND DRYER

- A. Manufacturer equal to Maytag Commercial Laundry
- B. Washer - Model Maytag #MHN33PD, Front Load Washer, Coin Operated, Energy Star, free standing type, color – white.
- C. Dryer - Model Maytag #MLE26PD – stack electric dryers, coin operated, free standing type, removable lint screen, color – white

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify that openings and utility services are ready to receive work and opening dimensions are as indicated on shop drawings.

3.2 INSTALLATION

- A. Install equipment in accordance with manufacturer's instructions.
- B. Set and adjust units level and plumb.
- C. Activate units to confirm correct operation.

END OF SECTION

SECTION 122416

PLEATED WINDOW SHADES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pleated Shades

1.2 SYSTEM DESCRIPTION

- A. Pleated Shades: All First and Second Floor Windows

1.3 SUBMITTALS

- A. Product Data: Provide data indicating colors available.
- B. Samples: Submit two samples, 4 inches long illustrating shade materials and finish, color, cord and color.

PART 2 PRODUCTS

2.1 HORIZONTAL LOUVER BLIND

- A. Manufacturers: Equal to Hunter Douglas Pleated Shades
- B. Width: Each Window opening shall be fitted with a single pleated shade equal to the width of that opening.
- C. Material: Manufacturer's Standard Materials and Colors
- D. Privacy & Light Control: Softened Light, Substantial Privacy
- E. Operating System: Cordlock Operation
- F. Cord: Braided nylon: continuous loop, free and weighted.
- G. Head Support Bracket: Manufacturer's Standard
- H. Accessory Hardware: Type recommended by shade manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify that openings are ready to receive work.

3.2 INSTALLATION

- A. Install pleated shades in accordance with manufacturer's instructions.
- B. Secure in place with concealed fasteners.
- C. Adjust shades for smooth operation.

END OF SECTION

SECTION 142400

HYDRAULIC ELEVATORS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Passenger elevator system, One (1) required.
- B. Motor and pump, controllers, and equipment.

1.2 SYSTEM DESCRIPTION

- A. Hydraulic Elevator System: One unit; buried cylinder and casing or hole less hoist way cylinder, with motor and pump adjacent to hoistway. Equal to KONE MonoSpace 500, Above Ground (1-stage)
- B. Characteristics of the elevator are as follows:
 - 1. Rated Net Capacity: 4,000 lbs.
 - 2. Rated Speed: 150 FPM
 - 3. Door Height: 7' – 0"
 - 4. Door Width: 48"
 - 5. Car height: 8' – 0"
 - 6. Shaft size (w x d): 7' 8" x 9' 2"
 - 7. Door Type: Single leaf.
 - 8. Door Operation: Side opening.
 - 9. Elevator No.1: Number of Stops: 3
 - 10. Elevator No.1: Number of Openings: 3
 - 11. Handrails: two side walls – 1 ½" diameter.
 - 12. Provide Removable wall mats.
- C. Finishes
 - 1. Floor Finish to be Sheet Vinyl No. 1 (SV-1) which will be furnished and installed by the Flooring Contractor.
 - 2. Wall and Ceiling Panels must be Powder Coat
 - 3. Handrails must be Stainless Steel
 - 4. Lighting must be Downlight with LED
 - 5. Hoistway Door & Frame: Powder Coat
 - 6. Cab Door & Front Wall Finish: Brushed Stainless Steel
- D. Controls System: Conform to the following criteria:
 - 1. Single Automatic Operation elevator control system.
 - 2. Lighted call button at each landing.
 - 3. Position indicator in the car.
 - 4. Prominent direction arrows in the car and at each landing.
 - 5. Audible signals which sound at each floor, sounding once in the up direction and sounding twice in the down direction.
 - 6. Emergency call phone connected to the reception office

7. An in-car alarm button.
8. Additional Traveling Cables for the installation of an electronic reader for floor access and a closed circuit TV camera.
9. Electronic lock out of all floors

- E. Special Operational Features:
1. Interconnect with building fire and smoke alarm system.

1.3 SUBMITTALS

- A. Shop Drawings: Indicate the following minimum information on shop drawings:
1. Motor and hydraulic pump, valves, and other component locations.
 2. Car, supporting beams, guide rails, and other components in hoistway.
 3. Loads on hoisting beams.
 4. Elevator control functions and operational description.
- B. Product Data: Provide data on the following items:
1. Signal and operating fixtures, operating panels, indicators.
 2. Cab design, dimensions, layout, and components.
 3. Cab and hoistway door and frame details.
- C. Schematic: Provide legible schematic of hydraulic piping and electric wiring diagrams describing installed equipment. Provide one copy of master schematic, mounted in plastic glazed metal frame, mounted on machine room wall.
- D. Samples: Submit three samples illustrating cab floor material, cab interior finishes, cab and hoistway door and frame finishes.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with the following:
1. ANSI A117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People and the Uniform Federal Accessibility Standards.
 2. ANSI/ASME A17.1 - Safety Code for Elevators and Escalators.
 3. ANSI/UL 10B - Fire Tests of Door Assemblies.
 4. Building Code of New York State
 5. Applicable Local Building Codes
 6. HUD Minimum Property Standards

1.5 MAINTENANCE

- A. Include description of elevator system's method of operation, control description, motor control system, cab and hoistway door operation, visual and audio signals, and specified non-standard features.
- B. Include a parts catalog with complete list of equipment replacement parts.
- C. Include legible schematic wiring diagrams of installed electrical equipment.

1.6 GUARANTEE

- A. Provide written guarantee from the manufacturer to cover parts and components for a period of

- B. Repairs or replacements made under the guarantee, must be guaranteed for an additional one year period.

1.7 SERVICE CONTRACT

- A. Elevator Contractor must provide a service contract to cover maintenance and callback service for a period of one year after the date of final acceptance by Owner. Coverage must include regular and systematic examination, adjustment, lubrication, and repair and/or replacement of equipment whenever required by the wear and tear of normal elevator usage. A service contract must be in continual enforcement for the entire length of the regulatory period.
- B. Owners are required to provide an Annual Service Contract for continual coverage for the entire length of the regulatory period. Service Contracts are to provide the same level of coverage as outlined above.

PART 2 PRODUCTS

A.1 ELEVATOR SYSTEM AND COMPONENTS

- A. Manufacturers: Equal to: KONE MonoSpace 500 4,000-pound hydraulic elevator
- B. Structural Components, Cylinder and Casing: Required to construct elevator system and conform to code.
- C. Sheet Steel: ASTM A366 Class 1.
- D. Stainless Steel: ASTM A167 Type 304, No. 4 finish.
- E. Aluminum: ASTM B221, extruded.
- F. Motors, Pumps, Valves, Regulators, Fluid Tank, Hydraulic Fluid, Controller, Controls, Buttons, Wiring and Devices, Indicators: UL approved.
- G. Spring Buffers, Attachment Brackets and Anchors: Purpose designed, sized according to code with safety factors.
- H. Pump Housing: Sheet steel, acoustically insulated, removable.

2.2 ELECTRICAL CHARACTERISTICS AND COMPONENTS

- A. Electrical Characteristics: 25 h.p., 208 volt, 3 phase, 60 cycle.
- B. Disconnect Switches: Provided by the electrical contractor.
- C. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., or other testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify that hoistway, pit and machine room are ready for work of this Section.
- B. Verify shaft and openings are of correct size and within tolerances.
- C. Verify that electrical power is available and of the correct characteristics.

3.2 INSTALLATION

- A. Install in accordance with ANSI/ASME A17.1.
- B. Install system components and connect to building utilities.
- C. Accommodate equipment in space indicated.
- D. Coordinate installation of hoistway wall construction.
- E. Grout sills in place. Set entrances in vertical alignment with car openings and aligned with plumb hoistway lines.
- F. Fill hoistway door frames solid with grout.
- G. Adjust for smooth acceleration and deceleration of car so not to cause passenger discomfort.
- H. Adjust automatic floor leveling feature at each floor to achieve 1/4 inch from flush.

3.3 TESTS BY REGULATORY AGENCIES

- A. Obtain required permits to perform tests. Perform tests required by regulatory agencies.

END OF SECTION

SECTION 210500 - BASIC FIRE SUPPRESSION REQUIREMENTS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide all labor, tools, materials, accessories, parts, transportation, taxes, and related items, essential for installation of the work and necessary to make work, complete, and operational. Provide new equipment and material unless otherwise called for. References to codes, specifications and standards called for in the specification sections and on the drawings mean, the latest edition, amendment and revision of such referenced standard in effect on the date of these contract documents. All materials and equipment shall be installed in accordance with the manufacturer's recommendations.

1.2 LICENSING

- A. The Contractor shall hold a license to perform the work as issued by the authority having jurisdiction.
- B. Plumbing contract work shall be performed by, or under, the direct supervision of a licensed master plumber.
- C. Electrical contract work shall be performed by, or under, the direct supervision of a licensed electrician.

1.3 PERMITS

- A. Apply for and obtain all required permits and inspections, pay all fees and charges including all service charges. Provide certificate of approval from the Authorities Having Jurisdiction prior to request for final payment.
- B. Provide electrical inspection certificate of approval from Middle Department Inspection Agency, Commonwealth Inspection Agency, or an Engineer approved Inspection Agency prior to request for final payment.

1.4 CODE COMPLIANCE

- A. Provide work in compliance with the following:
 - 1. 2020 Building Code of New York State.
 - 2. 2020 Fire Code of New York State.
 - 3. 2020 Plumbing Code of New York State.
 - 4. 2020 Mechanical Code of New York State.
 - 5. 2020 Fuel Gas Code of New York State.
 - 6. 2020 Property Maintenance Code of New York State.
 - 7. 2020 Energy Conservation Code of New York State.

8. Accessible and Usable Buildings and Facilities, ICC A117.1 (2009).
9. New York State Department of Labor Rules and Regulations.
10. New York State Department of Health.
11. 2017 National Electrical Code (NEC).
12. Occupational Safety and Health Administration (OSHA).
13. Local Codes and Ordinances.
14. Life Safety Code, NFPA 101.

1.5 GLOSSARY

ACI	American Concrete Institute
AGA	American Gas Association
AGCA	Associated General Contractors of America, Inc.
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AFBMA	Anti-Friction Bearing Manufacturer's Association
AMCA	Air Moving and Conditioning Association, Inc.
ANSI	American National Standards Institute
ARI	Air Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.
ASME	American Society of Mechanical Engineers
ASPE	American Society of Plumbing Engineers
ASTM	American Society for Testing Materials
AWSC	American Welding Society Code
AWWA	American Water Works Association
FM	Factory Mutual Insurance Company
IBR	Institute of Boiler & Radiation Manufacturers
IEEE	Institute of Electrical and Electronics Engineers
IRI	Industrial Risk Insurers
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association

NYS/DEC	New York State Department of Environmental Conservation
SBI	Steel Boiler Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
UFPO	Underground Facilities Protective Organization
UL	Underwriter's Laboratories, Inc.
OSHA	Occupational Safety and Health Administration
XL - GAP	XL Global Asset Protection Services

1.6 DEFINITIONS

Acceptance	Owner acceptance of the project from Contractor upon certification by Owner's Representative.
As Specified	Materials, equipment including the execution specified/shown in the contract documents.
Basis of Design	Equipment, materials, installation, etc. on which the design is based. (Refer to the article, Equipment Arrangements, and the article, Substitutions.)
Code Requirements	Minimum requirements.
Concealed	Work installed in pipe and duct shafts, chases or recesses, inside walls, above ceilings, in slabs or below grade.
Coordination Drawings	Show the relationship and integration of different construction elements and trades that require careful coordination during fabrication or installation, to fit in the space provided or to function as intended.
Delegated-Design Services	<p>Performance and Design criteria for Contractor provided professional services. Where professional design services or certifications by a design professional are specifically required of a Contractor, by the Contract Documents. Provide products and systems with the specific design criteria indicated.</p> <p>If criteria indicated is insufficient to perform services or certification required, submit a written request for additional information to the Engineer.</p> <p>Submit wet signed and sealed certification by the licensed design professional for each product and system specifically assigned to the Contractor to be designed or certified by a design professional.</p> <p>Examples: structural maintenance ladders, stairs and platforms, pipe anchors, seismic compliant system, wind, structural supports for material equipment, sprinkler hydraulic calculations.</p>
Equal, Equivalent, Equal To, Equivalent To, As Directed and As Required	Shall all be interpreted and should be taken to mean "to the satisfaction of the Engineer".
Exposed	Work not identified as concealed.
Extract	Carefully dismantle and store where directed by Owner's Representative

	and/or reinstall as indicated on drawings or as described in specifications.
Furnish	Purchase and deliver to job site, location as directed by the Owner's Representative.
Inspection	Visual observations by Owner's site Representative.
Install	Store at job site if required, proper placement within building construction including miscellaneous items needed to affect placement as required and protect during construction. Take responsibility to mount, connect, start-up and make fully functional.
Labeled	Refers to classification by a standards agency.
Manufacturers	Refer to the article, Equipment Arrangements, and the article, Substitutions.
Prime Professional	Architect or Engineer having a contract directly with the Owner for professional services.
Product Data	Illustrations, standard schedules, performance charts, instructions, brochures, wiring diagrams, finishes, or other information furnished by the Contractor to illustrate materials or equipment for some portion of the work.
Provide (Furnish and Install)	Contractor shall furnish all labor, materials, equipment and supplies necessary to install and place in operating condition, unless otherwise specifically stated.
Relocate	Disassemble, disconnect, and transport equipment to new locations, then clean, test, and install ready for use.
Remove	Dismantle and take away from premises without added cost to Owner, and dispose of in a legal manner.
Review and Reviewed	Should be taken to mean to be followed by "for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents".
Roughing	Pipe, duct, conduit, equipment layout and installation.
Samples	Physical full scale examples which illustrate materials, finishes, coatings, equipment or workmanship, and establishes standards by which work will be judged.
Satisfactory	As specified in contract documents.
Shop Drawings	Fabrication drawings, diagrams, schedules and other instruments, specifically prepared for the work by the Contractor or a Sub-contractor, manufacturer, supplier or distributor to illustrate some portion of the work.
Site Representative	Owner's Inspector or "Clerk of Works" at the work site.
Submittals Defined (Technical)	<p>Any item required to be delivered to the Engineer for review as requirement of the Contract Documents.</p> <p>The purpose of technical submittals is to demonstrate for those portions of the work for which a submittal is required, the manner in which the Contractor proposes to conform to the information given and design concepts expressed and required by the Contract Documents.</p>

1.7 SHOP DRAWINGS/PRODUCT DATA/SAMPLES

- A. Provide submittals on all items of equipment and materials to be furnished and installed. Submittals shall be accompanied by a transmittal letter, stating name of project and contractor, name of vendor supplying equipment, number of drawings, titles, specification sections (name and number) and other pertinent data called for in individual sections. Submittals shall have individual cover sheets that shall be dated and contain: Name of project; name of prime professional; name of prime contractor; description or names of equipment, materials and items; and complete identification of locations at which materials or equipment are to be installed. Individual piecemeal or incomplete submittals will not be accepted. Similar items, (all types specified) shall be submitted at under one cover sheet per specification section (e.g. valves, plumbing fixtures, etc.). Number each submittal by trade. Indicate deviations from contract requirements on Letter of Transmittal. Submittals will be given a general review only. Corrections or comments made on the Submittals during the review do not relieve Contractor from compliance with requirements of the drawings and specifications. The Contractor is responsible for: confirming and correcting all quantities; checking electrical characteristics and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades; and performing his work in a safe and satisfactory manner. If submitting hard copies, submit four (4) copies for review.
- B. If submittals are to be submitted electronically, all requirements in Item A apply. Submittals shall be emailed in PDF format to specific email address provided by the Construction Manager, General Contractor, Architect or Project Manager. Name of project shall be in subject line of email. Send emails to mealbasubmittalclerk@meengineering.com.
- C. Refer to Division 01 for additional requirements.

1.8 PROTECTION OF PERSONS AND PROPERTY

- A. Contractor shall assume responsibility for construction safety at all times and provide, as part of contract, all trench or building shoring, scaffolding, shielding, dust/fume protection, mechanical/electrical protection, special grounding, safety railings, barriers, and other safety feature required to provide safe conditions for all workmen and site visitors.

1.9 EQUIPMENT ARRANGEMENTS

- A. The contract documents are prepared using one manufacturer as the Basis of Design, even though other manufacturers' names are listed. If Contractor elects to use one of the listed manufacturers other than Basis of Design, submit detailed drawings, indicating proposed installation of equipment. Show maintenance clearances, service removal space required, and other pertinent revisions to the design arrangement. Make required changes in the work of other trades, at no increase in any contract. Provide larger motors, feeders, breakers, and equipment, additional control devices, valves, fittings and other miscellaneous equipment required for proper operation, and assume responsibility for proper location of roughing and connections by other trades. Remove and replace doorframes, access doors, walls, ceilings, or floors required to install other than Basis of

Design. If revised arrangement submittal is rejected, revise and resubmit specified Basis of Design item which conforms to Contract Documents.

1.10 SUBSTITUTIONS

- A. If Contractor desires to bid on any other kind, type, brand, or manufacture of material or equipment than those named in specifications, secure prior approval. To request such approval, Contractor shall submit complete information comparing (item-for-item) material or equipment offered with design material or equipment. Include sufficient information to permit quick and thorough comparison, and include performance curves on same basis, capacities, power requirements, controls, materials, metal gauges, finishes, dimensions, weights, etc., of major parts. If accepted, an addendum will be issued to this effect ahead of bid date. Unless such addendum is issued, substitution offered may not be used.

1.11 UTILITY COMPANY SERVICES

- A. Division 26 shall make arrangements with National Grid for electric service to the Owner's distribution equipment. Provide underground or overhead electric service as called for and transformers, meter sockets or meter compartments as required by the Utility Company. Coordinate all activities between the Owner and Utility Company. The installation of the electric service shall comply with the published Utility Company standards
- B. Division 22 shall make arrangements with National Grid for gas service to the Owner's distribution system. Provide service to the building as required by the Utility Company. Coordinate all activities between the Owner and Utility Company. The installation of the gas service shall comply with the published Utility Company standards

1.12 ROUGHING

- A. The Contract Drawings have been prepared in order to convey design intent and are diagrammatic only. Drawings shall not be interpreted to be fully coordinated for construction.
- B. Due to small scale of Drawings, it is not possible to indicate all offsets, fittings, changes in elevation, interferences, etc. Make necessary changes in contract work, equipment locations, etc., as part of a contract to accommodate work to avoid obstacles and interferences encountered. Before installing, verify exact location and elevations at work site. DO NOT SCALE plans. If field conditions, details, changes in equipment or shop drawing information require an important rearrangement, report same to Owner's Representative for review. Obtain written approval for all major changes before installing.
- C. Install work so that items both existing and new are operable and serviceable. Eliminate interference with removal of coils, motors, filters, belt guards and/or operation of doors. Provide easy, safe, and code mandated clearances at controllers, motor starters, valve access, and other equipment requiring maintenance and operation. Provide new materials, including new piping and insulation for relocated work.

- D. Coordinate work with other trades and determine exact route or location of each duct, pipe, conduit, etc., before fabrication and installation. Coordinate with Architectural Drawings. Obtain from Owner's Representative exact location of all equipment in finished areas, such as thermostat, fixture, and switch mounting heights, and equipment mounting heights. Coordinate all work with the architectural reflected ceiling plans and/or existing Architecture. Mechanical and electrical drawings show design arrangement only for diffusers, grilles, registers, air terminals, lighting fixtures, sprinklers, speakers, and other items. Do not rough-in contract work without reflected ceiling location plans.
- E. Before roughing for equipment furnished by Owner or in other Divisions, obtain from Owner and other Divisions, approved roughing drawings giving exact location for each piece of equipment. Do not "rough in" services without final layout drawings approved for construction. Cooperate with other trades to insure proper location and size of connections to insure proper functioning of all systems and equipment. For equipment and connections provided in this contract, prepare roughing drawing as follows:
 - 1. Existing Equipment: Measure the existing equipment and prepare for installation in new location.
 - 2. New Equipment: Obtain equipment roughing drawings and dimensions, then prepare roughing-in-drawings. If such information is not available in time, obtain an acknowledgement in writing, then make space arrangements as required with Owner's Representative.

1.13 COORDINATION DRAWINGS

- A. Before construction work commences, Divisions for all trades shall submit coordination drawings in the form of CAD drawing files, drawn at not less than 1/4 in. scale. Such drawings will be required throughout all areas, for all Contracts. These drawings shall show resolutions of trade conflicts in congested areas. Mechanical Equipment Rooms shall be drawn early in coordination drawing process simultaneous with all other congested areas. Prepare Coordination Drawings as follows:
 - 1. Division 23 shall prepare the base plan CAD coordination drawings showing all ductwork, all pertinent heating piping, and equipment. These drawings may be CAD files of the required Ductwork Shop Drawings. The drawings shall be coordinated with lighting fixtures, sprinklers, air diffusers, other ceiling mounted items, ceiling heights, structural work, maintenance clearances, electric code clearance, reflected ceiling plans, and other contract requirements. Reposition proposed locations of work after coordination drawing review by the Owner's Representative. Provide adjustments to exact size, location, and offsets of ducts, pipes, conduit, etc., to achieve reasonable appearance objectives. Provide these adjustments as part of contract. Minor revisions need not be redrawn.
 - 2. Division 23 shall provide CAD files and submit the base plan CAD Coordination Drawings to all Divisions.
 - 3. Divisions 21 and 22 shall draw the location of piping and equipment on the base plan CAD Coordination Drawings, indicating areas of conflict and suggested resolutions.

4. Divisions 26, 27 and 28 shall draw the location of lighting fixtures, cable trays, and feeders over 1-1/2 in. on the base plan CAD Coordination Drawings, indicating areas of conflict and suggested resolution.
 5. The General Construction Trade shall indicate areas of architectural/structural conflicts or obstacles on the CAD Coordination Drawings, and coordinate to suit the overall construction schedule.
 6. The General Construction Trade shall expedite all Coordination Drawing work and coordinate to suit the overall construction schedule. In the case of unresolved interferences, he shall notify the Owner's Representative. The Owner's Representative will then direct the various trades as to how to revise their drawings as required to eliminate installation interferences.
 7. If a given trade proceeds prior to resolving conflicts, then if necessary, that trade shall change its work at no extra cost in order to permit others to proceed with a coordinated installation. Coordination approval will be given by areas after special site meetings involving all Divisions.
- B. The purpose of the coordination drawing process is to identify and resolve potential conflicts between trades, and between trades and existing or new building construction, before they occur in construction. Coordination drawings are intended for the respective trade's use during construction and shall not replace any Shop Drawings, or record drawings required elsewhere in these contract documents.

1.14 EQUIPMENT AND MATERIAL REQUIREMENTS

- A. Provide materials that meet the following minimum requirements:
1. Materials shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less, in accordance with NFPA 255.
 2. All equipment and material for which there is a listing service shall bear a UL label.
 3. Potable water systems and equipment shall be built according to AWWA Standards.
 4. Gas-fired equipment and system shall meet AGA Regulations and shall have AGA label.
 5. Fire protection equipment shall be UL listed and FM approved.
- B. Exterior and wet locations shall utilize materials, equipment supports, mounting, etc. suitable for the intended locations. Metals shall be stainless steel, galvanized or with baked enamel finish as a minimum. Finishes and coatings shall be continuous and any surface damaged or cut ends shall be field corrected in accordance with the manufacturer's recommendations. Hardware (screws, bolts, nuts, washers, supports, fasteners, etc.) shall be:

1. Stainless steel where the associated system or equipment material is stainless steel or aluminum.
2. Hot dipped galvanized or stainless steel where the associated system or equipment is steel, galvanized steel or other.

1.15 CUTTING AND PATCHING

- A. Each trade shall include their required cutting and patching work unless shown as part of the General Construction Contract. Refer to General Conditions of the Contract for Construction, for additional requirements. Cut and drill from both sides of walls and/or floors to eliminate splaying. Patch cut or abandoned holes left by removals of equipment or fixtures. Patch adjacent existing work disturbed by installation of new work including insulation, walls and wall covering, ceiling and floor covering, other finished surfaces. Patch openings and damaged areas equal to existing surface finish. Cut openings in prefabricated construction units in accordance with manufacturer's instructions.

1.16 PAINTING

- A. Paint all insulated and bare piping, pipe hangers and supports exposed to view in mechanical equipment rooms, penthouse, boiler rooms and similar spaces. Paint all bare piping, ductwork and supports exposed to the out-of-doors with rust inhibiting coatings. Paint all equipment that is not factory finish painted (i.e. expansion tanks, etc.).
- B. All painting shall consist of one (1) prime coat and two (2) finish coats of non-lead oil base paint, unless otherwise indicated herein. Provide galvanized iron primer for all galvanized surfaces. All surfaces must be thoroughly cleaned before painting. Review system color coding prior to painting with the Owner's Representative or Architect.
- C. All items installed after finished painting is completed and any damaged factory finish paint on equipment furnished under this contract must be touched up by the Contractor responsible for same.
- D. Include painting for patchwork with color to match adjacent surfaces. Where color cannot be adequately matched, paint entire surface. Provide one (1) coat of primer and two (2) finish coats or as called for in the Specifications.
- E. All primers and paint used in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits called for in the current version of U.S. Green Building Council LEED Credits EQ 4.1 and EQ 4.2.
- F. Refer to Division 9 - Finishes, for additional information.

1.17 CONCEALMENT

- A. Conceal all contract work above ceilings and in walls, below slabs, and elsewhere throughout building. If concealment is impossible or impractical, notify Owner's Representative before starting that part of the work and install only after his review. In areas with no ceilings, install only after Owner's Representative reviews and comments on arrangement and appearance.

1.18 CHASES

A. New Construction:

1. Certain chases, recesses, openings, shafts, and wall pockets will be provided as part of General Construction Trade. Mechanical and Electrical trades shall provide all other openings required for their contract work.
2. Check Architectural and Structural Design and Shop Drawings to verify correct size and location for all openings, recesses and chases in general building construction work.
3. Assume responsibility for correct and final location and size of such openings.
4. Rectify improperly sized, improperly located or omitted chases or openings due to faulty or late information or failure to check final location.
5. Provide 18 gauge galvanized sleeves and inserts. Extend all sleeves 2 in. above finished floor. Set sleeves and inserts in place ahead of new construction, securely fastened during concrete pouring. Correct, by drilling, omitted or improperly located sleeves. Assume responsibility for all work and equipment damaged during course of drilling. Firestop all unused sleeves.
6. Provide angle iron frame where openings are required for contract work, unless provided by General Construction trade.

1.19 PENETRATION FIRESTOPPING

A. Fire-Stopping for Openings Through Fire and Smoke Rated Wall and Floor Assemblies:

1. Provide materials and products listed or classified by an approved independent testing laboratory for "Penetration Fire-Stop Systems". The system shall meet the requirements of "Fire Tests of Penetrations Fire-Stops" designated ASTM E814.
2. Provide fire-stop system seals at all locations where piping, tubing, conduit, electrical busways/cables/wires, ductwork and similar utilities pass through or penetrate fire rated wall or floor assembly. Provide fire-stop seal between sleeve and wall for drywall construction.
3. The minimum required fire resistance ratings of the wall or floor assembly shall be maintained by the fire-stop system. The installation shall provide an air and watertight seal.
4. The methods used shall incorporate qualities which permit the easy removal or addition of electrical conduits or cables without drilling or use of special tools. The product shall adhere to itself to allow repairs to be made with the same material and permit the vibration, expansion, and/or contraction of any items passing through the penetration without cracking, crumbling and resulting reduction in fire rating.

5. Plastic pipe/conduit materials shall be installed utilizing intumescent collars.
 6. Provide a submittal including products intended for use, manufacturer's installation instructions, and the UL details for all applicable types of wall and floor penetrations.
 7. Fire-stopping products shall not be used for sealing of penetrations of non-rated walls or floors.
- B. Acceptable Manufacturers:
1. Dow Corning Fire-Stop System Foams and Sealants.
 2. Nelson Electric Fire-Stop System Putty, CLK and WRP.
 3. S-100 FS500/600, Thomas & Betts.
 4. Carborundum Fyre Putty.
 5. 3-M Fire Products.
 6. Hilti Corporation.

1.20 NON-RATED WALL PENETRATIONS

- A. Each trade shall be responsible for sealing wall penetrations related to their installed work, including but not limited to ductwork, piping, conduits, etc. See individual specification sections for requirements.

1.21 SUPPORTS

- A. Provide required supports, beams, angles, hangers, rods, bases, braces, and other items to properly support contract work. Modify studs, add studs, add framing, or otherwise reinforce studs in metal stud walls and partitions as required to suit contract work. If necessary, in stud walls, provide special supports from floor to structure above.
- B. For precast panels/planks and metal decks, support mechanical/electrical work as determined by manufacturer and the Engineer. Provide heavy gauge steel mounting plates for mounting contract work. Mounting plates shall span two or more studs. Size, gauge, and strength of mounting plates shall be sufficient for equipment size, weight, and desired rigidity.
- C. For finished areas without a finished ceiling system such as classrooms, offices, conference rooms, etc., where decking and structure is exposed, and ductwork/piping/conduit is exposed: All mounting brackets, channel support systems and mounting hardware for ductwork, piping, lighting, etc. shall be concealed and approved by the Architect/Engineer prior to the installation. AirCraft cable style hanging for ductwork is required. It is recommended that room mockups be done and receive Architect/Engineer approval prior to proceeding with installation.

- D. Equipment, piping, conduit, raceway, etc. supports shall be installed to minimize the generation and transmission of vibration.
- E. Materials and equipment shall be solely supported by the building structure and connected framing. Gypboard, ceilings, other finishes, etc. shall not be used for support of materials and equipment.

1.22 ACCESS PANELS

- A. Provide access panels for required access to respective trade's work. Location and size shall be the responsibility of each trade. Access panels provided for equipment shall provide an opening not smaller than 22 in. by 22 in. Panels shall be capable of opening a minimum of 90 degrees. Bear cost of construction changes necessary due to improper information or failure to provide proper information in ample time. Access panels over 324 square inches shall have two cam locks. Provide proper frame and door type for various wall or ceiling finishes. Access panels shall be equal to "Milcor" as manufactured by Inland Steel Products Co., Milwaukee, Wisconsin. Provide General Construction trade with a set of architectural plans with size and locations of access panels.

1.23 CONCRETE BASES

- A. Provide concrete bases for all floor mounted equipment. Provide 3,000 lb. concrete, chamfer edges, trowel finish, and securely bond to floor by roughening slab and coating with cement grout. Bases 4 in. high (unless otherwise indicated); shape and size to accommodate equipment. Provide anchor bolts in equipment bases for all equipment provided for the project, whether mounted on new concrete bases or existing concrete bases.

1.24 HVAC EQUIPMENT CONNECTIONS

- A. Contractor is responsible for draining, filling, venting, chemically treating and restarting any systems which are affected by work shown on the Contract Documents unless specifically noted otherwise.
- B. Provide final connections to all equipment as required by the equipment. Provide final connections, including domestic water piping, wiring, controls, and devices from equipment to outlets left by other trades. Provide equipment waste, drip, overflow and drain connections extended to floor drains.
- C. Provide for Owner furnished and Contractor furnished equipment all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, insulation, sheet metal work, controls, dampers, as required.

1.25 PLUMBING EQUIPMENT CONNECTIONS

- A. Contractor is responsible for draining, filling, venting, chemically treating and restarting any systems which are affected by work shown on the Contract Documents unless specifically noted otherwise.

- B. Provide roughing and final connections to all equipment. Provide loose key stops, sanitary "P" traps, tailpiece, adapters, gas or air cocks, and all necessary piping and fittings from roughing point to equipment. Provide installation of sinks, faucets, traps, tailpiece furnished by others. Provide cold water line with gate valve and backflow prevention device at locations called for. Provide continuation of piping and connection to equipment that is furnished by others. Provide relief valve discharge piping from equipment relief valves.
- C. Provide valved water outlet adjacent to equipment requiring same. Provide equipment type floor drains, or drain hubs, adjacent to equipment.
- D. Install controls and devices furnished by others.
- E. Refer to Contract Documents for roughing schedules, and equipment and lists indicating scope of connections required.
- F. Provide for Owner furnished and Contractor furnished equipment all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, as required.

1.26 ELECTRICAL EQUIPMENT CONNECTIONS

- A. Provide complete power connections to all electrical equipment. Provide control connections to equipment. Heavy duty NEC rated disconnect ahead of each piece of equipment. Ground all equipment in accordance with NEC.
- B. Provide for Owner furnished and Contractor furnished equipment all power wiring, electric equipment, control wiring, switches, lights, receptacles, and connections as required.

1.27 STORAGE AND PROTECTION OF MATERIALS AND EQUIPMENT

- A. Store Materials on dry base, at least 6 in. aboveground or floor. Store so as not to interfere with other work or obstruct access to buildings or facilities. Provide waterproof/windproof covering. Remove and provide special storage for items subject to moisture damage. Protect against theft or damage from any cause. Replace items stolen or damaged, at no cost to Owner.
- B. Refer to Division 01 for additional information.

1.28 FREEZING AND WATER DAMAGE

- A. Take all necessary precautions with equipment, systems and building to prevent damage due to freezing and/or water damage. Repair or replace, at no change in contract, any such damage to equipment, systems, and building. Perform first seasons winterizing in presence of Owner's operating staff.

1.29 OWNER INSTRUCTIONS

- A. Before final acceptance of the work, furnish necessary skilled labor to operate all systems by seasons. Instruct designated person on proper operation, and care of

systems/equipment. Repeat instructions, if necessary. Obtain written acknowledgement from person instructed prior to final payment. Contractor is fully responsible for system until final acceptance, even though operated by Owner's personnel, unless otherwise agreed in writing. List under clear plastic, operating, maintenance, and starting precautions procedures to be followed by Owner for operating systems and equipment.

1.30 OPERATION AND MAINTENANCE MANUALS

- A. Submit by email (preferred) or digital media, thru the normal project submittal process. Include a copy of each final approved Shop Drawing, wiring diagrams, piping diagrams, spare parts lists, final testing and balancing report, as-built drawings and manufacturer's instructions. Include typewritten instructions, describing equipment, starting/operating procedures, emergency operating instructions, summer-winter changeover, freeze protection, precautions and recommended maintenance procedures. Include name, address, and telephone number of installing contractor and of supplier manufacturer Representative and service agency for all major equipment items. Provide a table of contents page and dividers based upon specification section numbers. Submit in a compiled and bookmarked PDF format as outlined below.
- B. Provide content for Operation and Maintenance Manuals as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Engineer and Commissioning Agent will comment on whether content of operation and maintenance submittals is acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- C. Submit Operation and Maintenance Manuals in the following format:
 - 1. Submit by uploading to web-based project software site, or by email to Architect, as a formal project submittal in conformance with the project specific submittal procedures. Enable reviewer comments on draft submittals.
 - 2. 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.
 - 3. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in the 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 on opening file.
- D. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing Owner training. Engineer and Commissioning Agent will comment on whether general scope and content of manual are acceptable.

- E. Final Manual Submittal: Submit O&M manual in final form prior to requesting inspection for Substantial Completion and at least 2 weeks before commencing Owner training. Engineer and Commissioning Agent will return copy with review comments.
 - 1. Correct or revise O&M manual to comply with Engineer's and Commissioning Agent's comments. Submit copies of each corrected manual within 2 weeks of receipt of Engineer's and Commissioning Agent's comments.
- F. Refer to Division 01 for additional requirements.

1.31 RECORD DRAWINGS

- A. The Contractor shall obtain at his expense one (1) set of construction Contract Drawings, (including non-reproduction black and white prints or electronic files) for the purpose of recording as-built conditions.
- B. The Contractor shall perform all survey work required for the location and construction of the work and to record information necessary for completion of the record drawings. Record drawings shall show the actual location of the constructed facilities in the same manner as was shown on the bid drawings. All elevations and dimensions shown on the drawings shall be verified or corrected so as to provide a complete and accurate record of the facilities as constructed.
- C. It shall be the responsibility of the Contractor to mark EACH sheet of the contract documents in red and to record thereon in a legible manner, any and all approved field changes and conditions as they occur. A complete file of approved field sketches, diagrams, and other changes shall also be maintained. At completion of the work, the complete set of red marked contract documents, plus all approved field sketches and diagrams shall be submitted to the engineer and used in preparation of the record drawings.
- D. A complete set of red marked contract drawings shall be submitted, at one time, as the "Record" set. If there are no changes to a specific drawing, the contractor shall indicate "NO CHANGES" on that drawing. ALL drawings shall be included in the "Record" set.
- E. The complete set of red marked Contract Documents or electronic files shall be certified by the Contractor as reflecting record conditions and submitted to the engineer for review.
- F. The Contractor shall have the marked up set scanned, if they are not already electronic files, and then submit them to the Engineer as the "Record Set".
- G. Refer to Division 01 for additional requirements.

1.32 FINAL INSPECTION

- A. Upon completion of all Engineering Site Observation list items, the Contractor shall provide a copy of the Engineering Site Observation Report back to the Engineer with each item noted as completed or the current status of the item. Upon receipt, the Engineer will schedule a final review.

1.33 COMMISSIONING

- A. Refer to General Commissioning Requirements in Division 01 for additional requirements.

1.34 TEMPORARY HEATING AND COOLING

- A. Refer to the General Conditions of the Contract for Construction and Supplemental General Conditions.

1.35 MAINTENANCE OF HVAC SYSTEMS DURING TEMPORARY USE PERIODS

- A. Provide each air handling system with a set of prefilters in addition to the permanent filters. Furnish four sets of prefilters for each system for use when system is operated for temporary heating or cooling. During such use, change prefilters as often as directed by Owner's Representative. Provide MERV-8 filters in all open ended ducts, return grilles and registers to keep dust out of ductwork. Change as often as necessary. Remove all such temporary filters upon completion. Use supply fans only. Do not operate return fans.
- B. Blank-off outside air intake opening during temporary heating period. Install first set of permanent filters and prefilters.
- C. Adjust dampers on supply system.
- D. Set all heating coil control valves for manual operation.
- E. Do not install any grilles or diffusers at room terminal ends of ducts until permission is given.
- F. Assume responsibility for systems and equipment at all times, even though used for temporary heat or ventilating. Repair or replace all dented, scratched or damaged parts of systems prior to final acceptance.
- G. Remove concrete, rust, paint spots, other blemishes, then clean.
- H. Just prior to final acceptance, remove used final filter and install new set. Deliver all unused sets of prefilters to the Owner and obtain written receipt. Properly lubricate system bearings before and during temporary use. Maintain thermostats, freeze stats, overload devices, and all other safety controls in operating condition.

1.36 TEMPORARY FACILITIES

- A. Refer to the Division 1 Sections, General Conditions and Supplemental General Conditions.

1.37 TEMPORARY LIGHT AND POWER

- A. Refer to the Division 1 Sections, General Conditions and Supplemental General Conditions.

1.38 CLEANING

- A. It is the Contractor's responsibility to keep clean all equipment and fixtures provided under this contract for the duration of the project. Each trade shall keep the premises free from an accumulation of waste material or rubbish caused by his operations. The facilities require an environment of extreme cleanliness, and it is the Contractor's responsibility to adhere to the strict regulations regarding procedures on the existing premises. After all tests are made and installations completed satisfactorily:
1. Thoroughly clean entire installation, both exposed surfaces and interiors.
 2. Remove all debris caused by work.
 3. Remove tools, surplus, materials, when work is finally accepted.

1.39 SYSTEM START-UP AND TESTING

- A. Prior to commencement of work, the Division(s) effecting such system shall survey all building mechanical, plumbing, fire protection and electrical systems and components and make written notice to the Owner's Representative regarding any damage, missing items and/or incomplete systems. Prior to the conclusion of this project, the Contractor shall verify with the Owner's Representative that all building systems have been returned to their original conditions.

1.40 TRANSFER OF ELECTRONIC FILES

- A. M/E Engineering, P.C. will provide electronic files for the Contractor's use in the preparation of sheetmetal shop drawings, coordination drawings, or record drawings related to the project, subject to a and the following terms and conditions:
1. The Contractor shall submit a formal request for electronic drawing files on the M/E Engineering, P.C. website, by utilizing the following website link:
<http://www.meengineering.com/contact-pages/contractor-request>.
 2. M/E Engineering, P.C. makes no representation as to the compatibility of these files with the Contractor's hardware or the Contractor's software beyond the specific release of the referenced specifications.
 3. M/E Engineering, P.C. can only provide CAD files of M/E/P/FP drawing levels for which we are the Engineer of Record. CAD files of Architectural backgrounds, reflected ceiling plans, structural plans, etc. must be obtained separately from the Architect of Record.
 4. Data contained on these electronic files is part of M/E Engineering, P.C.'s instruments of service shall not be used by the Contractor or anyone else receiving data through or from the Contractor for any purpose other than as convenience in the preparation of shop drawings for the referenced project. Any other use or reuse by the Contractor or by others will be at the Contractor's sole risk and without liability or legal exposure to M/E Engineering, P.C. The Contractor agrees to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against M/E

Engineering, P.C., its officers, directors, employees, agents or sub-consultants which may arise out of or in connection with the Contractor's use of the electronic files.

5. Furthermore, the Contractor shall, to the fullest extent permitted by law, indemnify and hold harmless, M/E Engineering, P.C. from all claims, damages, losses and expenses, including attorney's fees arising out of or resulting from the Contractor's use of these electronic files.
6. These electronic files are not contract documents. Significant difference may arise between these electronic files and corresponding hard copy contract documents due to addenda, change orders or other revisions. M/E Engineering, P.C. makes no representation regarding the accuracy or completeness of the electronic files the Contractor receives. In the event that a conflict arises between the signed contract documents prepared by M/E Engineering, P.C. and electronic files, the signed contract documents shall govern. The Contractor is responsible for determining if any conflicts exist. By the Contractor's use of these electronic files the Contractor is not relieved of the Contractor's duty to comply with the contract documents, including and without limitation, the need to check, confirm and coordinate all dimensions and details, take field measurements, field verify conditions and coordinate the Contractor's work with that of other contractors for the project.

1.41 ENERGY INCENTIVES

- A. The Contractor, his Subcontractors and Suppliers shall provide to the Owner all paperwork necessary to support the Owners pursuit of incentives related to energy conservation as offered by the utility company or state sponsored incentive programs. This shall include at a minimum, receipts, and quantities and data sheets for energy efficient equipment such as: lighting, motors, variable frequency drives, etc.

END OF SECTION

SECTION 210523 - VALVES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Document.

1.2 SUBMITTALS

- A. Submit manufacturer's data in accordance with Basic Mechanical/Electrical Requirements. Obtain approval prior to ordering material.
- B. Provide submittals for all items specified under Part 2 of this section.

PART 2 - PRODUCTS

2.1 VALVES

- A. General: Valves shall have the following requirements:
 - 1. Working pressure stamped or cast on bodies.
 - 2. Stem packing serviceable without removing valve from line.
 - 3. UL listed and FM approved and labeled for intended fire protection service. Sprinkler systems 175 WWP; stamped/cast on body.
- B. Acceptable Manufacturers:
 - 1. Gate Valves: Kennedy, Mueller, Nibco, Stockham, Victaulic.
 - 2. Butterfly/Ball Valves, Indicating Type: Grinnell, Kennedy, Milwaukee, Stockham, Victaulic.
 - 3. Check Valves: Grinnell, Kennedy, Nibco, Stockham, Victaulic.

2.2 GATE VALVES

- A. 2-1/2 in. and Larger: IBBM, resilient wedge disc, OS&Y, flanged ends, stems grooved for tamper switch, 200 WWP; Stockham Fig. G-610.
- B. 2 in. and Smaller: Bronze body and bonnet, OS&Y, threaded ends, solid wedge, 175 WWP; Stockham Fig. B-133.

2.3 BUTTERFLY/BALL VALVE

- A. 2-1/2 in. and Larger: Butterfly style, ductile iron body, lug type, aluminum bronze disc, stainless steel trim, EPDM seat, bubbletight shutoff, suitable for dead end service, gear operator, provision to tamper switch, 200 WWP; Stockham #LD-72UF.

- B. 2 in. and Smaller: Bronze body, threaded ends; indicating gear operator, provision for tamper switch; Milwaukee "Butterball".

2.4 CHECK VALVES

- A. 2-1/2 in. and Larger: IBBM, swing type, rubber faced disc, bolted flange cap, flanged ends; Stockham #G-940.
- B. 2 in. and Smaller: Bronze body, swing type, rubber faced, threaded ends; Grinnell #3315.

2.5 PRESSURE REDUCING VALVES

- A. Ductile iron body construction, nylon reinforced diaphragm, nylon reinforced brass and stainless steel pilot valve, integral strainer, pressure relief valve, adjustable pressure range.
- B. Valve shall be UL listed and FM approved.
- C. Design Equipment: Tyco Model PRV-1.
- D. Acceptable Manufacturers: Cla-Val, Tyco, Viking.

2.6 MISCELLANEOUS

- A. Trim and Test Valves: Ball, plug, angle or globe type; bronze body; threaded ends; UL listed.
 - 1. Ball Valves: Bronze two-piece body, full port, threaded ends, chrome plated ball, blowout proof stem, reinforced TFE seats, 300 psi working pressure, UL listed, FM approved; Nibco Model KT-585-70-UL.
- B. Hose Thread Drain Valves:
 - 1. Ball Valve: Bronze body, hardened chrome ball with hose thread end, cap and chain; Watts #B6001CC (sweat connection), Watts #B6000CC (threaded connection).

2.7 UNDERGROUND VALVES AND ACCESSORIES

- A. Gate Valves 2 in and larger: IBBM, inside screw-in, wedge disc, resilient seat, "O" ring seals, 175 WWP, open counter-clockwise, 2 in. square wrench nut, mechanical joint ends, AWWA C509: Kennedy Ken Seal Fig. #4571
- B. Valve Boxes: Cast iron adjustable screw type box and cover extending from the valve to finish grade. Cast arrow and lettering on cover of box denoting direction of valve opening and service. Provide with each curb valve.
- C. Valve Key: Steel socket key for gate valve or curb valves.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide all shutoff, check, drain and other type valves as required by Code as indicated and as required for proper system maintenance, isolation and safety.
- B. Locate valves for easy access and provide separate support where necessary. Install valves with stems at or above the horizontal position. Install swing check valves in horizontal position with hinge pin level.
- C. Provide hose thread drain valves at all low points to enable complete drainage of all portions of the system.
- D. For underground valves: Valve boxes shall be placed vertically over each valve, and the top of the box adjusted to proper grade, and the valve and box immediately backfilled with crushed stone carefully tamped into place. Valves shall be checked for proper operation before installation and, unless otherwise instructed are to be left in the open position.
- E. Install valves per respective listing/approval.
- F. Use 250 WWP, FM approved anti-water hammer check valves at discharge and bypass of fire pumps, otherwise use swing type.
- G. Use ball valves for auxiliary drains and inspector test valves on dry pipe and pre-action systems.

END OF SECTION

SECTION 210553 - FIRE PROTECTION IDENTIFICATION

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Documents.

1.2 QUALIFICATIONS

- A. All identification devices shall comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles.

1.3 SUBMITTALS

- A. Submit manufacturer's technical product data and installation instructions for each identification material and device. Submit valve schedule for each piping system typewritten on an 8-1/2 in. x 11 in. paper (minimum), indicating code number, location and valve function. Submit schedule of pipe, equipment and name identification for review before labeling.

1.4 ACCEPTABLE MANUFACTURERS

- A. Allen Systems, Inc., Brady (W.H.) Co.; Signmark Div., Emedco, Industrial Safety Supply Co., Inc., Lab Safety Supply, Seton Name Plate Corp.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide manufacturer's standard products of categories and types required for each application. In cases where there is more than one type specified for an application, selection is installer's option, but provide single selection for each product category.
- B. All adhesives used for labels in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits as called for in the current version of U.S. Green Building Council LEED Credits EQ 4.1 and EQ 4.2.

2.2 PIPING IDENTIFICATION

- A. Identification Types:
 - 1. Snap-on type: Provide manufacturer's standard pre-printed, semi rigid snap-on, color coded pipe markers, complying with ANSI-A13.1.
 - 2. Pressure sensitive type: Provide manufacturer's standard pre-printed, permanent adhesive, color coded, pressure sensitive vinyl pipe markers complying with ANSI A13.1. Provide a 360° wrap of flow arrow tape at each end of pipe label.

B. Lettering:

1. Piping labeling shall conform to the following list:

PIPE FUNCTION	IDENTIFICATION
Fire Protection Water	FIRE PROTECTION WATER
Fire Sprinkler Water	FIRE SPRINKLER WATER

2.3 VALVE IDENTIFICATION

A. Valve Tags:

1. Standard brass valve tags, 2 in. diameter with 1/2 in. high black-filled numerals. Attach to valve with brass jack chain and "S" hook. Identify between fire protection, heating and plumbing services with 1/4 in. letters above the valve number.
2. Equal to Seton Style No. M4507.

B. Provide a sign for each control, sectional and drain valve identifying the portion of the building served in accordance with NFPA 13 Valve Chart:

1. Provide valve chart for all valves provided as a part of this project. Frame and place under clear glass. Mount in Mechanical Room.

2.4 ABOVE CEILING EQUIPMENT LOCATOR

- A. 3/4 in. diameter adhesive stickers placed on ceiling grid and color-coded.
- B. The color for all fire protection valves shall be RED.

PART 3 - EXECUTION

3.1 GENERAL

- A. Provide valve tags for all valves provided on project.
- B. Provide piping identification with directional flow arrows for all piping on project, maximum every 20'-0" or piping installed through rooms, provide at least one pipe label in each room, for each pipe function.
- C. Provide equipment tags for all equipment provided.

END OF SECTION

SECTION 211010 - PIPING SYSTEMS AND ACCESSORIES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 SUBMITTALS

- A. Provide a schedule of pipe materials, fittings and connections.
- B. Provide a detailed matrix listing the specific UL approved firestop system assembly to be used for each type of piping provided and each type of construction to be penetrated along with all associated UL assembly details.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Pipe and fittings shall be new, marked with manufacturer's name and comply with applicable ASTM and ANSI Standards.

2.2 STEEL PIPING AND FITTINGS

- A. Pipe: ASTM A53, or ASTM A106 seamless, Schedule 40 weight; black finish as called for; ends chamfered for welding or grooved for grooved mechanical connections.
- B. Fittings: Same material and pressure class as adjoining pipe.
 - 1. Welded Fittings: Factory forged, seamless construction, butt weld type chamfered ends. Where branch connections are two or more sizes smaller than main size, use of "Weldolets", "Thredolets" or "Sokolets" acceptable. Mitered elbows, "shaped" nipples, and job fabricated reductions not acceptable unless specifically called for. Socket weld type, 2000 psi wp, where called for.
 - 2. Threaded Fittings: Class 125, cast or malleable iron, black, as called for; UL listed and FM approved for fire protection systems. Street type 45° and 90° elbows are not acceptable.
- C. Flanges, Unions, and Couplings:
 - 1. Threaded Connections:
 - a. Flanges: Cast iron companion type; for sizes 2-1/2 in. and larger.
 - b. Unions: Malleable iron, bronze to iron seat, 300 lb. wwp; for sizes 2 in. and smaller.
 - c. Couplings: Malleable iron. Steel thread protectors are not acceptable as couplings.

2. Welded Connections:

- a. Flanges: Welding neck type. Slip-on type not allowed unless noted and shall not be installed in conjunction with butterfly valves.

3. Grooved Mechanical Connections:

- a. Couplings: Ductile iron, ASTM A395 and ASTM A536, with painted coating, designed for rolled grooved piping, hot dipped galvanized finish complying with ASTM A153 where called for.
- b. Gaskets: Grade "E" EPDM synthetic rubber, -30°F to 230°F temperature range, suitable for water service.
- c. Bolts and Nuts: Heat treated, hex head carbon steel, ASTM A183, cadmium plated or zinc electroplated.
- d. Fittings: Elbows, tees, laterals, reducers, adapters as required shall be fabricated from carbon steel pipe conforming to ASTM A53. Fittings shall have grooves designed to accept grooved end couplings of the same manufacturer.
- e. Victaulic, rigid system, Style 005 couplings cast with offsetting angle pattern bolt pads to provide system rigidity and support in accordance with ANSI B31.1 and B 31.9. UL listed and FM approved; 300 psi wwp; follow all terms of listings/approvals.
- f. Acceptable Manufacturers: Grinnell, Gruvlok by Anvil, Victaulic or approved equal.

D. Gauge and Instrument Connections: Nipples and plugs for adapting gauges and instruments to piping system shall be IPS brass.

E. Base Elbows:

1. Cast iron or steel type, flange connections; Crane 500 or equivalent made from welding elbows, with welded pipe support and steel base. Reducing elbows where necessary.

ELBOW SIZE	SUPPORT SIZE	BASE PLATE
4 in. to 6 in.	2-1/2 in.	8 in. x 8 in. x 1/4 in.

2. Anchor bolt holes in each corner of base for securely bolting to floor or concrete base; minimum 3/4 in. bolts.

2.3 DIELECTRIC PIPE FITTINGS

- A. Description: Assembly or fitting having insulating material isolating joined dissimilar metals to prevent galvanic action and stop corrosion.

- B. Unions: Factory fabricated, for 250 psi minimum working pressure at 180°F, threaded or solder ends, insulating material suitable for system fluid, pressure and temperature.
- C. Flanges: Factory fabricated, companion flange assembly, for 150 or 300 psig minimum pressure to suit system fluid pressures and temperatures with flange insulation kits and bolt sleeves.
- D. Acceptable Manufacturers: EPCO, Capitol Manufacturing, Victaulic, Watts or approved equal.

2.4 HANGERS, INSERTS AND SUPPORTS

- A. Hangers, Inserts, Clamps: B-Line, Grinnell, Michigan Hanger, PHD Manufacturing.
- B. Hangers:
 - 1. Adjustable, wrought malleable iron or steel with electroplated zinc or cadmium finish. Copper plated or PVC coated where in contact with copper piping. Hot-dipped galvanized finish for exterior locations.
 - 2. Adjustable ring type where piping is installed directly on hanger for piping 3 in. and smaller.
 - 3. Adjustable steel clevis type for piping 4 in. and larger.
 - 4. Nuts, washers and rods with electroplated zinc or cadmium finish. Hot-dipped galvanized finish for exterior locations.
- C. Spacing Schedule (Maximum Distance between Hangers (ft.-in.):

NOMINAL PIPE SIZE (IN.)	3/4	1	1-1/4	1-1/2	2	2-1/2	3	3-1/2	4
Steel Pipe	N/A	12-0	12-0	15-0	15-0	15-0	15-0	15-0	15-0
Rod Size (in.)	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8

- D. Beam Attachments:
 - 1. C-Clamp style, locknut, restraining strap, electroplated finish, UL listed, FM approved for pipe sizes 2 in. and smaller, complying with NFPA 13.
 - 2. Center loaded style with clamp attachments that engage both edges of beam, electroplated finish, UL listed, FM approved, for pipe sizes larger than 2 in., refer to "Supports" for additional requirements, complying with NFPA 13.
- E. Inserts: Carbon steel body and square insert nut, galvanized finish, maximum loading 1300 lbs., for 3/8 in. to 3/4 in. rod sizes, reinforcing rods on both sides, MSS-SP-69 Type 19 or approved equal, complying with NFPA 13.

F. Supports:

1. For all piping larger than 2 in., provide intermediate structural steel members for hanger attachment. Members shall span across the bar joists at panel points of joists. Secure member to structure. Select size of members based on a minimum factor of safety of four.
2. For weights under 1,000 lbs.: "Drill-In" inserts, "U" shaped Channel, beam clamps or other structurally reviewed support. The factor of safety shall be at least four. Follow manufacturer's recommendations.
3. For Metal Decks: Drill hole through for hanger rods and imbed a welded plate in concrete or use devices designed for this application, with a safety factor of four.
4. Acceptable Manufacturers: Hilti, ITW Ramset, Phillips "Red Head" or approved equal.

- G. Hangers for fire protection piping as specified and in accordance with NFPA 13 and NFPA 14. Hangers and building attachments shall be UL listed and FM approved for fire protection service. Adjustable swivel ring type hangers are permitted for 3 in. and smaller piping.

2.5 PIPING ACCESSORIES

- A. Escutcheon Plates: Steel or cast brass, split hinge type with setscrew, high plates where required for extended sleeves. Chrome plated in finished areas.
- B. All bushings and nipples required for instruments and gauges shall be brass.

2.6 SLEEVES

A. Standard Type:

1. Schedule 40 black steel pipe sleeves for structural surfaces, two (2) pipe sizes larger than the pipe, and as recommended by the sealing element manufacturer. Provide full circle water stop collar for sleeves located within below grade walls, wet wells and waterproofed surfaces. The collar shall be fabricated from steel plate and welded to the sleeve around its entire circumference.
2. Schedule 40 PVC sleeves or sheet metal sleeves for nonstructural surfaces and existing construction. Sheet metal sleeves shall be 18 gauge minimum and braced to prevent collapsing.

2.7 SEALING ELEMENTS

- A. Expanding neoprene link type, watertight seal consisting of interlocking links with zinc plated bolts.
1. Acceptable Manufacturers: Thunderline "Link-Seal" Series 200, 300 or 400, Pyropac, Calipco.

2.8 FIRESTOP SYSTEM FOR OPENINGS THROUGH FIRE RATED WALL AND FLOOR ASSEMBLIES

- A. Materials for firestopping seals shall be listed by an approved independent testing laboratory for "Through-Penetration Firestop Systems". The system shall meet the standard fire test for Through-Penetration Firestop Systems designated ASTM E814. Firestop system seals shall be provided at locations where piping pass through fire rated wall, floor/ceiling, or ceiling/roof assembly. Minimum required fire resistant ratings of the assembly shall be maintained by the Firestop System. Installation shall conform to the manufacturer's recommendations and other requirements necessary to meet the testing laboratory's listing for the specific installation.

2.9 PIPING MATERIALS AND SCHEDULE

- A. See Exhibit "A" - Piping Materials at end of this Section for Fire Protection piping.
- B. See Exhibit "B" - Testing at end of this Section for Fire Protection piping.

PART 3 - EXECUTION

3.1 EQUIPMENT AND SYSTEMS

- A. Install equipment and systems in accordance with provisions of each applicable section of these Specifications, and Local/State Codes/Regulations having jurisdiction. Accurately establish grade and elevation of piping before setting sleeves. Install piping without springing or forcing, except where specifically called for, making proper allowance for expansion and anchoring. Changes in size shall be made with reducing fittings. Reducing couplings are not acceptable. Arrange piping at equipment with necessary offsets, unions, flanges, and valves, to allow for easy part removal and maintenance. Offset piping and change elevation as required, to coordinate with other work. Avoid contact with other mechanical or electrical systems. Provide adequate means of draining and venting systems. Conceal piping unless otherwise called for.
- B. Cap or plug equipment and pipe openings during construction. Install piping parallel with lines of building, properly spaced to provide clearance for insulation. Make changes in direction and branch connections with fittings. Do not install valves, unions and flanges in inaccessible locations. Materials within a system and between systems shall be consistent. If this is not possible, install dielectric fittings.

3.2 PIPING OVER ELECTRICAL EQUIPMENT

- A. Contractor shall route piping to avoid installation directly over electric equipment, including, but not limited to panels, transformers, disconnects, starters, motor control center, adjustable speed drives and fused switches.
- B. Piping shall not be installed in the dedicated electric and working space as defined by NEC 110. Dedicated electrical space is generally equal to the depth and width of electrical equipment, and extends 6 ft. above the electrical equipment, or to a structural ceiling. Dedicated working space is a minimum of 30 in. wide or the width of equipment (whichever is larger) a minimum of 6 ft.-6 in. tall, with a depth of 3ft. to 9 ft. depending on the voltage.

3.3 HANGERS, INSERTS AND SUPPORTS

- A. Piping shall not be supported by wires, band iron, chains, from other piping, or by vertical expansion bolts. Support piping with individual hangers from concrete inserts, wood construction, welded supports, or beam clamps of proper configuration and loading design requirements for each location; replace if not suitable. Follow manufacturer's safe loading recommendations. Suspend with rods of sufficient length for swing and of size called for, using four (4) nuts per rod. Provide additional structural steel members, having one coat rustproof paint, where required for proper support. Provide oversized hangers on diesel engine exhaust piping where insulation/supports must pass between pipe and hanger. Hangers, when attached to joists, shall only be placed at the top or bottom chord panel point. Only concentric type hangers are permissible on piping larger than 2-1/2 in.; "C" types are permitted for piping 2 in. and smaller on joists. Provide riser clamps for each riser at each floor.

3.4 PIPE CONNECTIONS

- A. Threaded Connections: Clean out tapering threads, made up with pipe dope; screwed until tight connection. Pipe dope must be specifically selected for each application.
- B. Grooved Mechanical Joints: Pipes joined with grooved fittings shall be joined by a listed combination of fittings, couplings, gaskets and grooves of a single manufacturer. Lubricate and install gasket and couplings. Follow manufacturer's recommendations. Grooved ends shall be clean and free of indentations, projections and roll marks in the area from pipe end to groove.
- C. Dielectric Pipe Fittings: Protect fittings from excessive heat.

3.5 WELDING

- A. Welding shall be performed in compliance with the welding procedure specifications prepared by the National Certified Pipe Welding Bureau. Welded piping fabricated by qualified welder. Use certified welder where specifically required by code or insurance company. If indicated and permitted for fire protection systems, all provisions for welded pipe shall additionally be in accordance with NFPA Standard 13. Use full length pipe where possible; minimum distance between welds, 18 in. on straight runs. Welds must be at least full thickness of pipe with inside smooth and remove cutting beads, slag and excess material at joints; chamfer ends. Minimum gap 1/8 in., maximum 1/4 in., for butt welds. Overlaps on position and bench welds to be not less than 3/4 in. One internal pass and one external pass minimum required on slip-on flanges. Do not apply heat to rectify distorted pipe due to concentrated welding; replace distorted pipe.

3.6 SLEEVES

- A. Provide for pipes passing through floors, walls or ceilings. Not required for floors that are core-drilled, except where floor is waterproofed. Extend 1/8 in. above finished floor in finished areas. In above grade Mechanical Rooms and other areas with floor drains use steel pipe sleeves 2 in. above floor. Use steel pipe sleeves in bearing wall, structural slabs, beams and other structural surfaces, and where called for. Sleeves shall be as small as practical, consistent with insulation, so as to preserve fire rating. Fill abandoned

sleeves with concrete. Provide rubber grommet seals for pipes passing through ducts or air chambers or built-up housings.

3.7 SLEEVE PACKING

- A. Seal void space at sleeves as follows:
 - 1. Interior locations: Firmly pack with fiberglass and caulk.
 - 2. Exterior walls above grade: Use sealing element.
 - 3. Exterior walls below grade and above floors: Use sealing element.
 - 4. Cored holes: Use sealing element.
 - 5. Fire rated, partitions and floor slabs: Use fire rated sealing elements, materials and methods. Provide per manufacturer's instructions to maintain firestop.
 - 6. Waterproofed walls/floors: Use waterproof sealing element, device or compound.

3.8 ESCUTCHEON PLATES

- A. Provide polished chrome setscrew type escutcheon plates for all exposed piping passing through floors, walls or ceilings, in all rooms except in Boiler, Fan and Mechanical Rooms.

3.9 TESTS

- A. Fire suppression systems shall be hydrostatically tested at 200 psi for two (2) hours in accordance with NFPA 13.
- B. Provide all necessary items to complete proper testing of work. Perform all testing in accordance with governing Codes, local utilities and other agencies having jurisdiction and as specified. Pay all costs to perform tests. Perform all testing in a safe manner. Isolate existing systems.

3.10 PIPE LINE SIZING

- A. Pipe sizes called for are to be maintained. Pipe size changes made only as reviewed by Owner's Representative and shall be justified by hydraulic calculations. Where discrepancy in size occurs, the larger size shall be provided.

EXHIBIT "A" - PIPING MATERIALS

<u>SERVICE</u>	<u>PIPE MATERIALS</u>	<u>FITTINGS</u>	<u>CONNECTIONS</u>
Fire service	SEE "UNDERGROUND PIPING AND ACCESSORIES" SECTION 221020		
Sprinkler (wet)	Schedule 40, black steel, 4 in. and smaller	Cast or malleable iron	Threaded

EXHIBIT "B" - TESTING

<u>SERVICE</u>	<u>TEST REQUIREMENTS</u>
Sprinklers	Test hydrostatically at 200 psi for two (2) hours in accordance with NFPA 13.

END OF SECTION

SECTION 211300 - FIRE SUPPRESSION SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.
- B. Wet pipe sprinkler system to be provided throughout new building. All spaces are required to be covered with sprinkler heads per NFPA 13 requirements and New York State Building and Fire Codes for a Type "I" institutional occupancy. Attic spaces will require full sprinkler coverage as required.
- C. Fire Protection/Sprinkler system requirements and installation for this project are performance base per this specification design criteria. Fire Protection/Sprinkler contractor will be required to provide the following:
 - 1. Flow test and flow test data of the existing municipal water main being the source of the fire water service line (4").
 - 2. Hydraulic Calculations and associated "shop" installation plans for complete building system layout.
 - 3. Complete Sprinkler system installation from the 4" water source. Include service riser, 4" alarm check valve, floor control valves (tamper, flow switch, drain), alarm devices for valves and flow indication. Include Horn/strobe type device for water flow alarm, mounted on exterior above/adjacent to FDC.
 - 4. Fire Department Connection (FDC). Exterior connection / Inlet type per local Fire Department requirements.
 - 5. "As-Built" sprinkler plans for final close out documentation.
 - 6. Areas subject to freezing including unheated attic spaces to be protected with an auxillary dry pipe sprinkler system with a dry pipe riser and air compressor located at main 4" water service entrance.

1.2 QUALITY ASSURANCE

- A. Comply with the 2020 Fire Code of New York State referenced edition of the following National Fire Protection Association (NFPA) Standards:
 - 1. NFPA 13: Standard for the Installation of Sprinkler Systems.
 - 2. NFPA 24: Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
 - 3. NFPA 25: Inspection, Testing and Maintenance of Water-Based Fire Protection Systems.

4. NFPA 72: National Fire Alarm Code.
- B. Follow all requirements, recommendations and appendices to comply with the latest edition of the following publications, codes, standards, and listings/approvals:
 1. Factory Mutual Engineering Corporation (FM) Approval Guide.
 2. Underwriters Laboratories, Inc. (UL) Fire Protection Equipment Directory.
 3. 2020 Fire Code of New York State.
 4. OSHA Rules and Regulations.
 5. Requirements of Insurance Underwriter and other Authorities Having Jurisdiction.
- C. Equipment, devices, hangers and components shall be UL listed and FM approved and labeled for the intended fire protection service.
- D. The fire protection work shall be performed by an experienced firm regularly engaged in the installation of fire protection sprinkler systems.
- E. Preparation of working plans, calculations and site observation of systems shall be completed by a NICET Level III technician under the direction of a qualified New York State Registered Professional Engineer.

1.3 SYSTEM DESCRIPTION

- A. The fire protection system shall be a wet pipe automatic sprinkler system arranged to properly protect all spaces.
- B. Water is supplied from an unknown size / TBD. Municipal water main located in West Clarkstown Road, through a 4 in. underground water main to the system's main riser. Water supply data / flow test at the municipal main needs to indicate the following:
 1. X psi static.
 2. X psi residual with X gpm flowing.
- C. The residual hydrant is located at West Clarkstown Road with the flow hydrant located at West Clarkstown Road. This contractor shall arrange for a new flow test on the municipal main prior to performing hydraulic calculations. Fire department connection(s) shall be provided to allow the servicing fire department to augment the system's normal automatic water supply.
- D. The system shall be hydraulically calculated in accordance with all provisions of the Contract Documents and any Authority Having Jurisdiction.
- E. Calculations shall be based upon the specific hazard for the areas being protected. The following minimum requirements shall be provided as actually installed in the protected spaces.

1. Light hazard: These areas shall include: All occupied rooms.
 - a. Water density: 0.10 gpm/sq. ft.
 - b. Maximum coverage per sprinkler = 168 sq. ft.
 - c. Hydraulic remote area: 1500 sq. ft.
 - d. Interior hose demand: 100 gpm.
 2. Ordinary Hazard Group 1: These areas shall include: Mechanical Rooms and Attic Space.
 - a. Water density: 0.15 gpm/sq. ft.
 - b. Maximum coverage per sprinkler = 130 sq. ft.
 - c. Hydraulic remote area: 1500 sq. ft.
 - d. Interior hose demand: 100 gpm.
- F. Maximum coverage for any sprinkler head shall not exceed NFPA requirements and the listing for the sprinklers provided.
- G. A minimum 10 psi safety factor shall be provided between the available municipal water supply curve and the total system demand point. The total system demand point shall be at the municipal water main and include the calculated sprinkler and interior hose stream demands plus the exterior hose stream demand at the residual pressure required for proper system operation.
- H. The maximum flow velocity shall not exceed 20 ft. per second in the piping system and 15 ft. per second in mains with paddle type waterflow indicators.
- I. Water supply control valves shall be electrically supervised and mechanically locked for proper position. Waterflow and supervisory circuits shall be in accordance with the requirements of electrical specifications. Electric connections to sprinkler system shall be by Division 26. Furnish wiring diagrams for all equipment.
- J. Provide 3/16 in. x 1 in. cadmium plated carbon steel chains and master keyed all brass case hardened padlocks to lock water supply valves in the proper position.

1.4 SUBMITTALS

- A. Product Data:
1. Submit manufacturer's catalog cut, specifications and installation instructions for each item or component of fire protection system. Clearly indicate pertinent information such as, but not limited to:
 - a. Manufacturer's model number.
 - b. Materials, size, finish and type of connection.

- c. Pressure ratings of components.
 - d. FM approval/UL listing.
- B. Certification: Submit Contractor's NICET certification and number.
- C. Samples:
 - 1. If requested, submit sample of sprinklers.
- D. Drawings and Calculations:
 - 1. All drawings and calculations shall be signed and sealed by a New York State Registered Professional Engineer.
 - 2. Submit complete NFPA 13 drawings and hydraulic calculations with cross reference to applicable drawings, water supply data, and equipment schedule with ratings for the system to the Owner's Representative, Insurance Underwriter, and other Authorities Having Jurisdiction.
 - 3. Submit hydraulic calculations for each design density/remote area with items in NFPA 13 incorporated including sketches to indicate flow quantities, sprinklers operating and direction of flow for pipes in looped and gridded systems.
 - 4. Drawing shall be fabrication drawings provided to indicate actual sprinkler, and equipment layouts. Drawings shall be 1/4" = 1'-0" scale on reproducible sheets of uniform size. Drawings shall show all data required by NFPA 13.
 - 5. Submit drawings in one (1) complete package.
- E. Record Drawings and Documents:
 - 1. Submit Record Drawings, hydraulic calculations, test reports, and NFPA Above and Below Ground Material and Test Certificates to the Owner's Representative, Insurance Underwriter and other Authorities Having Jurisdiction.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Mixing of manufacturers or models of the same or similar component will not be acceptable.

2.2 FIRE DEPARTMENT CONNECTION

- A. Cast brass; straight or angle body as required; two-way lug swivel inlets with individual drop clappers; cast brass; raised letter escutcheon labeled "AUTOSPKR"; matching brass plugs and chains.
 - 1. 2-1/2 in. x 2-1/2 in. x 4 in. Or Storz type. Confirm type with local Fire Department.

2. 2-1/2 in. hose threads shall match those in use by the local Fire Department.
 3. Polished brass escutcheon, inlets, plugs, and chains.
 4. Design Equipment:
 - a. Horizontal Flush Wall Type: Potter-Roemer 5020 Series.
- B. Storz quick connect type with 30 degree elbow, cap, chain and escutcheon labeled "AUTOSPKR".
1. 4 in. Storz x 4 in. NPT.
 2. Polished brass escutcheon, inlets, plugs and chains.
 3. Design Equipment: Potter-Roemer Fig. No. 5795-01 connection with Fig. No. 5799-01 cap and chain.
- C. Acceptable Manufacturers: Badger-Powhatan, Croker, Elkhart, Potter-Roemer.

2.3 PRESSURE GAUGES

- A. Water Pressure Gauge:
1. Anodized aluminum case, 3-1/2 in. diameter, glass lens, brass movement, 1/4 in. NPT male bottom connection with gauge cock.
 2. 0 to 300 psi range, in 5 psi increments with accuracy to meet ANSI B40.1.
- B. Air Pressure Gauge:
1. Anodized aluminum case, 3-1/2 in. diameter, glass lens, brass movement, 1/4 in. NPT male bottom connection with gauge cock.
 2. 0 to 80 psi range, in 1 psi increments with accuracy to meet ANSI B40.1.

2.4 SPRINKLER EQUIPMENT

- A. Alarm Check Valve: Vertical style with grooved ends, cast iron body, replaceable clapper facing, right or left hand alarm trim for variable pressure operation.
1. Trim:
 - a. Main drain and valve.
 - b. Gauges with gauge cocks.
 - c. Galvanized pipe and trim fittings.
 - d. Retard chamber and pressure switch.
 - e. Horn/Strobe flow device.

2. Design Equipment: Reliable Model E (175 psi).
 3. Acceptable Manufacturers: Reliable, Tyco, Victaulic, Viking.
- B. Riser Check Valve: Vertical style, grooved end, cast iron body and stainless steel clapper with replaceable facing.
1. Trim:
 - a. Main drain and valve.
 - b. Gauges with gauge cocks.
 - c. Galvanized pipe and trim fittings.
 2. Design Equipment: Reliable Model G (250 psi).
 3. Acceptable Manufacturers: Reliable, Tyco, Victaulic, Viking.
- C. Dry Pipe Valve: Vertical style with grooved ends, cast iron body, replaceable clapper facing with right or left hand trim and controls for automatic operation.
1. Trim:
 - a. Main drain and valve.
 - b. Gauges with gauge cocks.
 - c. Galvanized pipe and trim fittings.
 - d. Low air and waterflow alarm switches.
 - e. Automatic air pressure maintenance device.
 - f. Air relief valve set at 5 psi in excess of maximum pressure that should be on system.
 - g. Horn/Strobe Flow Device.
 - h. Anti-flooding type accelerator with trimmings.
 2. Design Equipment: Reliable Model D 4 in.
 3. Acceptable Manufacturers: Reliable, Tyco, Victaulic, Viking.
- D. Air Compressor - Riser Mounted Type: Direct drive, air cooled, single stage, oil less compressor, air filter, safety relief valve, field adjustable pressure range, 1/3 HP, 120 volt, 1 phase electric motor, mounting bracket, sized to pump system to 40 psi in less than 30 minutes, with air maintenance device.
1. Design Equipment: Reliable Model A.

2. Acceptable Manufacturers: General, Reliable, Viking.

2.5 SPRINKLERS AND ACCESSORIES

- A. Brass or bronze, 1/2 in. orifice, 1/2 in. NPT. 165°F ordinary temperature classification for light and ordinary hazards. Use 286°F sprinklers in Mechanical, Electrical and Elevator Rooms; in vicinity of heat equipment/sources; and in accordance with NFPA 13.
 1. Finished Ceiling Areas: White finish sprinklers Concealed pendent sprinklers with matching coverplate, color white.
 2. Unfinished Ceiling Areas: Natural brass/bronze finish pendent or upright sprinklers as required.
- B. Sprinkler Types and Design Equipment:
 1. Quick Response Upright: Reliable Model F1FR.
 2. Quick Response Concealed Pendent: Reliable Model G4A.
 3. Quick Response Horizontal Sidewall: Reliable Model F1FR-HSW1.
 4. Quick Response Dry Pendent and Horizontal Sidewall: Reliable Model F3QR.
 5. Attic Sprinklers: Tyco Model BB (Back-to-Back), SD (Single Directional), HIP, AP Attic Plus.
- C. Flexible Sprinkler Drops:
 1. FM Approved braided Type 304 stainless steel tube with union joints, factory tested to 400 psi and listed for up to three (3) 90° bends including bracket for mounting to ceiling or building structure.
 - a. Design Equipment: Victaulic "VicFlex".
- D. Sprinkler Cabinets and Spare Sprinklers:
 1. Steel or aluminum construction with shelves and shell holes to accommodate the number of spare sprinklers required by NFPA 13.
 2. Bright red finish with hinged front door and label.
 3. Sprinkler wrenches compatible for each type used.
 4. Spare sprinklers for each system of the type and proportion of those used in each system.
 5. Design Equipment: Reliable Model A-4.
- E. Acceptable Manufacturers: Reliable, Tyco, Victaulic, Viking.

2.6 ALARM EQUIPMENT

A. Waterflow Pressure Switch:

1. Pressure activated waterflow alarm switch with retard, steel enclosure and cover, adjustable differential type, SPDT contacts, 24 volt DC, 1/2 in. pressure connection, 250 psi rated.
2. Design Equipment: Potter Electric #WFSR-F.

B. Air Pressure Supervisory Switch:

1. For remote low air pressure supervisory alarm and for air compressor operation, steel enclosure and cover, adjustable differential type, SPDT contacts, 24 volt DC, 1/2 in. pressure connection compatible with system devices, 250 psi rated.
2. Design Equipment: Potter Electric #PS40A.

C. Paddle Waterflow Detectors:

1. Adjustable retard feature, SPDT contacts, 24 volt DC, 250 psi rated.
2. Design Equipment: Potter Electric #VSR Series.

D. Tamper Switches:

1. Integral with valve or separate device installed on valve to actuate alarm upon valve movement, steel enclosure, SPDT contacts, 24 volt DC, mounting brackets and hardware.
2. Design Equipment: Potter Electric #OSYSU (for OS&Y valves) and #PIVSU-A (for post indicator and butterfly valves).

E. Acceptable Manufacturers: Autocall, Potter Electric, System Sensor.

2.7 INSPECTOR'S TEST EQUIPMENT

A. Test and Drain Valve:

1. Combined test and drain valves, sight glass and interchangeable restricting orifice, sized for smallest orifice in sprinkler zone.
2. Design Equipment: AGF Manufacturing "Test and Drain".
3. Acceptable Manufacturers: AGF Manufacturing, Viking, Victaulic.

2.8 MANUAL AIR VENTS

A. Manual air vent shall include 1 in. isolation valve with forged brass body, stainless steel 20 mesh strainer, ball float, hose connection, threaded cap and lanyard.

1. Design Equipment: AGF Manufacturing, Inc. Model 7910MAV.

2. Acceptable Manufacturers: AGF Manufacturing, Inc.

2.9 AUTOMATIC AIR VENTS

- A. Automatic air vent shall include 1 in. NPT isolation valve with forged brass body and stainless steel 20 mesh strainer, adjustable purge valve with hose connection, threaded cap and lanyard and automatic air release valve with conical body, recessed venting valve, single float on rigid shaft and bubble breaker.
- B. Provide with end cap and close nipple (AGF Model 7930ECA)
 1. Design Equipment: AGF Manufacturing, Inc. Model 7900AAV.
 2. Acceptable Manufacturers: AGF Manufacturing, Inc.

2.10 SYSTEM COMPONENT IDENTIFICATION

- A. At control, test and drain valves, provide permanently marked identification signs constructed of 18 gauge steel with baked enameled finish. The signs shall be permanently mounted on the piping or wall at the valve, or on the valve, but shall not be hung on the valve with wires or chains which permits easy removal of the sign. The sign shall clearly indicate the valve's purpose and what portion of the structure it serves. Additional signs, shall be provided at each alarm check and dry pipe valve to clearly indicate hydraulic calculation data.

2.11 ADDITIONAL SPRINKLERS AND SPRINKLER GUARDS

- A. Include allowance for providing 6 additional sprinklers with related piping, fittings, hangers installed at locations where job conditions or equipment selections may be required.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The nature of the work requires coordination with other trades. Shop fabrication shall be done at the Contractor's risk. Relocation of piping and components to avoid obstructions may be necessary. Relocation, if required, shall be done at the Contractor's expense. The installation shall be performed in a workmanlike manner as determined by the Owner's Representative and in accordance with the Contract Documents, manufacturer's printed installation instructions, and submitted and Owner's Representative reviewed drawings.
- B. Piping shall not pass directly over electric panelboards, switchboards, motor control centers, and similar electric and telephone equipment. However, protection for these spaces shall be provided.
- C. Piping shall be installed concealed above finish ceiling area with sprinklers located in the center of ceiling tiles where ceiling tiles are used.
- D. Provide a readily removable flushing connection consisting of a cap at each end of cross mains.

- E. Each sprinkler system shall be provided with an automatic vent valve or a manual vent valve located near the high point of the system in accordance with NFPA requirements.
- F. Pipe ball drip valves at a floor drain or to the exterior. Pipe 2 in. main drains and water motor gong drains to discharge to the exterior at approximately 2 ft. above finished grade.
- G. Securely install the spare sprinkler cabinets to the building wall at the main riser.
- H. Inspector's test valves and dry system auxiliary drains shall be installed 7 ft. or less above the finished floor.
- I. Fire department connections shall be installed 3 ft. above finished grade and water motor gongs approximately 10 ft. above finished grade.
- J. Upright sprinklers directly on branch lines shall be installed with their frame parallel to the piping.
- K. Provide sprinkler protection under ductwork, groups of ductwork and other obstructions to water spray and distribution. Use intermediate level sprinklers if subject to waterspray from above.
- L. Exposed pipe shall be left clean for painting.
- M. Coordinate and activate the systems or portions of the system to operational status as soon as possible.

3.2 PIPING, VALVES AND HANGERS

- A. Refer to other applicable sections.
- B. All piping shall be installed to permit drainage of the system through a main drain valve. Where a change in piping direction prevents drainage of the system, auxiliary drains shall be provided. The auxiliary drain assembly shall consist of a lockable ball valve, nipple and cap or plug and shall be located 7 ft. or less above the finished floor. Pipe drain to an accessible location.

3.3 TESTS

- A. General:
 - 1. Pipe installation shall be inspected by Owner's Representative prior to being covered by building construction or backfill.
 - 2. Give the Owner's Representative advance notice of final tests. Perform tests in a safe manner. Provide written certification that tests have been successfully completed. Use NFPA Above and Below Ground Material and Test Certificate Forms.
 - 3. Correct system leaks prior to final test. Do not utilize water additives, caulking, etc. to correct leaks. Provide appliances, equipment, instruments, devices and personnel.

4. Flushing: Follow Contract Documents and utilize open end pipe sections if possible.

B. Pressure Tests:

1. Hydrostatic Tests: Minimum 200 psi and in accordance with NFPA 13 for two (2) hours.
 - a. Air test not accepted as final test.
2. Air Test: Minimum 40 psi for 24 hours with loss not to exceed 1.5 psi within 24 hour duration.
3. Do not subject existing systems to excess pressures.

C. Alarm Tests:

1. Demonstrate activation of alarms and operational trip test and water delivery time for dry systems by use of Inspector's test valve.

3.4 SYSTEM TURNOVER

- A. Prior to final acceptance, instruct the Owner's Representative in the proper operation, maintenance, testing, inspection and emergency procedures for all systems furnished, for a period of time as needed. Provide one (1) new original pamphlet of NFPA 25. Indicate in writing to the Owner's Representative the provisions for proper maintenance, testing, and inspection of the systems as required by local fire codes.

END OF SECTION

SECTION 220500 - BASIC PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide all labor, tools, materials, accessories, parts, transportation, taxes, and related items, essential for installation of the work and necessary to make work, complete, and operational. Provide new equipment and material unless otherwise called for. References to codes, specifications and standards called for in the specification sections and on the drawings mean, the latest edition, amendment and revision of such referenced standard in effect on the date of these contract documents. All materials and equipment shall be installed in accordance with the manufacturer's recommendations.

1.2 LICENSING

- A. The Contractor shall hold a license to perform the work as issued by the authority having jurisdiction.
- B. Plumbing contract work shall be performed by, or under, the direct supervision of a licensed master plumber.
- C. Electrical contract work shall be performed by, or under, the direct supervision of a licensed electrician.

1.3 PERMITS

- A. Apply for and obtain all required permits and inspections, pay all fees and charges including all service charges. Provide certificate of approval from the Authorities Having Jurisdiction prior to request for final payment.
- B. Provide electrical inspection certificate of approval from Middle Department Inspection Agency, Commonwealth Inspection Agency, or an Engineer approved Inspection Agency prior to request for final payment.

1.4 CODE COMPLIANCE

- A. Provide work in compliance with the following:
 - 1. 2020 Building Code of New York State.
 - 2. 2020 Fire Code of New York State.
 - 3. 2020 Plumbing Code of New York State.
 - 4. 2020 Mechanical Code of New York State.
 - 5. 2020 Fuel Gas Code of New York State.
 - 6. 2020 Property Maintenance Code of New York State.
 - 7. 2020 Energy Conservation Code of New York State.

8. Accessible and Usable Buildings and Facilities, ICC A117.1 (2009).
9. New York State Department of Labor Rules and Regulations.
10. New York State Department of Health.
11. 2017 National Electrical Code (NEC).
12. Occupational Safety and Health Administration (OSHA).
13. Local Codes and Ordinances.
14. Life Safety Code, NFPA 101.

1.5 GLOSSARY

ACI	American Concrete Institute
AGA	American Gas Association
AGCA	Associated General Contractors of America, Inc.
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AFBMA	Anti-Friction Bearing Manufacturer's Association
AMCA	Air Moving and Conditioning Association, Inc.
ANSI	American National Standards Institute
ARI	Air Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.
ASME	American Society of Mechanical Engineers
ASPE	American Society of Plumbing Engineers
ASTM	American Society for Testing Materials
AWSC	American Welding Society Code
AWWA	American Water Works Association
FM	Factory Mutual Insurance Company
IBR	Institute of Boiler & Radiation Manufacturers
IEEE	Institute of Electrical and Electronics Engineers
IRI	Industrial Risk Insurers
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association

NYS/DEC	New York State Department of Environmental Conservation
SBI	Steel Boiler Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
UFPO	Underground Facilities Protective Organization
UL	Underwriter's Laboratories, Inc.
OSHA	Occupational Safety and Health Administration
XL - GAP	XL Global Asset Protection Services

1.6 DEFINITIONS

Acceptance	Owner acceptance of the project from Contractor upon certification by Owner's Representative.
As Specified	Materials, equipment including the execution specified/shown in the contract documents.
Basis of Design	Equipment, materials, installation, etc. on which the design is based. (Refer to the article, Equipment Arrangements, and the article, Substitutions.)
Code Requirements	Minimum requirements.
Concealed	Work installed in pipe and duct shafts, chases or recesses, inside walls, above ceilings, in slabs or below grade.
Coordination Drawings	Show the relationship and integration of different construction elements and trades that require careful coordination during fabrication or installation, to fit in the space provided or to function as intended.
Delegated-Design Services	<p>Performance and Design criteria for Contractor provided professional services. Where professional design services or certifications by a design professional are specifically required of a Contractor, by the Contract Documents. Provide products and systems with the specific design criteria indicated.</p> <p>If criteria indicated is insufficient to perform services or certification required, submit a written request for additional information to the Engineer.</p> <p>Submit wet signed and sealed certification by the licensed design professional for each product and system specifically assigned to the Contractor to be designed or certified by a design professional.</p> <p>Examples: structural maintenance ladders, stairs and platforms, pipe anchors, seismic compliant system, wind, structural supports for material equipment, sprinkler hydraulic calculations.</p>
Equal, Equivalent, Equal To, Equivalent To, As Directed and As Required	Shall all be interpreted and should be taken to mean "to the satisfaction of the Engineer".
Exposed	Work not identified as concealed.
Extract	Carefully dismantle and store where directed by Owner's Representative

	and/or reinstall as indicated on drawings or as described in specifications.
Furnish	Purchase and deliver to job site, location as directed by the Owner's Representative.
Inspection	Visual observations by Owner's site Representative.
Install	Store at job site if required, proper placement within building construction including miscellaneous items needed to affect placement as required and protect during construction. Take responsibility to mount, connect, start-up and make fully functional.
Labeled	Refers to classification by a standards agency.
Manufacturers	Refer to the article, Equipment Arrangements, and the article, Substitutions.
Prime Professional	Architect or Engineer having a contract directly with the Owner for professional services.
Product Data	Illustrations, standard schedules, performance charts, instructions, brochures, wiring diagrams, finishes, or other information furnished by the Contractor to illustrate materials or equipment for some portion of the work.
Provide (Furnish and Install)	Contractor shall furnish all labor, materials, equipment and supplies necessary to install and place in operating condition, unless otherwise specifically stated.
Relocate	Disassemble, disconnect, and transport equipment to new locations, then clean, test, and install ready for use.
Remove	Dismantle and take away from premises without added cost to Owner, and dispose of in a legal manner.
Review and Reviewed	Should be taken to mean to be followed by "for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents".
Roughing	Pipe, duct, conduit, equipment layout and installation.
Samples	Physical full scale examples which illustrate materials, finishes, coatings, equipment or workmanship, and establishes standards by which work will be judged.
Satisfactory	As specified in contract documents.
Shop Drawings	Fabrication drawings, diagrams, schedules and other instruments, specifically prepared for the work by the Contractor or a Sub-contractor, manufacturer, supplier or distributor to illustrate some portion of the work.
Site Representative	Owner's Inspector or "Clerk of Works" at the work site.
Submittals Defined (Technical)	<p>Any item required to be delivered to the Engineer for review as requirement of the Contract Documents.</p> <p>The purpose of technical submittals is to demonstrate for those portions of the work for which a submittal is required, the manner in which the Contractor proposes to conform to the information given and design concepts expressed and required by the Contract Documents.</p>

1.7 SHOP DRAWINGS/PRODUCT DATA/SAMPLES

- A. Provide submittals on all items of equipment and materials to be furnished and installed. Submittals shall be accompanied by a transmittal letter, stating name of project and contractor, name of vendor supplying equipment, number of drawings, titles, specification sections (name and number) and other pertinent data called for in individual sections. Submittals shall have individual cover sheets that shall be dated and contain: Name of project; name of prime professional; name of prime contractor; description or names of equipment, materials and items; and complete identification of locations at which materials or equipment are to be installed. Individual piecemeal or incomplete submittals will not be accepted. Similar items, (all types specified) shall be submitted at under one cover sheet per specification section (e.g. valves, plumbing fixtures, etc.). Number each submittal by trade. Indicate deviations from contract requirements on Letter of Transmittal. Submittals will be given a general review only. Corrections or comments made on the Submittals during the review do not relieve Contractor from compliance with requirements of the drawings and specifications. The Contractor is responsible for: confirming and correcting all quantities; checking electrical characteristics and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades; and performing his work in a safe and satisfactory manner. If submitting hard copies, submit four (4) copies for review.
- B. If submittals are to be submitted electronically, all requirements in Item A apply. Submittals shall be emailed in PDF format to specific email address provided by the Construction Manager, General Contractor, Architect or Project Manager. Name of project shall be in subject line of email. Send emails to mealbasubmittalclerk@meengineering.com.
- C. Refer to Division 01 for additional requirements.

1.8 PROTECTION OF PERSONS AND PROPERTY

- A. Contractor shall assume responsibility for construction safety at all times and provide, as part of contract, all trench or building shoring, scaffolding, shielding, dust/fume protection, mechanical/electrical protection, special grounding, safety railings, barriers, and other safety feature required to provide safe conditions for all workmen and site visitors.

1.9 EQUIPMENT ARRANGEMENTS

- A. The contract documents are prepared using one manufacturer as the Basis of Design, even though other manufacturers' names are listed. If Contractor elects to use one of the listed manufacturers other than Basis of Design, submit detailed drawings, indicating proposed installation of equipment. Show maintenance clearances, service removal space required, and other pertinent revisions to the design arrangement. Make required changes in the work of other trades, at no increase in any contract. Provide larger motors, feeders, breakers, and equipment, additional control devices, valves, fittings and other miscellaneous equipment required for proper operation, and assume responsibility for proper location of roughing and connections by other trades. Remove and replace doorframes, access doors, walls, ceilings, or floors required to install other than Basis of

Design. If revised arrangement submittal is rejected, revise and resubmit specified Basis of Design item which conforms to Contract Documents.

1.10 SUBSTITUTIONS

- A. If Contractor desires to bid on any other kind, type, brand, or manufacture of material or equipment than those named in specifications, secure prior approval. To request such approval, Contractor shall submit complete information comparing (item-for-item) material or equipment offered with design material or equipment. Include sufficient information to permit quick and thorough comparison, and include performance curves on same basis, capacities, power requirements, controls, materials, metal gauges, finishes, dimensions, weights, etc., of major parts. If accepted, an addendum will be issued to this effect ahead of bid date. Unless such addendum is issued, substitution offered may not be used.

1.11 UTILITY COMPANY SERVICES

- A. Division 26 shall make arrangements with National Grid for electric service to the Owner's distribution equipment. Provide underground or overhead electric service as called for and transformers, meter sockets or meter compartments as required by the Utility Company. Coordinate all activities between the Owner and Utility Company. The installation of the electric service shall comply with the published Utility Company standards
- B. Division 22 shall make arrangements with National Grid for gas service to the Owner's distribution system. Provide service to the building as required by the Utility Company. Coordinate all activities between the Owner and Utility Company. The installation of the gas service shall comply with the published Utility Company standards

1.12 ROUGHING

- A. The Contract Drawings have been prepared in order to convey design intent and are diagrammatic only. Drawings shall not be interpreted to be fully coordinated for construction.
- B. Due to small scale of Drawings, it is not possible to indicate all offsets, fittings, changes in elevation, interferences, etc. Make necessary changes in contract work, equipment locations, etc., as part of a contract to accommodate work to avoid obstacles and interferences encountered. Before installing, verify exact location and elevations at work site. DO NOT SCALE plans. If field conditions, details, changes in equipment or shop drawing information require an important rearrangement, report same to Owner's Representative for review. Obtain written approval for all major changes before installing.
- C. Install work so that items both existing and new are operable and serviceable. Eliminate interference with removal of coils, motors, filters, belt guards and/or operation of doors. Provide easy, safe, and code mandated clearances at controllers, motor starters, valve access, and other equipment requiring maintenance and operation. Provide new materials, including new piping and insulation for relocated work.

- D. Coordinate work with other trades and determine exact route or location of each duct, pipe, conduit, etc., before fabrication and installation. Coordinate with Architectural Drawings. Obtain from Owner's Representative exact location of all equipment in finished areas, such as thermostat, fixture, and switch mounting heights, and equipment mounting heights. Coordinate all work with the architectural reflected ceiling plans and/or existing Architecture. Mechanical and electrical drawings show design arrangement only for diffusers, grilles, registers, air terminals, lighting fixtures, sprinklers, speakers, and other items. Do not rough-in contract work without reflected ceiling location plans.
- E. Before roughing for equipment furnished by Owner or in other Divisions, obtain from Owner and other Divisions, approved roughing drawings giving exact location for each piece of equipment. Do not "rough in" services without final layout drawings approved for construction. Cooperate with other trades to insure proper location and size of connections to insure proper functioning of all systems and equipment. For equipment and connections provided in this contract, prepare roughing drawing as follows:
 - 1. Existing Equipment: Measure the existing equipment and prepare for installation in new location.
 - 2. New Equipment: Obtain equipment roughing drawings and dimensions, then prepare roughing-in-drawings. If such information is not available in time, obtain an acknowledgement in writing, then make space arrangements as required with Owner's Representative.

1.13 COORDINATION DRAWINGS

- A. Before construction work commences, Divisions for all trades shall submit coordination drawings in the form of CAD drawing files, drawn at not less than 1/4 in. scale. Such drawings will be required throughout all areas, for all Contracts. These drawings shall show resolutions of trade conflicts in congested areas. Mechanical Equipment Rooms shall be drawn early in coordination drawing process simultaneous with all other congested areas. Prepare Coordination Drawings as follows:
 - 1. Division 23 shall prepare the base plan CAD coordination drawings showing all ductwork, all pertinent heating piping, and equipment. These drawings may be CAD files of the required Ductwork Shop Drawings. The drawings shall be coordinated with lighting fixtures, sprinklers, air diffusers, other ceiling mounted items, ceiling heights, structural work, maintenance clearances, electric code clearance, reflected ceiling plans, and other contract requirements. Reposition proposed locations of work after coordination drawing review by the Owner's Representative. Provide adjustments to exact size, location, and offsets of ducts, pipes, conduit, etc., to achieve reasonable appearance objectives. Provide these adjustments as part of contract. Minor revisions need not be redrawn.
 - 2. Division 23 shall provide CAD files and submit the base plan CAD Coordination Drawings to all Divisions.
 - 3. Divisions 21 and 22 shall draw the location of piping and equipment on the base plan CAD Coordination Drawings, indicating areas of conflict and suggested resolutions.

4. Divisions 26, 27 and 28 shall draw the location of lighting fixtures, cable trays, and feeders over 1-1/2 in. on the base plan CAD Coordination Drawings, indicating areas of conflict and suggested resolution.
 5. The General Construction Trade shall indicate areas of architectural/structural conflicts or obstacles on the CAD Coordination Drawings, and coordinate to suit the overall construction schedule.
 6. The General Construction Trade shall expedite all Coordination Drawing work and coordinate to suit the overall construction schedule. In the case of unresolved interferences, he shall notify the Owner's Representative. The Owner's Representative will then direct the various trades as to how to revise their drawings as required to eliminate installation interferences.
 7. If a given trade proceeds prior to resolving conflicts, then if necessary, that trade shall change its work at no extra cost in order to permit others to proceed with a coordinated installation. Coordination approval will be given by areas after special site meetings involving all Divisions.
- B. The purpose of the coordination drawing process is to identify and resolve potential conflicts between trades, and between trades and existing or new building construction, before they occur in construction. Coordination drawings are intended for the respective trade's use during construction and shall not replace any Shop Drawings, or record drawings required elsewhere in these contract documents.

1.14 EQUIPMENT AND MATERIAL REQUIREMENTS

- A. Provide materials that meet the following minimum requirements:
1. Materials shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less, in accordance with NFPA 255.
 2. All equipment and material for which there is a listing service shall bear a UL label.
 3. Potable water systems and equipment shall be built according to AWWA Standards.
 4. Gas-fired equipment and system shall meet AGA Regulations and shall have AGA label.
 5. Fire protection equipment shall be UL listed and FM approved.
- B. Exterior and wet locations shall utilize materials, equipment supports, mounting, etc. suitable for the intended locations. Metals shall be stainless steel, galvanized or with baked enamel finish as a minimum. Finishes and coatings shall be continuous and any surface damaged or cut ends shall be field corrected in accordance with the manufacturer's recommendations. Hardware (screws, bolts, nuts, washers, supports, fasteners, etc.) shall be:

1. Stainless steel where the associated system or equipment material is stainless steel or aluminum.
2. Hot dipped galvanized or stainless steel where the associated system or equipment is steel, galvanized steel or other.

1.15 CUTTING AND PATCHING

- A. Each trade shall include their required cutting and patching work unless shown as part of the General Construction Contract. Refer to General Conditions of the Contract for Construction, for additional requirements. Cut and drill from both sides of walls and/or floors to eliminate splaying. Patch cut or abandoned holes left by removals of equipment or fixtures. Patch adjacent existing work disturbed by installation of new work including insulation, walls and wall covering, ceiling and floor covering, other finished surfaces. Patch openings and damaged areas equal to existing surface finish. Cut openings in prefabricated construction units in accordance with manufacturer's instructions.

1.16 PAINTING

- A. Paint all insulated and bare piping, pipe hangers and supports exposed to view in mechanical equipment rooms, penthouse, boiler rooms and similar spaces. Paint all bare piping, ductwork and supports exposed to the out-of-doors with rust inhibiting coatings. Paint all equipment that is not factory finish painted (i.e. expansion tanks, etc.).
- B. All painting shall consist of one (1) prime coat and two (2) finish coats of non-lead oil base paint, unless otherwise indicated herein. Provide galvanized iron primer for all galvanized surfaces. All surfaces must be thoroughly cleaned before painting. Review system color coding prior to painting with the Owner's Representative or Architect.
- C. All items installed after finished painting is completed and any damaged factory finish paint on equipment furnished under this contract must be touched up by the Contractor responsible for same.
- D. Include painting for patchwork with color to match adjacent surfaces. Where color cannot be adequately matched, paint entire surface. Provide one (1) coat of primer and two (2) finish coats or as called for in the Specifications.
- E. All primers and paint used in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits called for in the current version of U.S. Green Building Council LEED Credits EQ 4.1 and EQ 4.2.
- F. Refer to Division 9 - Finishes, for additional information.

1.17 CONCEALMENT

- A. Conceal all contract work above ceilings and in walls, below slabs, and elsewhere throughout building. If concealment is impossible or impractical, notify Owner's Representative before starting that part of the work and install only after his review. In areas with no ceilings, install only after Owner's Representative reviews and comments on arrangement and appearance.

1.18 CHASES

A. New Construction:

1. Certain chases, recesses, openings, shafts, and wall pockets will be provided as part of General Construction Trade. Mechanical and Electrical trades shall provide all other openings required for their contract work.
2. Check Architectural and Structural Design and Shop Drawings to verify correct size and location for all openings, recesses and chases in general building construction work.
3. Assume responsibility for correct and final location and size of such openings.
4. Rectify improperly sized, improperly located or omitted chases or openings due to faulty or late information or failure to check final location.
5. Provide 18 gauge galvanized sleeves and inserts. Extend all sleeves 2 in. above finished floor. Set sleeves and inserts in place ahead of new construction, securely fastened during concrete pouring. Correct, by drilling, omitted or improperly located sleeves. Assume responsibility for all work and equipment damaged during course of drilling. Firestop all unused sleeves.
6. Provide angle iron frame where openings are required for contract work, unless provided by General Construction trade.

1.19 PENETRATION FIRESTOPPING

A. Fire-Stopping for Openings Through Fire and Smoke Rated Wall and Floor Assemblies:

1. Provide materials and products listed or classified by an approved independent testing laboratory for "Penetration Fire-Stop Systems". The system shall meet the requirements of "Fire Tests of Penetrations Fire-Stops" designated ASTM E814.
2. Provide fire-stop system seals at all locations where piping, tubing, conduit, electrical busways/cables/wires, ductwork and similar utilities pass through or penetrate fire rated wall or floor assembly. Provide fire-stop seal between sleeve and wall for drywall construction.
3. The minimum required fire resistance ratings of the wall or floor assembly shall be maintained by the fire-stop system. The installation shall provide an air and watertight seal.
4. The methods used shall incorporate qualities which permit the easy removal or addition of electrical conduits or cables without drilling or use of special tools. The product shall adhere to itself to allow repairs to be made with the same material and permit the vibration, expansion, and/or contraction of any items passing through the penetration without cracking, crumbling and resulting reduction in fire rating.

5. Plastic pipe/conduit materials shall be installed utilizing intumescent collars.
 6. Provide a submittal including products intended for use, manufacturer's installation instructions, and the UL details for all applicable types of wall and floor penetrations.
 7. Fire-stopping products shall not be used for sealing of penetrations of non-rated walls or floors.
- B. Acceptable Manufacturers:
1. Dow Corning Fire-Stop System Foams and Sealants.
 2. Nelson Electric Fire-Stop System Putty, CLK and WRP.
 3. S-100 FS500/600, Thomas & Betts.
 4. Carborundum Fyre Putty.
 5. 3-M Fire Products.
 6. Hilti Corporation.

1.20 NON-RATED WALL PENETRATIONS

- A. Each trade shall be responsible for sealing wall penetrations related to their installed work, including but not limited to ductwork, piping, conduits, etc. See individual specification sections for requirements.

1.21 SUPPORTS

- A. Provide required supports, beams, angles, hangers, rods, bases, braces, and other items to properly support contract work. Modify studs, add studs, add framing, or otherwise reinforce studs in metal stud walls and partitions as required to suit contract work. If necessary, in stud walls, provide special supports from floor to structure above.
- B. For precast panels/planks and metal decks, support mechanical/electrical work as determined by manufacturer and the Engineer. Provide heavy gauge steel mounting plates for mounting contract work. Mounting plates shall span two or more studs. Size, gauge, and strength of mounting plates shall be sufficient for equipment size, weight, and desired rigidity.
- C. For finished areas without a finished ceiling system such as classrooms, offices, conference rooms, etc., where decking and structure is exposed, and ductwork/piping/conduit is exposed: All mounting brackets, channel support systems and mounting hardware for ductwork, piping, lighting, etc. shall be concealed and approved by the Architect/Engineer prior to the installation. AirCraft cable style hanging for ductwork is required. It is recommended that room mockups be done and receive Architect/Engineer approval prior to proceeding with installation.

- D. Equipment, piping, conduit, raceway, etc. supports shall be installed to minimize the generation and transmission of vibration.
- E. Materials and equipment shall be solely supported by the building structure and connected framing. Gypboard, ceilings, other finishes, etc. shall not be used for support of materials and equipment.

1.22 ACCESS PANELS

- A. Provide access panels for required access to respective trade's work. Location and size shall be the responsibility of each trade. Access panels provided for equipment shall provide an opening not smaller than 22 in. by 22 in. Panels shall be capable of opening a minimum of 90 degrees. Bear cost of construction changes necessary due to improper information or failure to provide proper information in ample time. Access panels over 324 square inches shall have two cam locks. Provide proper frame and door type for various wall or ceiling finishes. Access panels shall be equal to "Milcor" as manufactured by Inland Steel Products Co., Milwaukee, Wisconsin. Provide General Construction trade with a set of architectural plans with size and locations of access panels.

1.23 CONCRETE BASES

- A. Provide concrete bases for all floor mounted equipment. Provide 3,000 lb. concrete, chamfer edges, trowel finish, and securely bond to floor by roughening slab and coating with cement grout. Bases 4 in. high (unless otherwise indicated); shape and size to accommodate equipment. Provide anchor bolts in equipment bases for all equipment provided for the project, whether mounted on new concrete bases or existing concrete bases.

1.24 HVAC EQUIPMENT CONNECTIONS

- A. Contractor is responsible for draining, filling, venting, chemically treating and restarting any systems which are affected by work shown on the Contract Documents unless specifically noted otherwise.
- B. Provide final connections to all equipment as required by the equipment. Provide final connections, including domestic water piping, wiring, controls, and devices from equipment to outlets left by other trades. Provide equipment waste, drip, overflow and drain connections extended to floor drains.
- C. Provide for Owner furnished and Contractor furnished equipment all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, insulation, sheet metal work, controls, dampers, as required.

1.25 PLUMBING EQUIPMENT CONNECTIONS

- A. Contractor is responsible for draining, filling, venting, chemically treating and restarting any systems which are affected by work shown on the Contract Documents unless specifically noted otherwise.

- B. Provide roughing and final connections to all equipment. Provide loose key stops, sanitary "P" traps, tailpiece, adapters, gas or air cocks, and all necessary piping and fittings from roughing point to equipment. Provide installation of sinks, faucets, traps, tailpiece furnished by others. Provide cold water line with gate valve and backflow prevention device at locations called for. Provide continuation of piping and connection to equipment that is furnished by others. Provide relief valve discharge piping from equipment relief valves.
- C. Provide valved water outlet adjacent to equipment requiring same. Provide equipment type floor drains, or drain hubs, adjacent to equipment.
- D. Install controls and devices furnished by others.
- E. Refer to Contract Documents for roughing schedules, and equipment and lists indicating scope of connections required.
- F. Provide for Owner furnished and Contractor furnished equipment all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, as required.

1.26 ELECTRICAL EQUIPMENT CONNECTIONS

- A. Provide complete power connections to all electrical equipment. Provide control connections to equipment. Heavy duty NEC rated disconnect ahead of each piece of equipment. Ground all equipment in accordance with NEC.
- B. Provide for Owner furnished and Contractor furnished equipment all power wiring, electric equipment, control wiring, switches, lights, receptacles, and connections as required.

1.27 STORAGE AND PROTECTION OF MATERIALS AND EQUIPMENT

- A. Store Materials on dry base, at least 6 in. aboveground or floor. Store so as not to interfere with other work or obstruct access to buildings or facilities. Provide waterproof/windproof covering. Remove and provide special storage for items subject to moisture damage. Protect against theft or damage from any cause. Replace items stolen or damaged, at no cost to Owner.
- B. Refer to Division 01 for additional information.

1.28 FREEZING AND WATER DAMAGE

- A. Take all necessary precautions with equipment, systems and building to prevent damage due to freezing and/or water damage. Repair or replace, at no change in contract, any such damage to equipment, systems, and building. Perform first seasons winterizing in presence of Owner's operating staff.

1.29 OWNER INSTRUCTIONS

- A. Before final acceptance of the work, furnish necessary skilled labor to operate all systems by seasons. Instruct designated person on proper operation, and care of

systems/equipment. Repeat instructions, if necessary. Obtain written acknowledgement from person instructed prior to final payment. Contractor is fully responsible for system until final acceptance, even though operated by Owner's personnel, unless otherwise agreed in writing. List under clear plastic, operating, maintenance, and starting precautions procedures to be followed by Owner for operating systems and equipment.

1.30 OPERATION AND MAINTENANCE MANUALS

- A. Submit by email (preferred) or digital media, thru the normal project submittal process. Include a copy of each final approved Shop Drawing, wiring diagrams, piping diagrams, spare parts lists, final testing and balancing report, as-built drawings and manufacturer's instructions. Include typewritten instructions, describing equipment, starting/operating procedures, emergency operating instructions, summer-winter changeover, freeze protection, precautions and recommended maintenance procedures. Include name, address, and telephone number of installing contractor and of supplier manufacturer Representative and service agency for all major equipment items. Provide a table of contents page and dividers based upon specification section numbers. Submit in a compiled and bookmarked PDF format as outlined below.
- B. Provide content for Operation and Maintenance Manuals as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Engineer and Commissioning Agent will comment on whether content of operation and maintenance submittals is acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- C. Submit Operation and Maintenance Manuals in the following format:
 - 1. Submit by uploading to web-based project software site, or by email to Architect, as a formal project submittal in conformance with the project specific submittal procedures. Enable reviewer comments on draft submittals.
 - 2. 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.
 - 3. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in the 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 on opening file.
- D. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing Owner training. Engineer and Commissioning Agent will comment on whether general scope and content of manual are acceptable.

- E. Final Manual Submittal: Submit O&M manual in final form prior to requesting inspection for Substantial Completion and at least 2 weeks before commencing Owner training. Engineer and Commissioning Agent will return copy with review comments.
 - 1. Correct or revise O&M manual to comply with Engineer's and Commissioning Agent's comments. Submit copies of each corrected manual within 2 weeks of receipt of Engineer's and Commissioning Agent's comments.
- F. Refer to Division 01 for additional requirements.

1.31 RECORD DRAWINGS

- A. The Contractor shall obtain at his expense one (1) set of construction Contract Drawings, (including non-reproduction black and white prints or electronic files) for the purpose of recording as-built conditions.
- B. The Contractor shall perform all survey work required for the location and construction of the work and to record information necessary for completion of the record drawings. Record drawings shall show the actual location of the constructed facilities in the same manner as was shown on the bid drawings. All elevations and dimensions shown on the drawings shall be verified or corrected so as to provide a complete and accurate record of the facilities as constructed.
- C. It shall be the responsibility of the Contractor to mark EACH sheet of the contract documents in red and to record thereon in a legible manner, any and all approved field changes and conditions as they occur. A complete file of approved field sketches, diagrams, and other changes shall also be maintained. At completion of the work, the complete set of red marked contract documents, plus all approved field sketches and diagrams shall be submitted to the engineer and used in preparation of the record drawings.
- D. A complete set of red marked contract drawings shall be submitted, at one time, as the "Record" set. If there are no changes to a specific drawing, the contractor shall indicate "NO CHANGES" on that drawing. ALL drawings shall be included in the "Record" set.
- E. The complete set of red marked Contract Documents or electronic files shall be certified by the Contractor as reflecting record conditions and submitted to the engineer for review.
- F. The Contractor shall have the marked up set scanned, if they are not already electronic files, and then submit them to the Engineer as the "Record Set".
- G. Refer to Division 01 for additional requirements.

1.32 FINAL INSPECTION

- A. Upon completion of all Engineering Site Observation list items, the Contractor shall provide a copy of the Engineering Site Observation Report back to the Engineer with each item noted as completed or the current status of the item. Upon receipt, the Engineer will schedule a final review.

1.33 COMMISSIONING

- A. Refer to General Commissioning Requirements in Division 01 for additional requirements.

1.34 TEMPORARY HEATING AND COOLING

- A. Refer to the General Conditions of the Contract for Construction and Supplemental General Conditions.

1.35 MAINTENANCE OF HVAC SYSTEMS DURING TEMPORARY USE PERIODS

- A. Provide each air handling system with a set of prefilters in addition to the permanent filters. Furnish four sets of prefilters for each system for use when system is operated for temporary heating or cooling. During such use, change prefilters as often as directed by Owner's Representative. Provide MERV-8 filters in all open ended ducts, return grilles and registers to keep dust out of ductwork. Change as often as necessary. Remove all such temporary filters upon completion. Use supply fans only. Do not operate return fans.
- B. Blank-off outside air intake opening during temporary heating period. Install first set of permanent filters and prefilters.
- C. Adjust dampers on supply system.
- D. Set all heating coil control valves for manual operation.
- E. Do not install any grilles or diffusers at room terminal ends of ducts until permission is given.
- F. Assume responsibility for systems and equipment at all times, even though used for temporary heat or ventilating. Repair or replace all dented, scratched or damaged parts of systems prior to final acceptance.
- G. Remove concrete, rust, paint spots, other blemishes, then clean.
- H. Just prior to final acceptance, remove used final filter and install new set. Deliver all unused sets of prefilters to the Owner and obtain written receipt. Properly lubricate system bearings before and during temporary use. Maintain thermostats, freeze stats, overload devices, and all other safety controls in operating condition.

1.36 TEMPORARY FACILITIES

- A. Refer to the Division 1 Sections, General Conditions and Supplemental General Conditions.

1.37 TEMPORARY LIGHT AND POWER

- A. Refer to the Division 1 Sections, General Conditions and Supplemental General Conditions.

1.38 CLEANING

- A. It is the Contractor's responsibility to keep clean all equipment and fixtures provided under this contract for the duration of the project. Each trade shall keep the premises free from an accumulation of waste material or rubbish caused by his operations. The facilities require an environment of extreme cleanliness, and it is the Contractor's responsibility to adhere to the strict regulations regarding procedures on the existing premises. After all tests are made and installations completed satisfactorily:
1. Thoroughly clean entire installation, both exposed surfaces and interiors.
 2. Remove all debris caused by work.
 3. Remove tools, surplus, materials, when work is finally accepted.

1.39 SYSTEM START-UP AND TESTING

- A. Prior to commencement of work, the Division(s) effecting such system shall survey all building mechanical, plumbing, fire protection and electrical systems and components and make written notice to the Owner's Representative regarding any damage, missing items and/or incomplete systems. Prior to the conclusion of this project, the Contractor shall verify with the Owner's Representative that all building systems have been returned to their original conditions.

1.40 TRANSFER OF ELECTRONIC FILES

- A. M/E Engineering, P.C. will provide electronic files for the Contractor's use in the preparation of sheetmetal shop drawings, coordination drawings, or record drawings related to the project, subject to a and the following terms and conditions:
1. The Contractor shall submit a formal request for electronic drawing files on the M/E Engineering, P.C. website, by utilizing the following website link:
<http://www.meengineering.com/contact-pages/contractor-request>.
 2. M/E Engineering, P.C. makes no representation as to the compatibility of these files with the Contractor's hardware or the Contractor's software beyond the specific release of the referenced specifications.
 3. M/E Engineering, P.C. can only provide CAD files of M/E/P/FP drawing levels for which we are the Engineer of Record. CAD files of Architectural backgrounds, reflected ceiling plans, structural plans, etc. must be obtained separately from the Architect of Record.
 4. Data contained on these electronic files is part of M/E Engineering, P.C.'s instruments of service shall not be used by the Contractor or anyone else receiving data through or from the Contractor for any purpose other than as convenience in the preparation of shop drawings for the referenced project. Any other use or reuse by the Contractor or by others will be at the Contractor's sole risk and without liability or legal exposure to M/E Engineering, P.C. The Contractor agrees to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against M/E

Engineering, P.C., its officers, directors, employees, agents or sub-consultants which may arise out of or in connection with the Contractor's use of the electronic files.

5. Furthermore, the Contractor shall, to the fullest extent permitted by law, indemnify and hold harmless, M/E Engineering, P.C. from all claims, damages, losses and expenses, including attorney's fees arising out of or resulting from the Contractor's use of these electronic files.
6. These electronic files are not contract documents. Significant difference may arise between these electronic files and corresponding hard copy contract documents due to addenda, change orders or other revisions. M/E Engineering, P.C. makes no representation regarding the accuracy or completeness of the electronic files the Contractor receives. In the event that a conflict arises between the signed contract documents prepared by M/E Engineering, P.C. and electronic files, the signed contract documents shall govern. The Contractor is responsible for determining if any conflicts exist. By the Contractor's use of these electronic files the Contractor is not relieved of the Contractor's duty to comply with the contract documents, including and without limitation, the need to check, confirm and coordinate all dimensions and details, take field measurements, field verify conditions and coordinate the Contractor's work with that of other contractors for the project.

1.41 ENERGY INCENTIVES

- A. The Contractor, his Subcontractors and Suppliers shall provide to the Owner all paperwork necessary to support the Owners pursuit of incentives related to energy conservation as offered by the utility company or state sponsored incentive programs. This shall include at a minimum, receipts, and quantities and data sheets for energy efficient equipment such as: lighting, motors, variable frequency drives, etc.

END OF SECTION

SECTION 220523 - VALVES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Document.

1.2 SUBMITTALS

- A. Submit manufacturer's data in accordance with Basic Mechanical and Electrical Requirements. Obtain approval prior to ordering material.
- B. Provide submittals for all items specified under Part 2 of this section.

PART 2 - PRODUCTS

2.1 VALVES - GENERAL

- A. Valves shall have following requirements:
 - 1. Working pressure stamped or cast on bodies.
 - 2. Stem packing serviceable without removing valve from line.
 - 3. All items here-in used to convey water for potable use shall be lead free in accordance with NSF Standard, Standard 61, Section 9 - Standard for Drinking Water and Lavatory Faucets and NSF Standard 372 - Maximum Lead Requirements. Compliance shall be via third party testing and certification.
- B. Acceptable Manufacturers:
 - 1. Balance Valves: Armstrong, Bell & Gossett, Red White, Taco, Tour and Anderson.
 - 2. Ball Valves: Apollo, Hammond, Milwaukee, Nibco, Red White, Watts.
 - 3. Butterfly Valves: Bray, Jamesbury, Keystone, Milwaukee, Red White, Watts.
 - 4. Gate and Check Valves: Hammond, Milwaukee, Nibco, Red White, Stockham, Watts.
 - 5. To establish a standard of quality and identify features, certain manufacturer's numbers are given in the following paragraphs.

2.2 DOMESTIC WATER VALVES

- A. Gate Valves:
 - 1. 4 in. and Larger, Hot Water Service: IBBM, solid wedge disc, OS&Y, flanged ends, 125 SWP; Milwaukee F-2885.

2. 4 in. and Larger, Cold Water Service: Epoxy coated, resilient wedge, OS&Y, flanged ends, 175 wwp, UL/FM; Watts 408 RW.
3. 3 in. and Smaller: Bronze, solid wedge disc, rising stem, 125 SWP; Milwaukee 1152 (threaded ends, union bonnet) or Milwaukee 149 (sweat ends, threaded bonnet.)

B. Check Valves:

1. 3 in. and Larger: IBBM, renewable seat and disc, bolted flange cap, flanged ends, 125 SWP; Milwaukee F-2974.
2. 2 in. and Smaller: Lead-free swing check with silicone bronze body, bonnet and trim, PTFE disc seat and stainless steel seat disc washer, 200 psi working pressure, Nibco T-413-Y-LF (threaded) or Nibco's S-413-Y-LF (solder).
3. Silent Type: Lead-free spring check with silicone bronze body, stainless steel trim and PTFE disc: 250 psi working pressure; Nibco T-480-4-LF (threaded) or Nibco S-480-Y-LF (solder).

C. Ball Valves:

1. 2-1/2 in. and Larger: Lead-free, forged copper silicon 2-piece body, chrome plated brass ball, full port, teflon seats and stem packing, separate packing and handle nut, blowout proof stem extended for insulation, vinyl insulator for handle, 600 WOG, 125 WSP; Watts LF-FBV-3C Series (threaded ends) or Watts LF-FBVS-3C series (sweat ends).
2. 2 in. and Smaller: Lead-free, brass 2-piece body, 316 stainless steel ball and stem, full port, teflon seats and stem packing, separate packing and handle nut, blow out proof stem extended for insulation, vinyl insulator for handle, 600 WOG, 150 SWP: Watts #LFB-6080 (threaded ends) or Watts #LFB-6081 (sweat ends).
3. 2 in. and Smaller: True union style, CPVC body and ball, 150 psi, EPDM O-ring seals, constructed for end entrance with socket, flanged or threaded ends, full port design, conforming to and listed by NSF 14 for potable water.

D. Balance Valves:

1. 2 in. and Smaller: Lead-free, brass body, chrome plated brass ball, glass and carbon filled PTFE seat rings, Viton packing, threaded or solder ends, differential readout ports, calibrated nameplate and memory stop indicator rated for 125 psi; and pre-formed insulation to permit access for balancing and readout; Watt Series LFCSM-61-S.
 - a. Balance valve sizes shall be based upon gpm range rather than pipe size.

Balance Valve Size	GPM Range
1/2 in.	Up to 2.5

Balance Valve Size	GPM Range
3/4 in.	2.5 - 4.5
1 in.	4.5 - 10
1-1/4 in.	10 - 15
1-1/2 in.	15 - 30
2 in.	30 - 60

E. Valves for Gauges and Instruments:

1. 1/2 in. Size: Brass bar stock for 1000 psi and 300°F; Trerice No. 735 needle valve.

F. Hose Thread Drain Valves:

1. Ball valve, bronze body, hardened chrome ball with hose thread end, cap and chain; Watts #B6001CC (sweat connection), Watts #B6000CC (threaded connection).

2.3 GAS VALVES

A. Plug Valves:

1. 2 in. and Smaller: Semi-steel body and plug, short pattern, 100% pipe area round port, full bore lubricated plug, wrench operated with handle, sealing compound suitable with natural gas, threaded ends, 200 WOG, UL Listed for natural gas; Homestead Figure 651.
2. 2-1/2 in. thru 4 in.: Semi-steel body and plug, short pattern, 100% pipe area round port, full bore lubricated plug, wrench operated with handle, sealing compound suitable with natural gas, flanged ends, 200 WOG, UL listed for natural gas; Homestead Figure 652.
3. 6 in. thru 12 in.: Semi-steel body and plug, short pattern, 100% pipe area round port, full bore lubricated plug, gear operated with handle, sealing compound suitable with natural gas, flanged ends, 200 WOG, UL listed for natural gas; Homestead Figure 652-G.

B. Ball Valves:

1. 2 in. and Smaller: Ball type, two-piece, full port, brass body with chrome plated brass ball, teflon seats, threaded ends, 600 psi WOG, UL listed for natural gas, Watts FBV-3C-UL.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide all shutoff, check, balancing and other type valves as indicated, as required by Code and as required for proper system maintenance, isolation and safety. Provide at major building and systems sections. Provide shutoff valves on all branch lines serving

two fixtures or more, at all equipment, fixtures, before and after automatic control valves, and at future connections.

- B. Locate valves for easy access and provide separate support where necessary. Install valves with stems at or above the horizontal position. Install swing check valves in horizontal position with hinge pin level.
- C. Provide drain valves with hose thread connections on all equipment. Provide hose thread drain valves at all low points to enable complete drainage of all piping systems including, water mains, branches, at base of vertical risers and at strainers.
- D. Provide shutoff valve and wye-strainer before all automatic control valves and pressure reducing valves.
- E. Inspect valves for proper operation before installation. Install underground valve boxes vertically over each valve. Adjust top of box to proper grade. Immediately backfill with crushed stone and carefully tamp into place. Unless otherwise noted, leave in the open position.

3.2 DOMESTIC WATER SYSTEM

- A. The main water service shutoff valve inside the building and valves for a 3 in. and larger water meter assembly shall be OS&Y gate valves in accordance with the local water authority requirements.
- B. Install balance valves in each hot water circulation branch and where noted.

3.3 NATURAL GAS SYSTEM

- A. Ball valves shall be UL listed for use in natural gas systems, or certified by another acceptable third-party testing agency.

END OF SECTION

SECTION 220553 - PLUMBING IDENTIFICATION

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services as required for the complete installation designed in Contract Documents.

1.2 QUALIFICATIONS

- A. All identification devices shall comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles.

1.3 SUBMITTALS

- A. Submit manufacturer's technical product data and installation instructions for each identification material and device. Submit valve schedule for each piping system typewritten on an 8-1/2 in. x 11 in. paper (minimum), indicating valve number, location and valve function. Submit schedule of pipe, equipment and name identification for review before stenciling or labeling.

1.4 MAKES

- A. Allen Systems, Inc., Brady (W.H.) Co.; Signmark Div., Industrial Safety Supply Co., Inc., Seton Name Plate Corp.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide manufacturer's standard products of categories and types required for each application. In cases where there is more than one type specified for an application, selection is installer's option, but provide single selection for each product category.
- B. All adhesives used for labels in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits as called for in the current version of U.S. Green Building Council LEED Credits EQ 4.1 and EQ 4.2.

2.2 PIPING IDENTIFICATION

- A. Identification Types:
1. Pressure Sensitive Type: Provide manufacturer's standard pre-printed, permanent adhesive, color coded, pressure sensitive vinyl pipe markers complying with ANSI A13.1. Provide a 360° wrap of flow arrow tape at each end of pipe label.

O.D. PIPE OR COVERING	SIZE STENCIL LETTER
3/4 in., 1 in., 1-1/4 in.	1/2 in.
1-1/2 in., 2 in.	3/4 in.
2-1/2 in. and over	1-1/4 in.

B. Lettering:

1. Piping labeling shall conform to the following list:

PIPE FUNCTION	IDENTIFICATION
Cold Water	DOMESTIC COLD WATER
Hot Water	DOMESTIC HOT WATER
Hot Water Recirculating	DOMESTIC HOT WATER RECIRCULATING
140 Degree Hot Water	DOMESTIC HOT WATER - 140°F
140 Degree Hot Water Recirculating	DOMESTIC HOT WATER RECIRCULATING - 140°F
Sanitary Waste	SANITARY WASTE
Indirect Waste	INDIRECT WASTE
Storm	STORM
Vent	VENT
Pump Discharge	PUMP DISCHARGE
Natural Gas	NATURAL GAS
Compressed Air	COMPRESSED AIR
Acid Vent	ACID VENT
Acid Waste	ACID WASTE
Soft Water	SOFT WATER
Reverse Osmosis	R/O WATER
Deionized Water	DEIONIZED WATER
Non-Potable Water	NON-POTABLE WATER
Vacuum	VACUUM
Oxygen	OXYGEN
Nitrogen	NITROGEN
Medical Vacuum	MEDICAL VACUUM
Medical Compressed Air	MEDICAL AIR
Nitrous Oxide	NITROUS OXIDE
Carbon Dioxide	CARBON DIOXIDE
Decontamination Piping	DECON WASTE
Waste Anesthesia Gas Disposal	WAGD
Propane	PROPANE GAS
Exhaust Air	EXHAUST AIR

2.3 VALVE IDENTIFICATION

A. Valve Tags:

1. Standard brass valve tags, 2 in. diameter with 1/2 in. high black-filled numerals. Attach to valve with brass jack chain and "S" hook. Identify between heating and plumbing services with 1/4 in. letters above the valve number.
2. Acceptable Manufacturers: Seton Style No. M4507, or approved equal.

B. Valve Chart:

1. Provide valve chart for all valves provided as a part of this project. Frame and place under clear glass. Mount in Mechanical Room.

2.4 EQUIPMENT IDENTIFICATION

A. General:

1. Provide engraved vinyl nameplates for each major piece of mechanical equipment provided, 2-1/2 in. x 3/4 in. size.
2. Acceptable Manufacturers: Seton Style No. M4562, or approved equal.

2.5 ABOVE CEILING EQUIPMENT LOCATOR

- A. 3/4 in. diameter adhesive stickers placed on ceiling grid and color-coded.
- B. The color for all plumbing valves shall be BLUE.

PART 3 - EXECUTION

3.1 GENERAL

- A. Provide valve tags for all valves provided on project.
- B. Provide equipment tags for all equipment provided on project.
- C. Provide piping identification with directional flow arrows for all piping on project, maximum intervals of 20'-0". For piping installed through rooms, provide at least one (1) pipe label in each room, for each pipe function.

END OF SECTION

SECTION 220593 - ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services to perform operations required for complete adjusting and balancing Work as required in Contract Documents.

1.2 SUBMITTALS

- A. Provide information in report form listing items required by specifications. Report shall be typed and three copies submitted for review. Results shall be guaranteed. Contractor shall be subject to recall to site to verify report information before acceptance of the report by the Owner's Representative.
- B. Report format shall consist of the following:
 - 1. Title sheet with job name, contractor, engineer, date, balance contractor's name, address, telephone number and contact person's name and the balancing technician's name.

1.3 QUALIFICATIONS

- A. Follow procedures and methods published by one or more of the following:
 - 1. Individual manufacturer requirements and recommendations.
- B. Maintain qualified person at project for system operation, trouble shooting and perform mechanical adjustments in conjunction with balancing procedure.
- C. Balancing contractor shall be current member of AABC or NEBB.

1.4 GENERAL REQUIREMENTS

- A. Before concealment of systems visit the job site to verify and advise on type and location of balancing devices and test points. Make changes as required to balancing facilities.
- B. Place systems in satisfactory operating condition.
 - 1. Adjusting and balancing shall be accomplished as soon as the systems are complete and before Owner takes possession.
 - 2. Prior to balancing adjust balancing devices for full flow; fill, vent and clean hydronic systems, replace temporary strainers.
 - 3. Initial adjustment and balancing to quantities as called for or as directed by the engineer, to satisfy job conditions.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Provide tools, ladders, recording meters, gauges, thermometers, velometers, anemometers, inclined gauge manometers, magnehelic gauges, amprobes, voltmeters, psychrometers and tachometers required. Instruments used shall be accurately calibrated as per AABC or NEBB requirements.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine Bid Documents and notify Owner's Representative of any questions regarding balancing, within thirty (30) days after receipt of bid and prior to starting work.

3.2 WATER SIDE

- A. Test, adjust and record the following:
 - 1. Hot Water Recirculating Pump:
 - a. Check rotation
 - b. GPM
 - c. Running suction pressure
 - d. Running discharge pressure
 - e. Running load amps
 - f. RPM - motor
 - g. Complete nameplate motor and pump
 - 2. Recirculation Balancing Valves:
 - a. Balance every valve to 1.0 GPM, unless otherwise noted.

END OF SECTION

SECTION 220700 - INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 SUBMITTAL

- A. Shall include product description, manufacturer's installation instructions, types and recommended thicknesses for each application, and location of materials.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Insulation, jackets, adhesive, and coatings shall comply with the following:
 - 1. Treatment of jackets or facing for flame and smoke safety must be permanent. Water-soluble treatments not permitted.
 - 2. Insulation, including finishes and adhesives on the exterior surfaces of pipes and equipment, shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less.
 - 3. Asbestos or asbestos bearing materials are prohibited.
 - 4. Comply with 2020 International Energy Conservation Code as amended by Part 1 of the 2020 Supplement to the New York State Energy Conservation Code.
 - 5. All adhesives and sealants used for insulation in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits as called for in the current version of U.S. Green Building Council LEED Credits EQ E4.1 and EQ E4.2.
 - 6. Provide materials which are the standard products of manufacturers regularly engaged in the manufacture of such products and that essentially duplicate items that have been in satisfactory use for at least two (2) years prior to bid opening. Provide insulation systems in accordance with the approved MICA or NAIMA Insulation Standards.
 - 7. Insulation shall be clearly marked with manufacturer's name, identification of installed thermal resistance (R) value, out-of-package R value, flame spread and smoke developed indexes in accordance with Energy Code requirements.

2.2 ACCEPTABLE MANUFACTURERS

- A. Fiberglass: Knauf, Johns Manville, Owen-Corning, Certainteed.

- B. Polyisocyanurate: Dow Trymer 2000XP, HyTherm.
- C. Calcium Silicate: Industrial Insulation Group (ILG).
- D. Flexible Elastomeric: Armacell, K-Flex.
- E. Adhesives: Childers Products, Foster.
- F. Heat Tracing: Raychem, Thermon.

2.3 PIPE INSULATION (RIGID FIBERGLASS TYPE)

- A. Product meeting ASTM C 547, ASTM C 585, and ASTM C 795; rigid, molded, noncombustible.
- B. 'K' Value: ASTM C 335, 0.23 at 75°F mean temperature. Maximum Service Temperature: 1000°F.
- C. Vapor Retarder Jacket: ASJ/SSL conforming to ASTM C 1136 Type I, secured with self-sealing longitudinal laps and butt strips.
- D. Field-Applied PVC Fitting Covers with Flexible Fiberglass Insulation: Proto Corporation 25/50 or Indoor/Outdoor, UV-resistant fittings, jacketing and accessories, white or colored. Fitting cover system shall consist of pre-molded, high-impact PVC materials with blanket type fiberglass wrap inserts. Blanket fiberglass wrap inserts shall have a thermal conductivity ('K') of 0.26 at 75°F mean temperature. Closures shall be stainless steel tacks, matching PVC tape, or PVC adhesive per manufacturer's recommendations.
- E. Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in pre-forming insulation to cover valves, elbows, tees, and flanges.

2.4 PIPE INSULATION (FLEXIBLE TYPE)

- A. Flexible Elastomeric Thermal Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials. Adhesive: As recommended by insulation material manufacturer.
- B. Insulation (1 in. thickness and smaller) shall have a flame-spread index of less than 25 and a smoke-developed index of less than 50 as tested by ASTM E 84 and CAN/ULC S-102, "Method of Test for Surface Burning Characteristics of Building Materials".

2.5 FIRE RATED INSULATION

- A. Wrap shall be fully tested against external fires (ASTM E 119/UL263), through penetration insulated piping fires (ASTM 814/UL1479), wall fires (ASTM E 119), and surface burning (ASTM E 84/UL723). Wrap for engine exhaust applications shall use two layers of 1-1/2 in. wrap. The interior layer shall be applied with a butt joint. The second layer shall be offset a minimum of six inches from the initial layer, with an overlap of three inches and the insulated pipe is banded with stainless steel straps.

- B. Acceptable Manufacturers: John Mansville Firetemp Wrap, Certainteed FlameChek or approved equal.

2.6 FIELD-APPLIED JACKETS

- A. Piping:
 - 1. PVC Pipe Jacket: High-impact, ultraviolet-resistant PVC; 20 mils thick; roll stock ready for shop or field cutting and forming. Adhesive: As recommended by insulation material manufacturer. PVC Jacket Color: White.

2.7 COATINGS, MASTICS, ADHESIVES AND SEALANTS

- A. Vapor Barrier Coatings: Used in conjunction with reinforcing mesh to coat insulation on below ambient services temperatures. Permeance shall be no greater than 0.08 perms at 45 mils dry as tested by ASTM F1249. Foster 30-65 Vapor Fas; Childers CP-34, or approved equal.
- B. Lagging Adhesives: Used in conjunction with canvas or glass lagging cloth to protect equipment/piping indoors. Foster 30-36 Sealfas; Childers CP-50AMV1 Chil Seal, or approved equal.
- C. Fiberglass Adhesive: Used bond low density fibrous insulation to metal surfaces. Shall meet ASTM C916 Type II. Foster 85-60; Childers CP-127, or approved equal.
- D. Elastomeric Insulation Adhesive: Used to bond elastomeric insulation. Foster 85-75; Childers CP-82, or approved equal.
- E. Elastomeric Insulation Coating: Water based coating used to protect outside of elastomeric insulation. Foster 30-65, Childers CP-34 or approved equal.
- F. Insulation Joint Sealant: Used as a vapor sealant on below ambient piping with polyisocyanurate and cellular glass insulation. Foster 95-50; Childers CP-76, or approved equal.

2.8 PIPE SUPPORT INSULATION INSERTS

- A. 20 lbs./cu. ft. molded fiberglass, for -120°F to +450°F service temperature, non-combustible, 0.30 thermal conductivity (k), same thickness as pipe insulation.
- B. Acceptable Manufacturers: Hamfab "H" Block, or approved equal.

2.9 MATERIALS AND SCHEDULES

- A. See Exhibits at the end of this section.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. All materials shall be installed by skilled labor regularly engaged in this type of work. All materials shall be installed in strict accordance with manufacturer's recommendations, building codes, and industry standards.
- B. Locate insulation and cover seams in the least visible location. All surface finishes shall be extended in such a manner as to protect all raw edges, ends and surfaces of insulation. No glass fibers shall be exposed to the air.
- C. All pipe insulation shall be continuous through hangers, sleeves, walls, ceiling, floor, or roof openings, unless not allowed by fire stop system. Refer to Sections 220500, "Basic Plumbing Requirements" and 221010, "Piping Systems and Accessories" for firestop systems.
- D. Provide thermal insulation on clean, dry surfaces and after piping and equipment (as applicable) have been tested. Do not cover pipe joints with insulation until required tests are completed.
- E. All cold surfaces that may "sweat" must be insulated. Vapor barrier must be maintained; insulation shall be applied with a continuous, unbroken moisture and vapor seal. All hangers, supports, anchors, or other projections that are secured to cold surfaces shall be insulated and vapor sealed to prevent condensation. Cover valves, fittings and similar items in each piping system with insulation as applied to adjoining pipe run. Extra care must be taken on piping appurtenances to insure a tight fit to the piping system. For piping systems with fluid temperatures below ambient, all vapor retarder jacket (ASJ) seams must be coated with vapor barrier coating. All associated elbows, fittings, valves, etc. must be coated with vapor barrier coating and reinforcing mesh to prevent moisture ingress. Valve extension stems require Elastomeric insulation that is tight fitting to the adjoining fiberglass system insulation. Pumps, strainers, drain valves, etc. must be totally encapsulated with Elastomeric insulation.
- F. Items such as manholes, handholds, clean-outs, plugged connections, pet cocks, air vents, ASME stamp, and manufacturers' nameplates, may be left un-insulated unless omitting insulation would cause a condensation problem. When such is the case, appropriate tagging shall be provided to identify the presence of these items. Provide neatly beveled edges at interruptions of insulation.
- G. Provide protective insulation as required to prevent personal injury.
- H. All pipes shall be individually insulated.
- I. If any insulation material becomes wet because of transit or job site exposure to moisture or water, the contractor shall not install such material, and shall remove it from the job site.
- J. All exposed surfaces shall be white, unless noted otherwise.

3.2 PIPE INSULATION

- A. Insulate piping systems including fittings, valves, flanges, unions, strainers, and other attachments installed in piping system, whether exposed or concealed including all piping, valves, etc. within meter/backflow preventer enclosure.
- B. Insulation installed on piping operating below ambient temperatures must have a continuous vapor retarder. All joints, seams and fittings must be sealed. Insulation shall be continuous through hangers on all water piping and storm water piping.
- C. Hanger Shields: Refer to Section 221010 "Piping Systems and Accessories".
- D. Hanger shields shall be installed between hangers or supports and the piping insulation. Rigid insulation inserts shall be installed as required between the pipe and the insulation shields. Inserts shall be of equal thickness to the adjacent insulation and shall be vapor sealed as required.
 - 1. Pre-Insulated Type: Butt insulation to hanger shields and apply a wet coat of vapor barrier cement to the joints and seal with 3 in. wide vapor barrier tape.
 - 2. Field Insulated Type: Provide Hamfab Co. "H" blocks per manufacturers recommended spacing between pipe and shield.
 - 3. Tape shields to insulation.
- E. Joints in section pipe covering made as follows:
 - 1. All ends must be firmly butted and secured with appropriate butt-strip material. On high-temperature piping, double layering with staggered joints may be appropriate. When double layering, the inner layer should not be jacketed.
 - 2. Standard: Longitudinal laps and butt joint sealing strips cemented with white vapor barrier coating, or factory supplied pressure sensitive adhesive lap seal.
 - 3. Vapor Barrier: For cold services, Longitudinal laps and 4 in. vapor barrier strip at butt joints shall be sealed with white vapor barrier coating. Seal ends of pipe insulation at valves, flanges, and fittings with white vapor barrier coating.
- F. Fittings, Valves and Flanges:
 - 1. Domestic Hot and Cold Water: Premolded fitting insulation of the same material and thickness as the adjacent pipe insulation.
 - 2. White PVC jacketing, with continuous solvent weld of all seams. Tape all fittings.
- G. Flexible Pipe Insulation:
 - 1. Split longitudinal joint and seal with adhesive.

2. Fittings made from miter-cut pieces properly sealed with adhesive, or elbows may be continuous.
- H. Apply PVC jacket where indicated, with 1 in. overlap at longitudinal seams and end joints. Seal with manufacturers recommended adhesive.
- I. Piping in exterior walls, spaces, overhangs, attics, or where subject to freezing: Insulate pipe with double the thickness called for. Piping in wall chases: In addition to the above, pack chase with loose glass fiber insulation.
- J. Provide insulation on exposed hot and cold plumbing piping to within 18 in. of fixture or equipment connection.
- K. Insulate exposed domestic water and waste piping for plumbing fixtures designated for use by the handicapped.

EXHIBIT "I" - PIPE INSULATION MATERIALS
(Notes at end of Exhibit "I")

<u>SERVICE</u>	<u>INSULATION MATERIAL</u>	<u>THICKNESS</u>	<u>REMARKS</u>
Domestic cold water	Glass fiber	1-1/2 in. and larger: 1 in. 1-1/4 in. and smaller: 1/2 in.	SEE NOTES 1, 2
Domestic cold water (buried)	Flexible	1-1/2 in. and larger: 1 in. 1-1/4 in. and smaller: 1/2 in.	
Non potable cold water	Glass fiber	1-1/2 in. and larger: 1 in. 1-1/4 in. and smaller: 1/2 in.	SEE NOTE 2
Domestic hot, tempered and circulation water (105°F - 140°F)	Glass fiber	1-1/2 in. and larger: 1-1/2 in. 1-1/4 in. and smaller: 1 in.	SEE NOTES 1, 2
Domestic hot, tempered and circulation water (105°F - 140°F) (buried)	Flexible	1-1/2 in. and larger: 1-1/2 in. 1-1/4 in. and smaller: 1 in.	
Domestic hot, tempered and circulation water (141°F - 200°F)	Glass fiber	1-1/2 in. and larger: 2 in. 1-1/4 in. and smaller: 1-1/2 in.	SEE NOTES 1
AC unit drains, overflows and indirect waste piping associated with any HVAC equipment	Glass fiber Flexible	All sizes: 1/2 in.	Not required for exposed PVC drains SEE NOTE 2
Storm and secondary storm water	Glass fiber	All sizes: 1 in.	Insulate body of drain and storm water piping, horizontal and vertical, down to connection below ground floor slab or in crawl space SEE NOTE 4
Sanitary and waste	Glass fiber	All sizes: 1/2 in.	SEE NOTE 3, 4

NOTES FOR EXHIBIT I:

- NOTE 1: Exposed insulation at kitchen, laundry, and sterilizer equipment shall be covered with PVC jacket.
- NOTE 2: Flexible allowed in 1/2 in. thickness only.
- NOTE 3: Insulation on sanitary and waste piping located within plumbing chases and crawl spaces are not required.
- NOTE 4: When PVC piping is installed for storm, sanitary and vent piping within return air plenums, the piping shall be insulated and enclosed in materials listed and labeled for installation within a plenum.

END OF SECTION

SECTION 221010 - PIPING SYSTEMS AND ACCESSORIES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 SUBMITTALS

- A. Provide a schedule of pipe materials, fittings and connections.
- B. Provide a detailed matrix listing the specific UL approved firestop system assembly to be used for each type of piping provided and each type of construction to be penetrated along with all associated UL assembly details.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Pipe and fittings shall be new, marked with manufacturer's name and comply with applicable ASTM and ANSI Standards.
- B. All items here-in used to convey water for potable use shall be lead free in accordance with NSF, Standard 61, Section 9 - Standard for Drinking Water and Lavatory Faucets and NSF Standard 372 - Maximum Lead Requirements. Compliance shall be via third party testing and certification.

2.2 STEEL PIPING AND FITTINGS

- A. Pipe: ASTM A53, or ASTM A106 seamless, Schedule 40 or Schedule 80 weight; black or galvanized finish as called for; ends chamfered for welding or grooved for grooved mechanical connections.
- B. Fittings: Same material and pressure class as adjoining pipe.
 - 1. Welded fittings: Factory forged, seamless construction, butt weld type chamfered ends. Where branch connections are two or more sizes smaller than main size, use of "Weldolets", "Thredolets" or "Sockolets" acceptable. Mitered elbows, "shaped" nipples, and job fabricated reductions not acceptable unless specifically called for. Socket weld type, 2000 psi wp, where called for.
 - 2. Threaded fittings: Cast or malleable iron, black or galvanized, as called for; drainage type where called for; UL listed and FM approved for fire protection systems. Street type 45° and 90° elbows are not acceptable.
- C. Flanges, Unions, and Couplings:
 - 1. Threaded Connections:
 - a. Flanges: Cast iron companion type; for sizes 2-1/2 in. and larger.

- b. Unions: Malleable iron, bronze to iron seat, 300 lb. wwp; for sizes 2 in. and smaller.
 - c. Couplings: Malleable iron. Steel thread protectors are not acceptable as couplings.
 - 2. Welded Connections:
 - a. Flanges: Welding neck type. Slip-on type not allowed unless noted and shall not be installed in conjunction with butterfly valves.
 - 3. Grooved Mechanical Connections:
 - a. Couplings: Ductile iron, ASTM A536, with painted coating, designed for rolled grooved piping, hot dipped galvanized finish were called for.
 - b. Gaskets: Grade "E" EPDM synthetic rubber, -30°F to 230°F temperature range, suitable for water service.
 - c. Bolts and Nuts: Heat treated, hex head carbon steel, ASTM A183, cadmium plated or zinc electroplated.
 - d. Fittings: Elbows, tees, laterals, reducers, adapters as required. Same construction as couplings.
 - e. Design Equipment: Victaulic, flexible system, Style 77 couplings.
 - f. Acceptable Manufacturers: Grinnell, Gruvlok, Victaulic.
- D. Gauge and Instrument Connections: Nipples and plugs for adapting gauges and instruments to piping system shall be IPS brass.
- E. Base Elbows:
 - 1. Cast iron or steel type, flange connections; Crane 500 or equivalent made from welding elbows, with welded pipe support and steel base. Reducing elbows where necessary.

Elbow Size	Support Size	Base Plate
Up to 3 in.	1-1/4 in.	6 in. x 6 in. x 1/4 in.
4 in. to 6 in.	2-1/2 in.	8 in. x 8 in. x 1/4 in.
8 in. and larger	6 in.	14 in. x 14 in. x 5/16 in.

- 2. Anchor bolt holes in each corner of base for securely bolting to floor or concrete base; minimum 3/4 in. bolts.

2.3 STEEL PIPING AND FITTINGS - PRESS CONNECT FITTINGS

- A. Piping Standard: Black steel piping shall conform to ASTM A53 or ASTM A106 seamless, Schedule 40 weight pipe.

- B. Fittings: Listed in accordance with ANSI LC4/CSA 6.32.
 - 1. For natural gas service, -40 deg. F to 180 deg F at 125 PSI.
 - 2. Sizes 1/2 inch through 4 inch, Schedule 40.
 - 3. Schedule 40 steel fittings with zinc/nickel coating for use with IPS schedule 40 carbon steel, pipe conforming to ASTM A53 or ASTM A106. Fittings shall have an HNBR sealing element, 420 stainless steel grip ring, separator ring and "Smart Connect" (SC) feature.
- C. Design Make: Viega Mega Press G System.
- D. Acceptable Manufacturer: Viega.

2.4 COPPER TUBE AND FITTINGS

- A. Pipe: ASTM B88; Type K or L, hard temper. Soft temper only as called for. Plans show copper tube sizes.
- B. Fittings: Wrought copper and copper alloy, ASME B16.22 or cast copper alloy, ASME B16.18; solder end connections.
- C. Joints: Comply with the requirements of ASTM B828.
- D. Unions and Flanges: 2 in. and smaller use unions, solder type, cast bronze, ground joint, 150 lb. swp; 2-1/2 in. and over use flanges, cast bronze, companion type, ASME drilled, solder connection, 150 lb. swp.
- E. Flux Materials: Flux shall comply with ASTM B813 and the provisions of the New York State Plumbing Code.
- F. Solder Materials: No-lead solder, using alloys made from tin, copper, silver and nickel. Harris, Inc., "Stay-Safe 50" and "Bright", Engelhard "Silvabright 100", Canfield "Watersafe" or approved equal.
- G. Brazing Materials: Class BcuP-5 for brazing copper to brass, bronze to copper. Harris, Inc. "Stay-Silv 15" or approved equal.

2.5 COPPER TUBE AND FITTINGS - PRESS FITTINGS

- A. Tubing Standard: Copper tubing shall conform to ASTM B75 or ASTM B88.
- B. Fitting Standard: Copper fittings shall conform to ASME B16.18, ASME B16.22, or ASME B16.26.
- C. Press Fittings: Copper press fittings shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22. O-rings for copper press fittings shall be EPDM.
- D. Acceptable Manufacturers: Apollo, Mueller, Nibco, Viega.

2.6 CPVC DOMESTIC WATER PIPING

- A. All pipe and fittings shall be manufactured from CPVC compound with a cell class of 24448 for pipe and 23447 for fittings as per ASTM D-1784; shall conform to National Sanitation Foundation (NSF) Standards 6 and 14; and shall be intended for use in hot and cold domestic water distribution systems.
- B. 1/2 in. through 2 in. Sizes: CPVC Copper Tube Size, standard dimension ratio (SDR) 11 conforming to ASTM D-2846. Transition fittings shall have brass male or female connections with integral CPVC socket connections; Charlotte Pipe and Foundry Co. FlowGuard Gold or approved equal.
- C. 3 in. through 6 in. Sizes: CPVC Schedule 80 iron pipe size (IPS) conforming to ASTM F-441. Socket type fittings shall conform to ASTM F-439. Transition to metal piping shall be made using 150# flanged connections.
- D. All pipe and fittings shall be produced by a single manufacturer and installed in accordance with manufacturer's recommendations and local Code requirements. Piping shall be installed using approved solvent cement conforming to ASTM F-493 and primer conforming to ASTM F-656 and in accordance with manufacturer's recommendations.

2.7 PEX DOMESTIC WATER PIPING

- A. Pipe: Cross-linked, high density, polyethylene tubing for potable water. ASTM F-876/F-877; ANSI/NSF 61. Plans show nominal tube sizes.
- B. Manifolds: Copper manifold with sweat ends and 24-3/4 in. outlets on 3 in. centers. Provide reducing couplings as required for individual outlets.
- C. Valves: Brass body ball valves with sweat X PEX compression ends rated for 250 psi and 250°F. Provide crimp ring for PEX compression connections.
- D. Acceptable Manufacturers: Wirsbo, Viega, Zurn or approved equal.

2.8 COPPER TUBE AND FITTINGS - GROOVED MECHANICAL CONNECTIONS

- A. Pipe: ASTM B88, Type K or L, hard temper.
- B. Fittings: Wrought copper, roll grooved mechanical connections, ASTM B-75, ANSI B16.22 for 4 in. size. Cast bronze, rolled grooved mechanical connections, ASTM B-584, ANSI B16.18 for sizes 5 in. - 8 in.
- C. Couplings: Ductile iron, ASTM A-536, with copper colored alkyd enamel finish, designed for rolled grooved piping.
- D. Gaskets: Grade "E" EPDM synthetic rubber, copper color coded, -30°F to 230°F temperature range, suitable for water service.
- E. Bolts and Nuts: Heat treated, hex head carbon steel, ASTM A183, cadmium plated or zinc electroplated finish.

- F. Design Equipment: Victaulic Style 606 couplings.
- G. Acceptable Manufacturers: Grinnell, Gruvlok, Victaulic.

2.9 COPPER DRAINAGE TUBE AND FITTINGS

- A. Pipe: ASTM B306, Type DWV, hard temper.
 - 1. Copper not allowed for urinal waste.
- B. Fittings: Wrought copper, ANSI B16.29 or cast bronze, ANSI B16.23; solder end connections.
- C. Flux Materials: Flux shall comply with ASTM B813 and the provisions of the New York State Plumbing Code.
- D. Solder Materials: No lead solder, using alloys made from tin, copper, silver and nickel.
- E. Acceptable Manufacturers: Harris, Inc., "Stay-Safe 50" and "Bright", Engelhard "Silvabright 100", Canfield "Watersafe", or approved equal.

2.10 BRASS PIPE AND FITTINGS

- A. Piping: ASTM B43, semi-annealed, red brass containing not less than 85% copper; chrome plated where called for.
- B. Fittings: Cast brass, sps, malleable iron pattern, reinforced corresponding to weight of pipe; chrome plated with high polished finish where called for.

2.11 HUB AND SPIGOT CAST IRON SOIL PIPE AND FITTINGS

- A. Pipe: ASTM A74 service weight cast iron, bitumen coated.
- B. Fittings: Cast iron, service weight, hub and spigot, drainage pattern, bitumen coated.
- C. Connections: ASTM C564 neoprene gaskets and lubricant.
- D. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

2.12 NO-HUB CAST IRON SOIL PIPE AND FITTINGS

- A. Pipe: ASTM A888, CISPI Standard 301, no-hub cast iron, bitumen coated.
 - 1. For above grade only.
- B. Fittings: Cast iron, no-hub drainage pattern, bitumen coated.

C. Couplings:

1. 1-1/2 in. to 2 in.: CISPI standard 310 with 300 series stainless steel corrugated shield and clamp assembly with ASTM C564 neoprene sealing sleeve (or) same as specified for 3 in. and larger.
2. 3 in. and Larger: 24 gauge, Type 304 stainless steel housing clamp assembly with ASTM C564 neoprene sealing sleeve, 60 in. lbs. minimum torque rating, shall meet requirements of pipe manufacturer and shall be compatible with specified pipe. Acceptable Manufacturers: Clamp-All Coupling System, Tyler "Wide Body", Husky "Series 2000", Mission "Heavy Weight", Ideal Tridon "HD" heavy duty or approved equal.

- D. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

2.13 PVC SOLID WALL PIPE AND FITTINGS - DWV SYSTEM

- A. Pipe: PVC Schedule 40 solid wall pipe, iron pipe size conforming to ASTM D1785 and ASTM D2665. Pipe shall be manufactured from PVC compounds as identified in ASTM D1784. Both pipe and fittings shall conform to National Sanitation Foundation Standard 14.
- B. Fittings: Type DWV, socket type conforming to ASTM D2665. Fittings shall be manufactured from PVC compounds as identified in ASTM D1784. Solvent cement joints shall be made utilizing a two-step process with primer manufactured for thermoplastic piping and solvent cement conforming to ASTM D2564.

2.14 SPECIAL FITTINGS

- A. Cast Iron to Lead Pipe: Red brass ferrules and wiped joints. Caulk ferrule into cast iron hub.
- B. Copper to Cast Iron: Cast bronze, cast iron to sweat adapter.
- C. Copper to Steel Piping:
1. Cast bronze copper to iron male or female adapter with shoulder for drainage piping only.
 2. Dielectric pipefittings.
- D. Steel to Cast Iron: Cast iron soil pipe connector with spigot and IPS male thread end (Manhoff fittings).
- E. No-Hub, Cast Iron, Glass, Polypropylene or High Silicon Cast Iron: Proper adapter to piping being connected.
- F. Cast Iron and PVC Solvent: Aerators and deaerators as manufactured by Conine Manufacturing Co., Inc.

2.15 DIELECTRIC PIPE FITTINGS

- A. Description: Assembly or fitting having insulating material isolating joined dissimilar metals to prevent galvanic action and stop corrosion.
- B. Unions: Factory fabricated, for 250 psi minimum working pressure at 180°F, threaded or solder ends, insulating material suitable for system fluid, pressure and temperature.
- C. Flanges: Factory-fabricated, companion-flange assembly, for 150 or 300 psig minimum pressure to suit system fluid pressures and temperatures with flange insulation kits and bolt sleeves.
- D. Acceptable Manufacturers: EPCO, Capitol Manufacturing, Watts or approved equal.

2.16 HANGERS, INSERTS AND SUPPORTS

- A. Hangers, Inserts, Clamps: B-Line, Grinnell, Michigan Hanger, PHD Manufacturing.
- B. Hangers:
 - 1. Adjustable, wrought malleable iron or steel with electroplated zinc or cadmium finish. PVC coated where in contact with copper piping.
 - 2. Adjustable ring type where piping is installed directly on hanger for piping 3 in. and smaller.
 - 3. Adjustable steel clevis type for piping 4 in. and larger.
 - 4. Nuts, washers and rods with electroplated zinc or cadmium finish.
 - 5. Provide hot dipped galvanized finish for hangers and accessories installed in exterior locations and interior areas with moist environment conditions such as pools, pool filter rooms, areaways, garages and similar areas.
- C. Spacing Schedule:

Pipe Size	Steel	Copper	Plastic	Cast Iron	Rod Size
3/4 in. to 1 in.	8 ft.	6 ft.	3 ft.	Each Horizontal Joint 5 ft. Maximum O.C.	3/8 in.
1-1/4 in. to 2 in.	10 ft.	6 ft.	3 ft.		3/8 in.
2-1/2 in. to 4 in.	12 ft.	10 ft.	4 ft.		1/2 in.
5 in. and over	12 ft.	10 ft.	4 ft.		5/8 in.
8 in.	12 ft.	10 ft.	4 ft.		3/4 in.
Over 8 in.	To suit loading conditions.				

- D. Cast Iron No-Hub Supports:
 - 1. In accordance with manufacturer's recommendations.
 - 2. Vertical piping supported at each stack base, at each floor and 15 ft. on center, maximum. Freestanding vertical pipe should be adequately staked or braced during construction to maintain alignment. Bases of stacks shall be supported on

concrete, brick laid in cement mortar, metal brackets attached to the building construction or by other methods approved by the Owner's Representative.

3. Horizontal piping supported within 24 in. each side of the coupling joint at 10 ft. intervals for 10 ft. pipe lengths and at 5 ft. intervals for 5 ft. pipe lengths. Supports or hangers placed to maintain alignment and grade with provision made to prevent shear. Greater than 3 in. diameter pipe braced at changes of direction to prevent horizontal movement.

E. Beam Attachments:

1. C-Clamp style, locknut, restraining strap, electroplated finish, UL listed, FM approved for pipe sizes 2 in. and smaller.
2. Center loaded style with clamp attachments that engage both edges of beam, electroplated finish, UL listed, FM approved, for pipe sizes larger than 2 in., refer to "Supports" for additional requirements.

F. Inserts: Carbon steel body and square insert nut, galvanized finish, maximum loading 1300 lbs., for 3/8 in. to 3/4 in. rod sizes, reinforcing rods on both sides, MSS-SP-69 Type 19 or approved equal.

G. Supports:

1. Provide intermediate structural steel members where required for hanger attachment. Members shall span across the bar joists at panel points of joists. Secure member to structure. Select size of members based on a minimum factor of safety of four.
2. For Weights Under 1000 lbs.: "Drill-In" inserts, "U" shaped Channel, beam clamps or other structurally reviewed support. The factor of safety shall be at least four. Follow manufacturer's recommendations.
3. For Weights Above 1000 lbs.: Drill through floor slabs and provide flat flush plate welded to top of rod or provide additional "Drill-In" inserts and hangers to reduce load per hanger below 1000 lbs.
4. For Metal Decks: Drill hole through for hanger rods and imbed a welded plate in concrete or use devices designed for this application, with a safety factor of four.
5. For Wood Construction: Provide hangers and supports designed for attachment to wood construction.
6. Acceptable Manufacturers: Hilti, ITW Ramset, Phillips "Red Head" or approved equal.

H. Trapeze Hangers:

1. For plumbing systems only.
2. Hangers shall be supported with rod sized with a safety factor of four.

3. May be manufactured type "U" shaped channel, or suitable angle iron or channel. Round off all sharp edges.
4. Securely fasten piping to trapeze with "U" bolt or pipe clamps, dissimilar metals shall not touch, use isolation gaskets, similar to HoldRite strut-mounted cushion clamps. Fasten piping to trapeze at every third support, except uninsulated piping which shall be fastened at every support using strut-mounted cushion clamps.
5. Acceptable Manufacturers: B-Line, HoldRite, Kindorf, Unistrut or approved equal.

I. Roof Pipe Supports - Deck Mounted Rail:

1. Raised cant for insulated roof, heavy-gauge galvanized steel with integral base, 2 x 4 pressure treated wood nailer, removable galvanized steel counter flashing.
2. Steel channel track, roller assembly and accessories, adjustable, locking devices in roller assembly, all parts galvanized except painted cast iron roller.
3. Length as required for quantity of pipes to be supported. Anchor to roof deck per manufacturer.
4. Acceptable Manufacturers: Pate #PRS-5A or approved equal.

J. Roof Pipe Supports - Fixed and Adjustable Pillow Block Style:

1. Pipe support for placement on roof surface with base perforated for drainage. Provide pipe anchor strap option and manufacturer's support pad or roofing manufacturer's recommended slip sheet below support. Support models shall be selected based on total pipe O.D. and pipe weight operating full. All polycarbonate materials shall be UV stabilized.
2. Fixed Height Pipe Stand: For bare piping up to 5 in. nominal or insulated piping up to 6 in. outside diameter. Polycarbonate resin base plate with fixed height self-lubricating polycarbonate roller supported by glass-filled nylon or stainless steel rod. Miro Industries Model R Series.
3. Adjustable Height Pipe Stand with Polycarbonate Base: For bare piping up to 5 in. nominal or insulated piping up to 6 in. outside diameter. Polycarbonate base plate with adjustable stainless steel all thread rod vertical supports, polycarbonate roller on stainless steel rod. Miro Industries Model RAH Series.
4. Adjustable Height Pipe Stand with Metal Base: For bare piping 4 in. to 6 in. nominal or insulated piping up to 7 in. outside diameter. 12 in. by 16 in. wide hot dipped galvanized steel base plate with adjustable stainless steel all thread rod vertical supports, polycarbonate roller on stainless steel rod. Miro Industries Model RAH Series.
5. Pipe Hanger Stand with Polycarbonate Base: For bare piping up to 2-1/2 in. nominal or insulated piping up to 3-1/2 in. outside diameter. 9 in. by 15 in. wide

polycarbonate resin base plate with adjustable stainless steel all thread rod vertical supports, galvanized top strut with clevis hanger suspended on stainless steel all thread rod. Miro Industries Model 2.5-SB-H Series.

6. Adjustable Height Pipe Stand with Metal Base: For bare piping up to 6 in. nominal or insulated piping up to 7-1/2 in. outside diameter. Two (2) 8 in. by 14 in. wide hot dipped galvanized steel base plates, with adjustable height galvanized braced strut assembly with clevis hanger suspended on a stainless steel all thread rod. Miro Industries Model 6-H Series.

K. Cabinet Pipe Space Supports:

1. Piping below casework countertops within space behind cabinet shall be supported using continuous slot metal channels with pipe clamps.
2. Acceptable Manufacturers: B-Line, Kindorf, Unistrut or approved equal.

L. Hanger Insulation Shields:

1. Hanger insulation shields shall be provided for all water and storm water piping. Hangers shall attach directly to pipe for all remaining services.
2. Piping 2 in. and Smaller: Pipe insulated with glass fiber insulation shall be protected at point of support by a sheet metal shield. Shield shall be #18 gauge, galvanized steel, minimum 120 degree arc, formed to fit insulation thickness and 12 in. long. Tape shields to pipe insulation.
3. Piping 3 in. and Larger: Pipe insulated with glass fiber insulation shall be protected at point of support by a sheet metal shield and pipe support insulation insert(s) between pipe and hanger. Shield shall be #18 gauge, galvanized steel, minimum 120 degree arc, formed to fit insulation thickness and 12 in. long. Tape shields to pipe insulation. Provide temporary blocking to maintain proper spacing for insulation.

M. Provide continuous support for unpigmented polypropylene piping.

N. PEX tubing supports shall comply with manufacturer's recommendations, but shall be no more than 2 ft. - 0 in. on center.

O. Piping systems with material not listed above shall be supported and protected in accordance with manufacturer's recommendations.

2.17 PIPING ACCESSORIES

- A. Escutcheon Plates: Steel or cast brass, split hinge type with setscrew, high plates where required for extended sleeves. Chrome plated in finished areas and at plumbing fixtures.
- B. All cleanout plugs, bushings and nipples, required for instruments and gauges shall be brass.
- C. Hubless cast iron fitting restraints shall be Holdrite Series #117 or approved equal.

2.18 SLEEVES

A. Standard Type:

1. Schedule 40 black steel pipe sleeves for structural surfaces, two pipe sizes larger than the pipe, and as recommended by the sealing element manufacturer. Provide full circle water stop collar for sleeves located within below grade walls, wet wells and waterproofed surfaces. The collar shall be fabricated from steel plate and welded to the sleeve around its entire circumference.
2. Schedule 40 PVC sleeves or sheet metal sleeves for nonstructural surfaces and existing construction. Sheet metal sleeves shall be 18 gauge minimum and braced to prevent collapsing.

2.19 SEALING ELEMENTS

A. Expanding neoprene link type, watertight seal consisting of interlocking links with zinc plated bolts.

1. Acceptable Manufacturers: Thunderline "Link-Seal" Series 200, 300 or 400, Pyropac, Calipco.

2.20 FIRESTOP SYSTEM FOR OPENINGS THROUGH FIRE RATED WALL AND FLOOR ASSEMBLIES

A. Materials for firestopping seals shall be listed by an approved independent testing laboratory for "Through-Penetration Firestop Systems". The system shall meet the standard fire test for Through-Penetration Firestop Systems designated ASTM E814. Firestop system seals shall be provided at locations where piping pass through fire rated wall, floor/ceiling, or ceiling/roof assembly. Minimum required fire resistant ratings of the assembly shall be maintained by the Firestop System. Installation shall conform with the manufacturer's recommendations and other requirements necessary to meet the testing laboratory's listing for the specific installation.

2.21 STACK SLEEVE

A. Cast iron body with caulking recess, flashing clamp and under deck clamp.

B. Acceptable Manufacturers: Jay R. Smith Series 1720, Zurn, Wade.

2.22 STRAINERS

A. Description: Y-Pattern, self-cleaning, except where otherwise indicated, full size of connecting piping, Type 304 stainless steel screens, 125 lb. SWP, unless otherwise indicated.

B. Copper Piping 2-1/2 in. and Smaller: Lead free, cast bronze body, threaded ends, tapped retainer cap with closure plug, 20 mesh screen, Watts #LF777S.

C. Steel Piping 2-1/2 in. and Smaller: Iron body, threaded ends, tapped retainer cap with closure plug, 20 mesh screen, Watts #77S

- D. Piping 3 in. and Larger, Cold Water Applications: Lead free, cast iron body, flanged ends, standard screen openings, FDA approved epoxy coating, tapped retainer cap and gasket with closure plug; Watts #77F-DI-FDA-125.
- E. Fuel Oil Strainers 2 in. and Smaller: Line strainer, top cleanout, cast iron body and cap, malleable iron yoke, 50 psi operating pressure, 24 mesh stainless steel cage and basket for #2 fuel oil, female threaded ends, UL listed; Morrison Figure #286-U.

2.23 STAINLESS STEEL FLUE PIPE

- A. Double wall stainless steel flue pipe shall consist of 430 stainless steel outer jacket, 1/2 in. air space, AL-29-4C inner jacket. Flue piping shall be tested and listed to UL1738, for Categories III and IV. All joints shall be equipped with a factory-applied seal.
- B. Acceptable Manufacturers: Heatfab, Precision Vent, Selkirk.

2.24 PIPING MATERIALS AND SCHEDULE

- A. See Exhibit "A", "Schedule of Piping Materials" at end of this Section for (Plumbing) piping.
- B. See Exhibit "B", "Testing" at end of this Section.

PART 3 - EXECUTION

3.1 EQUIPMENT AND SYSTEMS

- A. Install equipment and systems in accordance with provisions of each applicable Section of these Specifications, and Local/State Codes/Regulations having jurisdiction. Accurately establish grade and elevation of piping before setting sleeves. Install piping without springing or forcing, except where specifically called for, making proper allowance for expansion and anchoring. Changes in sizes shall be made with reducing fittings. Reducing couplings are not acceptable. Arrange piping at equipment with necessary offsets, unions, flanges, and valves, to allow for easy part removal and maintenance. Offset piping and change elevation as required to coordinate with other work. Avoid contact with other mechanical or electrical systems. Provide adequate means of draining and venting units, risers, circuits and systems. Conceal piping unless otherwise called for. Copper tubing shall be cut with a wheeled tubing cutter or other approved copper tubing cutter tool. The tubing must be cut square to permit proper joining with the fittings. Ream pipes after cutting and clean before installing. Cap or plug equipment and pipe openings during construction. Install piping parallel with lines of building, properly spaced to provide clearance for insulation. Make changes in direction and branch connections with fittings. Do not install valves, unions and flanges in inaccessible locations. Materials within a system and between systems shall be consistent. If this is not possible, install dielectric fittings.

3.2 PIPING OVER ELECTRICAL EQUIPMENT

- A. Contractor shall route piping to avoid installation directly over electric equipment, including, but not limited to panels, transformers, disconnects, starters, motor control center, adjustable speed drives and fused switches.

- B. Piping shall not be installed in the dedicated electric and working space as defined by NEC 110. Dedicated electrical space is generally equal to the depth and width of electrical equipment, and extends 6 ft. above the electrical equipment, or to a structural ceiling. Dedicated working space is a minimum of 30 in. wide or the width of equipment (whichever is larger) a minimum of 6 ft.-6 in. tall, with a depth of 3ft. to 9 ft. depending on the voltage.

3.3 HANGERS, INSERTS AND SUPPORTS

- A. Piping shall not be supported by wires, band iron, chains, from other piping, or by vertical expansion bolts. Support piping with individual hangers from concrete inserts, wood construction, welded supports, or beams clamps of proper configuration and loading design requirements for each location; replace if not suitable. Follow manufacturer's safe loading recommendations. Suspend with rods of sufficient length for swing and of size called for, using four (4) nuts per rod. Provide additional structural steel members, having one coat rustproof paint, where required for proper support. Provide oversized hangers where insulation/supports must pass between pipe and hanger. Provide continuous support or extra supports for plastic piping per manufacturer's requirements. Hangers, when attached to joists, shall only be placed at the top or bottom chord panel point. Only concentric type hangers are permissible on piping larger than 2-1/2 in.; "C" types are permitted for piping 2 in. and smaller on joists. Provide riser clamps for each riser at each floor. Use trapeze hangers where a group of piping can be installed.
- B. Provide a pipe hanger within 12 inches of pipe unions and piping connections to equipment, in order to facilitate disconnections of piping without pipe sagging.

3.4 PIPE CONNECTIONS

- A. No-Lead Solder Connections: Nonacid flux and clean off excess flux and solder.
- B. Copper Press Connections: Copper press fittings shall be made in accordance with the manufacturer's installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer.
- C. Steel Press Connections:
 - 1. Natural Gas Systems: Sealing elements shall be verified for the intended use. Pipe ends shall be cut on a right angle (square) to the pipe. Pipe ends shall be reamed and all paint, lacquer, grease, oil, and dirt shall be removed from the pipe end with an abrasive cloth, or with a Ridgid MegaPress pipe end prep tool. Visually examine each fitting sealing element to ensure there is no damage. Insert the pipe fully into the fitting and mark the pipe wall at the face of the fitting. Always examine the pipe to ensure it is fully inserted into the fitting prior to pressing the joint. Steel Press fittings shall be installed using Ridgid, MegaPress Tools. Steel Press fittings shall be installed according to the most current edition of the manufacturer's installation guidelines. Installers shall be trained by a manufacturer representative on proper installation procedures.

2. Testing: After Steel Press fittings have been installed a "two step test" shall be followed. Utilizing air or, dry nitrogen, pressurize the system between 5 psi and 45 psi. Check the pressure gauge for pressure loss. If the system does not hold pressure, inspect entire system and check for un-pressed fittings. Should un-pressed fittings be identified, ensure the pipe is fully inserted into the fitting and properly marked prior to pressing the joint. After appropriate repairs have been made, test the system per local code, or specification requirements, not to exceed 200 psig.
- D. Brazed Connections: Make joints with silver brazing alloy in accordance with manufacturer's instructions. Remove working parts of valves before applying heat.
- E. Threaded Connections: Clean out tapering threads, made up with pipe dope; screwed until tight connection. Pipe dope must be specifically selected for each application.
- F. Flanged Joints: Select appropriate gasket material, size, type and thickness for service applications. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- G. Dielectric Pipe Fittings: Provide dielectric unions at ALL equipment connections where dissimilar metals meet. In addition, provide dielectric unions in all open type piping systems (condensing water, domestic water, etc.) where dissimilar metals are to be joined.
- H. Grooved Mechanical Joints: Pipe to be prepared in accordance with the latest manufacturer's grooving specification. Use manufacturer's recommended grooving tools. Pipe shall be checked to be sure it is free of indentations, projections; weld seams or roll marks on the exterior of the pipe over the entire gasket seating area. Pipe ends are to be square cut. Lubricant shall be applied to gasket and/or pipe ends and housing interiors to eliminate pinching the gasket.
- I. Solvent-Cement Plastic Piping Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
 2. CPVC Piping: Join according to ASTM D 2846.
 3. PVC Piping: Join according to ASTM D 2855.

3.5 WELDING

- A. Welding shall be performed in compliance with the welding procedure specifications prepared by the National Certified Pipe Welding Bureau. Welded pipe fabricated by certified welder. Contractor shall submit proof of current certification of each welder if requested by Owner. Use full-length pipe where possible; minimum distance between welds, 18 in. on straight runs. Welds must be at least full thickness of pipe inside smooth and remove cutting beads, slag and excess material at joints; chamfer ends. Minimum gap 1/8 in., maximum 1/4 in., for butt welds. Overlaps on position and bench welds to be not less than 3/4 in. One internal pass and one external pass minimum required on slip-

on flanges. Do not apply heat to rectify distorted pipe due to concentrated welding; replace distorted pipe.

- B. When welding galvanized pipe, apply cold galvanizing on joint following welding.

3.6 SLEEVES

- A. Provide for pipes passing through floors, walls or ceilings. Not required for floors that are core-drilled, except where floor is waterproofed.
- B. Extend 1/8 in. above finished floor in finished areas. In above grade Mechanical Rooms and other areas with floor drains, use steel pipe sleeves 2 in. above floor.
- C. Use steel pipe sleeves in bearing wall, structural slabs, beams and other structural surfaces, and where called for.
- D. Sleeves shall be as small as practical, consistent with insulation, so as to preserve fire rating.
- E. Fill abandoned sleeves with concrete.
- F. Provide rubber grommet seals for pipes passing through ducts or air chambers or built-up housings.

3.7 SLEEVE PACKING

- A. Seal void space at sleeves as follows:
 - 1. Interior Locations: Firmly pack with fiberglass and caulk.
 - 2. Exterior Walls and Below Grade Cored Holes: Use sealing element.
 - 3. Cored Holes: Use sealing element.
 - 4. Fire Rated, Partitions and Floor Slabs: Use fire rated sealing elements, materials and methods. Provide per manufacturer's instructions to maintain firestop.
 - 5. Waterproofed Walls/Floors: Use waterproof sealing element, device or compound.

3.8 ESCUTCHEON PLATES

- A. Provide polished chrome setscrew type escutcheon plates for all exposed piping passing through floors, walls or ceilings, in all rooms except in Boiler, Fan and Mechanical Rooms.

3.9 TESTS

- A. Refer to Exhibit "B" at the end of this section for testing of Plumbing Systems.
- B. Provide all necessary items to complete proper testing of work. Perform all testing in accordance with governing Codes, local utilities and other agencies having jurisdiction

and as specified. Pay all costs to perform tests. Perform all testing in a safe manner. Isolate existing systems.

C. Domestic Water:

1. Do not cover joints with insulation until required tests are completed and the Owner's Representative accepts the system.
2. Make leaks tight; no caulking permitted. Replace defective fittings, pipe or connections. Piping shall be tight and show no loss of pressure.
3. Air test not acceptable as final test.
4. Confirm in writing that tests and flushing have been conducted and successfully completed. Submit copy of the test report to Owner's Representative.

D. Sanitary and Storm:

1. There shall be no loss of water when testing interior piping.
2. Air test not acceptable as final test.
3. Should any leaks, defective joints or defective construction be detected in sewers and/or floors or walls of appurtenant structures, they shall be permanently stopped. Should any defective pipes, fitting or accessories be discovered they shall be removed and replaced at the Contractor's expense.
4. Confirm in writing that tests have been conducted and successfully completed. Submit copy of the test report to Owner's Representative.

3.10 DOMESTIC WATER PIPING CLEANING AND DISINFECTION

- A. Cleaning and disinfecting shall be in accordance with requirements of New York State Department of Health and authority having jurisdiction. Prior to disinfecting, flush piping to remove any sediment and debris.
- B. Clean and disinfect water distribution piping systems and parts of existing potable water systems that have been altered, extended or repaired.
- C. After disinfection procedures, submit water samples in sterile bottles to an approved Department of Health Laboratory. Samples shall be proven equal to the water quality served to the public from the existing water supply system and acceptable to the Department of Health. Flush and disinfect all sections of pipe that fail the laboratory tests. Submit test results indicating water is potable.

3.11 PEX DOMESTIC WATER PIPING

- A. Leave three (3) extra outlets on each manifold and cut manifolds to remove remaining outlets. Cap extra outlets for future use.
- B. Accessories: Provide all required accessories including, but not limited to, bond supports, finished sleeves, strike plates, etc. as recommended by manufacturer.

3.12 CONNECTIONS TO SPECIAL EQUIPMENT

A. Kitchen Equipment:

1. Kitchen Equipment shall be furnished by others and set in place by others.
2. Provide all piping, stops, valves, traps and fittings.
3. Where exposed, provide chrome plated brass piping, valves, hangers, brackets and accessories.
4. Pipe relief valves to floor. Size and arrangement of pipe, traps, valves and fittings, as recommended by manufacturer of equipment.

3.13 PIPE LINE SIZING

- #### A.
- Pipe sizes called for are to be maintained. Pipe size changes made only as reviewed by Owner's Representative. Where discrepancy in size occurs, the larger size shall be provided.

EXHIBIT "A" - PIPING MATERIALS (PLUMBING)
(Notes at end of Exhibit "A")

<u>SERVICE</u>	<u>PIPE MATERIALS</u>	<u>FITTINGS</u>	<u>CONNECTIONS</u>
Water service (2 in. and smaller)	SEE "UNDERGROUND PIPING AND ACCESSORIES" SECTION 221020		
Domestic water interior/hot, cold and circulating 3 in. and smaller	Type L copper	Wrought or cast copper	No-lead solder
	Type L copper	Wrought or cast copper	Press fit
	CPVC, SDR 11	Socket type	Solvent cement (SEE NOTE 6)
	PEX tubing	N/A	Compression
Domestic water interior/hot, cold and circulating 4 in. and larger	Type L copper	Wrought copper	Brazed
	Type L copper	Wrought or cast copper	Roll grooved mechanical type couplings
	CPVC, Schedule 80	Socket type	Solvent cement (SEE NOTE 6)
Sanitary, sanitary vent, grease waste and storm (buried)	SEE "UNDERGROUND PIPING AND ACCESSORIES" SECTION 221020		
Sanitary, sanitary vent and grease waste	Service weight cast iron soil pipe	Cast iron hub and spigot	Neoprene compression type gasket
	Service weight cast iron soil pipe	No hub	No hub neoprene gasket and stainless steel clamp assembly
	Type DWV copper	Wrought copper	No-lead solder (SEE NOTE 5)
	Schedule 40 PVC, solid wall	PVC, socket type	Solvent cement (SEE NOTE 4)

<u>SERVICE</u>	<u>PIPE MATERIALS</u>	<u>FITTINGS</u>	<u>CONNECTIONS</u>
Storm	Service weight cast iron soil pipe	Cast iron hub and spigot	Neoprene compression type gasket
	Service weight cast iron soil pipe	No hub	No hub neoprene gasket and stainless steel clamp assembly
	Schedule 40 PVC, solid wall	PVC, socket type	Solvent cement (SEE NOTE 4)
	Type DWV copper	Wrought copper	No-lead solder
Water heater intake piping	Schedule 40 PVC, solid wall	PVC, socket type	Solvent cement (SEE NOTE 4)
Water heater exhaust piping	AL-29-4C stainless steel (exhaust)	Stainless steel	Sealed closure system
Indirect waste	Type DWV copper	Wrought copper	No-lead solder
	Schedule 40 PVC, solid wall	PVC, socket type	Solvent cement (SEE NOTE 4)
	Schedule 40 PVC, foam core	PVC, socket type	Solvent cement (SEE NOTE 4)
Pump discharge	Schedule 40 galvanized steel	Galvanized cast iron drainage	Threaded
	Type L Copper	Wrought copper	No-lead solder
Natural gas (buried)	SEE "UNDERGROUND PIPING AND ACCESSORIES" SECTION 221020		
Natural gas (exterior above grade)	Schedule 40, black steel	Butt welded steel	Welded (SEE NOTE 2)
	Schedule 40, black steel	Malleable iron, 2 in. and smaller	Threaded (SEE NOTE 2)
	Schedule 40, black steel	Steel with zinc/nickel coating	Press fit
Natural gas (interior)	Schedule 40, black steel	Malleable iron, 2 in. and smaller	Threaded (SEE NOTE 2)
	Schedule 40, black steel	Butt welded steel, 2-1/2 in. and larger	Welded (SEE NOTE 2)

NOTES FOR EXHIBIT A:

- NOTE 1: Provide ductile iron, double thickness cement - lined pipe and fittings up to the water meter inlet valve in accordance with the New York State Plumbing Code and Water Bureau Requirements. Pipe and fittings shall be flanged.
- NOTE 2: Provide one coat of alkyd primer and two coats of exterior acrylic latex gloss enamel on exposed exterior and interior piping. Color as selected.
- NOTE 3: For gas piping systems having operating pressure other than the standard 50 to 55 psig (or 160 psig for nitrogen), provide Type K copper for medical gas.
- NOTE 4: PVC piping shall not be installed within return air plenums.
- NOTE 5: Copper piping shall not be used for urinal waste piping.
- NOTE 6: CPVC piping, copper tube size (SDR11) permitted for piping 2 in. and smaller. CPVC piping, Schedule 80 permitted for piping 3 in. and larger.

EXHIBIT "B" - TESTING

SERVICE

TEST REQUIREMENTS

Domestic water	Test hydrostatically at 150 PSI for two (2) hours or at 1.5 times the working pressure when working pressure exceeds 100 PSI
Sanitary, sanitary vent, storm	Maintain 10 ft. head of water for two (2) hours.
Indirect waste	Maintain 10 ft. head of water for two (2) hours.
Pump discharge	Hydrostatically test at 5 PSI greater than the pump rating for two (2) hours.
Natural gas	Refer to Section 227010 - "Natural Gas Systems".

END OF SECTION

SECTION 221020 - UNDERGROUND PIPING AND ACCESSORIES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents

1.2 SUBMITTALS

- A. Provide a schedule of pipe materials, fittings and connections.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Pipe and fittings new and marked with manufacturer's name, complying with applicable ASTM and ANSI Standards.

2.2 CAST IRON SOIL PIPE AND FITTINGS

- A. Pipe: ASTM A74 service weight cast iron, bitumen coated, hub and spigot.
- B. Fittings: Service weight cast iron, bitumen coated, hub and spigot, ASTM C564 service weight neoprene gasket of same manufacturer as piping.
- C. All cast iron pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

2.3 COPPER PIPE AND FITTINGS

- A. Pipe: ASTM B88, Type K, Soft Temper
- B. Fittings: ANSI B16.22 wrought copper; ANSI B16.26 and ASTM B62 cast bronze; flared end connections.

2.4 DUCTILE IRON PIPE AND FITTINGS

- A. Pipe: AWWA C151/ANSI A21.51, Class 52, ductile iron, mechanical type joints for short runs, otherwise use push-on type joints.
- B. Fittings: AWWA C110/ANSI A21.51, ductile iron, 250-psi pressure rating (or) AWWA C153/ANSI A21.53 ductile iron compact fitting, 350 psi pressure rating. Joints shall be restrained, mechanical type for short runs, otherwise use push-on type.
- C. Lining: Pipe and fittings shall have double thickness cement mortar lining with seal per AWWA C104/ANSI A21.4 on interior and asphaltic coating on outside.
- D. Glands and Gaskets: AWWA C111/ANSI A21.11, ductile iron gland, rubber gasket joints, provide two bronze wedges for each joint of pipe.

2.5 PVC SOLID WALL PIPE AND FITTINGS - DWV SYSTEM

- A. Pipe: PVC Schedule 40 solid wall pipe, iron pipe size conforming to ASTM D1785 and ASTM D2665. Pipe shall be manufactured from PVC compounds as identified in ASTM D1784. Both pipe and fittings shall conform to National Sanitation Foundation Standard 14.
- B. Fittings: Type DWV, socket type conforming to ASTM D2665. Fittings shall be manufactured from PVC compounds as identified in ASTM D1784. Solvent cement joints shall be made utilizing a two-step process with primer manufactured for thermoplastic piping and solvent cement conforming to ASTM D2564.

2.6 POLYETHYLENE PIPE AND FITTINGS - NATURAL GAS

- A. Pipe: ASTM D2513, SDR 11, Fittings: Same material as pipe. Heat fusion joints, socket-type ASTM D2683.
- B. Acceptable Manufacturers: Adrisco, Chevron Phillips, or approved equal.

2.7 HIGH-DENSITY POLYETHYLENE (HDPE) SEWER PIPE AND FITTINGS

- A. Pipe: Smooth interior and corrugated exterior wall HDPE pipe conforming to AASHTO M252 Type C (3 in. through 10 in.) or AASHTO M 294 Type C (12 in. through 24 in.). Pipe shall be manufactured from HDPE compounds as identified in ASTM D3350 with cell classification of 424420C (3 in. through 10 in.) and 435400C (12 in. through 24 in.).
- B. Fittings: Fittings shall conform to AASHTO M252 or AASHTO M294. Fittings shall be manufactured from compounds as identified in ASTM F810.
- C. Joints: Pipe connections shall be made with coupling bands covering at least two full corrugations on each end of pipe meeting soil-tight requirements of AASHTO M252 and M294. Gasketed connections shall incorporate closed-cell synthetic expanded rubber gaskets meeting ASTM D1056 Grade 2A2.

2.8 DETECTABLE TAPE

- A. Detectable underground warning tape, 5 mil. polyethylene, 6 in. wide, aluminum backing, APWA approved background colors within permanent black lettering identifying service below.
- B. Schedule:
 - 1. Sanitary: Green color, "Caution Buried Sewer Line Below".
 - 2. Storm: Green color, "Caution Buried Sewer Line Below".
 - 3. Water: Blue color, "Caution Buried Water Line Below".
 - 4. Gas: Yellow color, "Caution Buried Gas Line Below".
 - 5. Electric: Red color, "Caution Buried Electric Line Below".

- C. Acceptable Manufacturers: Seton, Terra Tape, Pro-Line Safety Products, Inc.

2.9 SCHEDULE OF PIPING MATERIALS

- A. See Exhibit "A", Schedule of Piping Materials at end of this section for piping.

PART 3 - EXECUTION

3.1 TESTING

- A. Sanitary and Storm:

1. Do not backfill over piping until required tests are completed and the Owner's Representative accepts the system.
2. There shall be no loss of water when testing interior piping inside the building foundation.
3. Air test not acceptable as final test.
4. Should any leaks, defective joints or defective construction be detected in sewers, floors or walls of appurtenant structures, they shall be permanently stopped. Should any defective pipes, fitting or accessories be discovered they shall be removed and replaced at the Contractor's expense.
5. Test exterior piping outside the building foundation in 100 ft. sections. The allowable rate of leakage per 24 hours per in. of diameter per 1,000 ft. of sewer tested shall not exceed 25 gallons. Piping shall be inspected and tested prior to backfill.
6. Confirm in writing that tests have been conducted and successfully completed. Submit copy of the test reports to Owner's Representative.

- B. Domestic Water:

1. Do not backfill over piping until required tests are completed and the Owner's Representative accepts the system.
2. Make leaks tight; no caulking permitted. Replace defective fittings, pipe or connections. Piping shall be tight and show no loss of pressure.
3. Air test not acceptable as final test.
4. Confirm in writing that tests and flushing have been conducted and successfully completed. Submit copy of the test report to Owner's Representative.

- C. Test exterior water and fire service piping outside the building foundation hydrostatically at 200 psi for two (2) hours. The amount of leakage shall not exceed two (2) quarts per hour per 100 gaskets or joints. Conform to NFPA 24.

3.2 HIGH-DENSITY POLYETHYLENE (HDPE) SEWER PIPE AND FITTINGS

- A. Pipe installation shall comply with ASTM D2321 and the manufacturer's recommendations.

3.3 DETECTABLE TAPE

- A. Provide detectable tape directly over the buried pipe lines at a depth of 1 ft. - 0 in. below finished grade. Install tape over the continuous length of the pipe.

3.4 GAS PIPING

- A. Refer to Section 227010, "Natural Gas Systems".

EXHIBIT "A" - PIPING MATERIALS (PLUMBING)

(Notes are at end of Exhibit "A")

<u>SERVICE</u>	<u>PIPE MATERIALS</u>	<u>FITTINGS</u>	<u>CONNECTIONS</u>
Water and Fire service	Ductile iron water main with cement lining	Ductile iron	Mechanical or push-on type
Water service (2 in. and smaller service)	Type K copper	Cast bronze	Flared
Sanitary and grease waste	Service weight cast iron soil pipe	Cast iron, hub and spigot	Neoprene gasket compression type
	Schedule 40 PVC, solid wall	PVC, socket type	Solvent cement (SEE NOTE 2)
	Schedule 40 PVC, foam core	PVC, socket type	Solvent cement (SEE NOTE 2)
Sanitary and grease waste vent	Service weight cast iron soil pipe	Cast iron, hub and spigot	Neoprene gasket compression type
Storm	Service weight cast iron soil pipe	Cast iron, hub and spigot	Neoprene gasket compression type
	Schedule 40 PVC, solid wall	PVC, socket type	Solvent cement
Natural gas	Schedule 40 steel, factory applied corrosion protective coating	Butt welded steel	Welded (SEE NOTE 1)
	SDR 11 Polyethylene	Polyethylene	Heat fusion

NOTES FOR EXHIBIT A:

NOTE 1: On buried coated steel pipe, tape all joints with Scotchwrap #50, 2 in. wide, 50% overlap. Provide cathodic protection system.

NOTE 2: Schedule 40 PVC pipe may not be used when the temperature of the waste can exceed 140°F.

EXHIBIT "B" - TESTING

<u>SERVICE</u>	<u>TEST REQUIREMENTS</u>
Water service	Test hydrostatically at 150 PSI for two (2) hours or at 1.5 times the working pressure when working pressure exceeds 100 PSI.
Sanitary, sanitary vent, storm	Maintain 10 ft. head of water for two (2) hours.
Acid waste and vent	Maintain 10 ft. head of water for two (2) hours.
Natural gas	Refer to Section 227010 - "Natural Gas Systems".
LG gas (propane)	Refer to Section 227011 - "LP Gas System".
Fire service	Test hydrostatically at 200 PSI or 50 PSI in excess of the system working pressure, whichever is greater for two (2) hours.

END OF SECTION

SECTION 221030 - PUMPS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 QUALITY ASSURANCE

- A. Follow all requirements, recommendations and appendices to comply with the following publications, codes, standards and listings/approvals:
 - 1. All items here-in used to convey water for potable use shall be lead free in accordance with NSF 61, Standard 61, Section 9 - Standard for Drinking Water and Lavatory Faucets and NSF Standard 372 - Maximum Lead Requirements. Compliance shall be via third party testing and certification.

1.3 SUBMITTALS

- A. Submit manufacturer's data in accordance with the Basic Mechanical and Electrical Requirements. Obtain approval prior to ordering material.
- B. Provide submittals for all items specified under Part 2 of this Section.

PART 2 - PRODUCTS

2.1 HOT WATER CIRCULATING PUMP

- A. Pump: Inline centrifugal, all stainless steel, system fluid lubricated, 145 psi working pressure, 230°F water temperature, ceramic shaft and radial rings, flange mount.
- B. Motor: Impedance protected, stainless steel can and static o-ring seals to isolate stator from system fluid, non-overloading throughout the pump curve.
- C. Electric Control: Time clock and aquastat for each pump and wiring to motor starter. Starter and time clock by Electrical Contractor.
- D. Refer to schedule on drawings for capacity and electrical characteristics.
- E. Acceptable Manufacturers: Armstrong, Bell and Gossett, Grundfos.

2.2 SUMP PUMP - SUBMERSIBLE

- A. Pump: Simplex, submersible type, 2 in. discharge, bronze construction, non-clog impeller, stainless steel shaft, capable of handling 5/8 in. solids, mechanical seal, minimum 50 gpm capacity.
- B. Motor: Oil filled, permanent lubrication, automatic reset thermal overload, oil and water resistant power cord with plug, non-overloading throughout the pump curve.

- C. Electric Control: Built-in automatic diaphragm-type pressure switch, completely prewired, requiring only receptacle for plug in power connection.
- D. Basin: Basin and cover shall be provided by the General Contractor.
- E. Refer to schedule on drawings for capacity and electrical characteristics.
- F. Acceptable Manufacturers: Hydromatic, Goulds, Weil, Zoeller.

2.3 SUMP PUMP - SUBMERSIBLE

- A. General: Provide pump and control system capable of pumping water and automatically shutting down the pumping system upon the detection of oil in the sump.
- B. Pump: Simplex, submersible effluent type, 2 in. discharge, stainless steel construction, capable of handling 5/8 in. solids, mechanical seal, meets UL 778 standard, minimum 50 gpm capacity.
- C. Motor: Capable of operating continuously or intermittently, housing constructed of #304 stainless steel, oil filled, permanent lubrication, automatic reset thermal overload, oil and water resistant power cord with plug, non-overloading throughout the pump curve.
- D. Basin: Basin and cover shall be provided by the General Contractor.
- E. The system shall function automatically and provide audible and visual alarms in the event of the presence of oil in the sump, high liquid in the sump, high amps or a locked rotor condition. LED lights shall be provided to indicate power on and pump running.
- F. Electric Control Panel: The control panel shall meet UL 508 standards and be housed in a gasketed NEMA 4X enclosure. The control shall be equipped with a twist lock receptacle, dual solid state relays with variable sensitivity settings, an over current relay, self-cleaning stainless steel sensor probe, high decibel warning horn with alarm silencing switch, dual floats, terminal board, remote monitoring contact, NEMA 4X junction box with twist-lock electrical receptacle and mating conductor cables. Provide all cables between the pump and junction box and the cable and plug from the control unit. The control panel, junction box, pump, floats and sensor shall be factory assembled and tested by a nationally recognized testing laboratory. The system shall allow for the main control panel to be located outside of the elevator shaft and be monitored for all functions. The system shall function automatically and provide audible and visual alarms in the event of the presence of oil in the sump, high liquid in the sump, high amps or a locked rotor condition. LED Lights shall be provided to indicate power on and pump running.
- G. Refer to Schedule on Drawings for capacity and electrical characteristics.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Pumps shall be installed, aligned and started in accordance with manufacturers written installation instruction.

- B. Install pumps in locations to provide access for maintenance and replacement of parts.
- C. Support pumps and piping separately so that piping does not support pumps.
- D. Provide the services of a factory trained mechanic to start up the system based on factory recommendations. Provide Owner instruction at time of startup. Submit three (3) copies of startup report to the Owner's Representative.
- E. All wiring for sump pump(s) between control panel and junction box shall be continuous. No junction boxes allowed within pump basin.

3.2 HOT WATER CIRCULATING PUMP

- A. Install shutoff valve and strainer on pump suction; check valve, balancing valve and shutoff valve in pump discharge. Install pressure gauge on suction and discharge piping. Adjust gpm of each circulating pump to capacity as noted.

3.3 SUMP PUMP

- A. Install gate valve and check valve in discharge piping for each pump.
- B. Simplex pump operation shall be completely automatic. Pressure style switch shall start and stop the pump at the factory set levels. Float style switches shall be adjusted to start and stop the pump at the specified levels.
- C. Install liquid level control devices at proper elevation to produce specified sump drawdown. Secure control devices to discharge piping with corrosion resistant brackets and fasteners.
- D. Install high water alarm and make electrical connections. Install liquid level control device at proper liquid depth. Secure control device to discharge piping with corrosion resistant brackets and fasteners.

3.4 TESTING

- A. Test hot water recirculating pumps for operation.
- B. Test sanitary and storm pumping systems for operation at specified liquid depths.
- C. Test high water alarm for operation at specified liquid depth.
- D. Test domestic water pressure booster pump system for operation.
- E. Certify in writing that tests have been performed and the systems are properly operating. Submit three (3) copies of all test reports to the Owner's Representative.

END OF SECTION

SECTION 223010 - EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Document.

1.2 SUBMITTALS

- A. Provide submittals for all items specified under Part 2 of this section.

PART 2 - PRODUCTS

2.1 FLOOR DRAINS

- A. Drain Description: All Floor Drains Type A unless otherwise noted.
 - 1. Type A: Cast iron body, flashing collar with weepholes, nickel bronze, 7 in. diameter adjustable strainer; Jay R. Smith Figure #2010-A.
 - 2. Type B: Cast iron body, flashing collar with weepholes, nickel bronze 7 in. diameter adjustable strainer with separate oval funnel; Jay R. Smith Figure #2010-A with #3590 funnel Type C: Cast iron body, flashing collar with weepholes, 8 in. diameter cast iron grate medium duty, removable sediment bucket; Jay R. Smith Figure #2110.
- B. Where floor drains are not installed in slabs on grade, provide flashing collar and flash with 24 in. square four (4) pound lead flashing or equal.
- C. Make: Josam, Jay R. Smith, Wade, Watts or Zurn.

2.2 FLOOR SINKS

- A. Sink Description:
 - 1. Type A: Acid resistant coated body with 12-1/2 in. square nickel bronze top, 8 in. deep with sediment bucket; Jay R. Smith Figure #3150.
- B. Make: Josam, Jay R. Smith, Wade, Watts or Zurn.

2.3 CLEANOUTS

- A. Floors: Cast iron body, nickel-bronze top with adjustable feature, bronze plug and flashing clamp where required, carpet marker and tile cover where applicable; Jay R. Smith Series #4028.
- B. Walls: Cast iron ferrule, with bronze plug and stainless steel smooth access cover.
 - 1. Horizontal: Jay R. Smith Figure #4402.

2. Vertical: Jay R. Smith Figure #4531.

C. Yard Cleanout:

1. Cast iron body, adjustable round heavy duty top, with tractor cover, vandal proof screws and bronze plug; Jay R. Smith Figure #4246.

- D. Make: Josam, Jay R. Smith, Wade, Watts or Zurn.

2.4 GREASE INTERCEPTOR STEEL

- A. Welded 1/4 in. steel body, 3/8 in. nonskid tread plate cover, secured with stainless steel bolts, extra heavy leakproof gasket, recessed installation, integral extension to floor/grade. Acid-resistant coating inside and outside.
- B. 15 gpm full flow, 10 gallon liquid holding capacity, 3 in. tapped inlet and outlet with outlet vent connection, 30 lb. greasy sludge capacity, removable separator screen, filter screen and anchor flange.
- C. Make: Zurn Z1170 - 400, MiFab, or equal.

2.5 LINT INTERCEPTOR

- A. Epoxy coated, fabricated steel, coated with primary and secondary stainless steel screens, 3/16 in. plate cover, secured and gasketed, 3 in. inlet and outlet; non-skid-heavy-duty cover.
- B. Acceptable Manufacturer: Watts #LI-807 70 gpm flow rate with anchor flange and membrane clamp, extension up to flush with floor, flow control fitting, and sediment bucket.

2.6 WALL HYDRANTS

- A. Exposed type hose connection, lead-free, solder connection, nickel bronze face, quarter turn valve, nonfreeze type, 3/4 in. hose connection, self draining, integral vacuum breaker with vandal resistant cap, loose key control and wall clamp; Jay R. Smith Figure #5609QT.
- B. Make: Jay R. Smith, Prier, Watts, Woodford or Zurn.

2.7 ROOF HYDRANT

- A. Non-freeze, post-type roof hydrant with ASSE 1052 dual check backflow preventer, underdeck clamp support, 1 in. water inlet, 3/4 in. hose connection and 1/8 inch drain port: Wood #RYH2-MS.
- B. Make: Jay R. Smith, Watts, Woodford or Zurn.

2.8 SHOCK ABSORBERS

- A. Hydropneumatically controlled with permanently sealed expansion chamber pre-charged with non-combustible gas; lead-free, threaded connection, meets or exceeds Plumbing and Drainage Institute Standard PDI WH-201 and ASSE Standard 1010.
 - 1. Bellows Type: Stainless steel construction with stainless steel bellows.
 - 2. Piston Type: Hard drawn copper body with brass piston, cap and adapter, and elastomer seals.
- B. Elastomer or rubber compound type bellows not allowed.
- C. Make: Watts #LF15M2, Precision Plumbing Products, Jay R. Smith, or Zurn.

2.9 TRAP GUARDS

- A. Elastomeric, normally closed seal to prevent evaporation of P-traps. Inserts into throat of floor drain. Provide for each new floor drain.
- B. Make: ProVent Systems, Inc. "ProSet Trap Guard".

2.10 WATER PRESSURE GAUGES

- A. Construction to be Bourdon tube type; 4-1/2 in. diameter, minimum dial face, stamped stainless steel, replaceable glass lens, with snap-on rings. Phosphor bronze tube, bronze bushed rotary movement, silver brazed or soldered to brass socket and brass tip, 1/4 in. bottom connection. Accuracy, on (1.0) percent of included scale range. White dial face with black numerals, graduated in pounds; equipped with bronze pulsation dampener or snubber and needle valve.
- B. Make: Trerice, Weiss, Weksler, Winters.

2.11 PIPING SYSTEM THERMOMETERS

- A. Industrial type, plastic, aluminum or steel case, glass or plastic front, non-toxic organic liquid filled, red reading column, white or silver V-shaped scale, black numerals. Union flange mounted, separable socket with thermowell, extension necks were required; range as called for service. Universal adjustable type, 9 in. scale. For installation in water systems where the maximum temperature is less than 120°F, graduations of 1°F, accurate to within 1/2°F. For installation greater than 120°F, graduations of 2°F, accurate to
- B. Make: Trerice, Weiss, Weksler, Winters.

2.12 TEMPERATURE MIXING VALVE - ELECTRONIC TYPE

- A. Valve shall mix 140°F hot water with 40°F cold water to obtain a water outlet temperature of 120°F. The valve shall consist of the following:

1. Electronic style, single thermostatic mixing valve with 3/4 in. inlet and 3/4 in. outlet. Flow capacity of 27 gpm at 7.5 psi pressure drop, and 43 gpm at 20 psi pressure drop.
2. 3 wire floating fail in place 24v actuator, capable of 14 to 130 degrees F, with an accuracy of +/-3°F.
3. LCD user interface/controller with battery backup.
4. Provide valves on hot, cold and tempered water piping with fittings, nipples, trim piping and escutcheon plates. Horizontal stem dial thermometers on hot, cold and tempered water piping.
5. DZR low lead brass lead free mixing valve and trim exposed on wall.

B. Make: Caleffi Legiomix 6000 series.

2.13 LAUNDRY UTILITY BOX (WMB)

- A. Guy Gray, Model DLWB1 washing machine supply and drain fitting with hot and cold water 1/2 in. sweat shutoff valves, 2 in. drain connection and in 20 gauge, white powder coated steel cabinet with faceplate.
- B. Provide vacuum breakers on each hose connection.

PART 3 - EXECUTION

3.1 EQUIPMENT CONNECTIONS

- A. Plumbing Contractor shall:
 1. Provide all roughing and final water, waste, vent, gas, air, vacuum, diesel and/or oxygen connections to all equipment requiring same as called for on Contract Documents.
 2. Refer to Contract Documents for roughing schedules, and equipment and lists indicating scope of connections required.
 3. Provide loose key stops, "P" traps, tailpieces, adapters, gas or air cocks and all necessary piping and fittings from roughing point to equipment.
 4. Provide for installation of sinks, faucets, traps, tailpieces provided by an Equipment Contractor. These items to be delivered, in easily identified cartons, to the proper room for Contractor's installation.
 5. Install controls and devices furnished by others.
 6. Provide cold water line with gate valve and backflow prevention device at locations called for. Continuation and connection to equipment by others.
 7. Install relief valve discharge piping from equipment relief valves.

8. Provide for Owner furnished equipment:
 - a. Connect complete and ready for use, including all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, insulation, sheet metal work, controls, dampers, etc., as required by Owner.
 - b. Refer to manufacturer Drawings and Specifications for requirements of special equipment. Verify connection requirements before bidding.

3.2 CLEANOUTS

- A. Install cleanouts out of traffic patterns and flush to floor. Provide offset from sanitary line served. Do not locate under doors or under lockers. Maintain distance between cleanouts on piping 4 in. and smaller, 50 ft.; over 4 in., 100 ft. At changes in direction greater than 45°. Install at base of soil, waste, vent, stacks and roof conductors and where called for.
- B. Cleanouts: Same nominal size as pipe, but not larger than 4 in.

3.3 WALL HYDRANTS

- A. Install minimum 24 in. above grade.

3.4 HOSE BIBBS

- A. Install at low points of piping system.

3.5 SHOCK ABSORBERS

- A. Install in vertical position.

3.6 THERMOMETERS

- A. Provide on piping system where called for and shown, with thermometer well at each location, mounted in oversize tee or elbow to provide as little restriction as possible to fluid flow, stems or proper length to allow accurate reading. Arrange to be easily read from floor.
- B. Select range such that the maximum system working temperature is in the middle one-third of the scale.

3.7 PRESSURE GAUGES

- A. Provide in piping system where called for and shown, with needle valve and pulsation damper or snubber at each location. Arrange to be easily read from the floor.
- B. Select range such that the maximum system working temperature is in the middle one-third of the scale.

3.8 TEMPERATURE MIXING VALVE

- A. Provide where called for. Provide 2 ft. - 0 in. deep heat trap on hot water supply line ahead of connection to mixing valve.
- B. Provide factory-trained technician to start up, adjust and inspect the mixing valve and piping for correct installation and temperature adjustment.

3.9 GREASE TRAP

- A. Install in accordance with manufacturer's written installation instructions.
- B. Provide concrete hold down pad as indicated on drawing.
- C. Set trap on a 6 in. deep level bed of compacted pea gravel spread evenly over the top of the concrete pad.
- D. Secure trap to pad with anchor bolts hooked under reinforcing rods of the hold down pad. Coat bolts, rods and other exposed metal surfaces with three coats of black asphaltum.

END OF SECTION

SECTION 223400 - WATER HEATERS

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Work of this section shall be performed in accordance with the requirements of the Contract Documents, including but not limited to Instructions to Bidders, Agreement and General Conditions, General Requirements and Basic Mechanical/Electrical Requirements.
- B. Provide labor, materials, equipment and services to perform work and related work required by Contract Documents for a complete operating system.

1.2 SUBMITTALS

- A. Submit manufacturer's data for approval in accordance with Basic Mechanical/Electrical Requirements. Obtain approval prior to ordering material.
- B. Provide submittals for all products to be installed including, but not limited to:
 - 1. Water Heater.
 - 2. Tank Protective Valves.
 - 3. Expansion Tank.
 - 4. All Heater and Tank Accessories.
 - 5. All System Wiring Diagrams.
 - 6. Tank Lining.
 - 7. Condensate Neutralizer Kit.

1.3 SPECIAL COORDINATION

- A. Coordinate all work of other trades in Water Room.
- B. Furnish Division 26 "Electric" with dimensional drawings showing location of electrical connections, location of equipment mounted on walls, and of other equipment requiring electrical connections, removals or replacements.

PART 2 - PRODUCTS

2.1 WATER HEATER SEMI-INstantaneous, GAS-FIRED CONDENSING TYPE

- A. Provide gas-fired, condensing fire tube heater with a modulating power burner.
- B. Units to fire on Natural gas.

- C. Heater shall be UL/FM approved with an input of 250 mbh and an output of 225 mbh with a minimum efficiency of 96%.
- D. Heater shall have a recovery rate of 291 GPH at 100°F rise.
- E. The tank shall be lined with Vitraglas® vitreous enamel and shall have a bolted hand hole cleanout.
- F. The tank shall have four extruded magnesium anode rods installed in separate head couplings.
- G. This water heater shall be equipped with stainless steel cold water inlet, Hydrojet® Sediment Reduction System.
- H. This water heater shall be equipped with an electronic ignition system, an ASME rated T&P relief valve and a premix closed combustion system for direct venting using either 2", 3", 4" or 6" PVC, CPVC, Polypropylene, Stainless Steel, or ABS vent pipe.
- I. The water heater shall be factory assembled and tested. The water heater shall be approved for zero inch clearance to combustibles.
- J. A digital LCD display shall be integrated into the front and be an adjustable electronic thermostat to any temperature up to 180°F. A recycling Energy Cut Off (E.C.O.) shuts off all gas in the event of an overheat condition.
- K. The entire installation shall be made in compliance with state and local codes and ordinances.
- L. Basis-of-Design: Bradford White Model EF-100T-250E-3N or approved equal.

2.2 THERMAL EXPANSION TANK

- A. Vertical steel expansion tank constructed and designed per ASME Code Section VIII, 150 PSI working pressure, steel outer shell, rigid polypropylene liner, heavy duty butyl rubber diaphragm and non-ferrous system connection tapping, suitable for potable hot water, factory pre-charged at 15 PSI. Tank will have a 12 in. diameter and a height of 18 in. with a 6.4 gallon total volume and 0.80 maximum acceptance factors. The manufacturer will be similar to Model ST-12C by Amtrol, Wessel or approved equal.
- B. Design Equipment: Watts.
- C. Acceptable Manufacturers: Amtrol, Watts, Wessel or approved equal.

2.3 TANK PROTECTIVE VALVES

- A. Pressure Relief Valves:
 - 1. ASME stamped and rated.
 - 2. Open at 125 lbs. pressure sized for full heating capacity.

3. Make: Bell & Gossett, Kunkle, Watts or approved equal.
- B. Temperature and Pressure Relief Valve:
 1. ASME stamped and rated (for steam or hot water).
 2. Size for full heat input.
 3. Complying with Federal Spec. MIL-V-13612C.
 4. Valve shall be sized and selected by manufacturer for tank and heater installed.
 5. Make: Camco, Cash-Acme, Watts, or approved equal.

PART 3 - EXECUTION

3.1 WATER HEATERS

- A. Install each heater on a 6 in. high concrete pad.
- B. Pipe pressure and temperature relief valve drain to discharge to nearest floor drain.
- C. Provide all electric wiring and equipment in accordance with manufacturer's wiring diagrams and instructions. Make all final connections.
- D. Provide all piping, valves and fittings in accordance with manufacturer's piping instructions. Make all final connections.
- E. Provide equipment in accordance with contract drawings and all local codes.
- F. Provide gas pressure regulator when inlet gas pressure exceeds 14 in. w.c.
- G. Provide start-up services of a factory trained technician to inspect the installation based on factory recommendations. Items include but are not limited to:
 1. Verification of proper piping arrangement.
 2. Fuel supply piping and connection(s).
 3. Combustion efficiency.
 4. Verification of proper temperature rise across heater(s).
 5. Verification of proper venting with draft reading.
 6. Operating and safety controls.
 7. Proper operation of equipment.
 8. Verification of piping arrangement and aquastat location.
 9. Verification of proper gas pressure to unit and to burners.

- 10. Relief valve settings and AGA BTU capacities.
- 11. All control settings.
- H. Submit three (3) copies of startup reports in writing with all factory checkout data signed by the factory authorized service agent to the Owner's Representative.
- I. Place equipment in operation.
- J. The installation of water heaters shall be based on the details shown on the drawings and specified in this Section. Approved water heaters provided other than type shown or specified shall be installed in accordance with manufacturer's recommended installation instructions and piping diagrams.

3.2 INSTANTANEOUS WATER HEATERS

- A. Install instantaneous type water heaters as recommended by the manufacturer. Place and secure anchorage devices to building structure. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible.

3.3 STORAGE TANKS AND HEATERS

- A. Provide 2 in. drain with valve off bottom.
- B. Install tank on a 6 in. high concrete pad.
- C. Temperature and Pressure Relief Valves:
 - 1. Extend drain piping to terminate at 6 in. above floor or floor drain. Support all discharge piping independent of valves to eliminate strain on valve bodies.
 - 2. Install all valves per ANSI Z21.22.
 - 3. The temperature sensing elements shall be immersed in the water within the top 6 in. of the top of the tank.
 - 4. Install pressure relief valve in the cold water line.
- D. Unused Tank Openings:
 - 1. Provide solid brass or bronze plugs in all unused tank openings.

3.4 CONDENSATE NEUTRALIZERS

- A. Verify if condensate neutralizer is available from factory to be provided with water heater to site.
- B. Install unit with 1/2 in. polyethylene tubing or piping in accordance with the water heater manufacturer's recommendations.

END OF SECTION

SECTION 224000 - PLUMBING FIXTURES AND TRIM

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 SUBMITTALS

- A. Submit manufacturer's data in accordance with Basic Mechanical/Electrical Requirements. Obtain approval prior to ordering material.
- B. Provide submittals for all items specified under Part 2 - Products of this section.

1.3 DESCRIPTION OF FIXTURES

- A. Fixtures and trim shall be of those manufacturers listed, unless otherwise indicated. Fixtures for this project shall be of same manufacturer.
 - 1. Fixtures: American Standard, Kohler, Mansfield, Sloan, Toto, Watts or Zurn.
 - 2. Faucets: Chicago Faucets, Delta, Moen, Symmons, T&S Brass or Zurn. All faucets shall be lead-free in accordance with NSF 61 and NSF 372.
 - 3. Closet Seats: Bemis, Beneke, Church or Olsonite.
 - 4. Fixture Carriers: Jay R. Smith, Watts, Wade, Josam or Zurn.
 - 5. Sinks: Elkay, Just or Kohler.
 - 6. Water Coolers: Elkay, Halsey Taylor or Haws.
 - 7. Supplies, Stops and Traps: Brasscraft, EBC, McGuire or Sanitary Dash.
- B. Exposed parts of trim shall have polished chrome plated finish.
- C. Tubular drainage products ("P" traps, nipples, etc.) shall be 17 gauge brass.

1.4 QUALITY ASSURANCE

- A. Comply with requirements of the Plumbing Fixture Law of the New York State Department of Environmental Conservation.
- B. Comply with the American Disabilities Act Guidelines and ANSI A117.1 "Accessible and Usable Buildings and Facilities".
- C. All items here-in used to convey water for potable use shall be lead free in accordance with NSF Standard 61, Section 9 Standard for Drinking Water and Lavatory Faucets and

NSF Standard 372 - Maximum Lead Requirements. Compliance shall be via third-party testing and certification.

- D. All fixture trim used to convey water for potable use shall be lead free.

PART 2 - PRODUCTS

2.1 WATER CLOSETS

A. WC-A (HDCP):

1. American Standard #2386.012 Cadet 3 Right Height, floor mounted, vitreous china, siphon action jetted, tank type, elongated bowl, close coupled, 16-1/2 in. high rim, fully glazed 2 in. ball pass trapway, 1.28 GPF fitted with the following:
 - a. Church #380TC extra heavy weight, white elongated solid plastic, open front seat with cover.
 - b. McGuire #166 chrome plated angle supply with 3/8 in. x 12 in. flexible riser, wheel handle stop and wall escutcheon with set screw.
 - c. Cast iron closet flange with stainless steel bolts and wax setting ring.
 - d. Color matching bolt caps.

2.2 LAVATORIES

A. LAV-A (HDCP):

1. American Standard #0355.012 Lucerne, 20 in. x 18 in., wall hung, vitreous china lavatory with 4 in. centers, front overflow, self-draining deck and punching for concealed arm carrier, fitted with following:
 - a. F-C faucet as specified herein.
 - b. McGuire #155WC offset chrome plated P.O. plug with open grid strainer and 1-1/4 in., 17 gauge offset tailpiece.
 - c. McGuire #8902 chrome plated, 17 gauge, 1-1/4 in. x 1-1/2 in. "P" trap with cleanout plug and cast brass escutcheon with set screw.
 - d. McGuire # LF165LKF, lead-free, 3/8 in. chrome plated wall supplies with loose key angle stops, 12 in. long flexible risers, cast brass escutcheon with set screws.
 - e. Jay R. Smith Series 700 concealed arm floor mounted carrier with rectangular uprights.
 - f. Cover exposed waste, stops and supply piping with ADA conforming pipe covers, Truebro, Inc. "Lav-Guard".

- g. Mount at ADA required height and location or as shown on Architectural drawings.

B. LAV-B:

1. American Standard #0497.221, 21-1/2 in. x 17 in. oval, undermount, vitreous china lavatory with front overflow fitted with the following:
 - a. F-L faucet as specified herein.
 - b. McGuire #155-A chrome plated PO plug with open grid strainer and 1-1/4 in., 17 gauge tailpiece.
 - c. McGuire #8902 chrome plated, 17 gauge, 1-1/4 in. x 1-1/2 in. "P" trap with cleanout plug and cast brass escutcheon with set screw.
 - d. McGuire # LF165LKF, lead-free, 3/8 in. chrome plated wall supplies with loose key angle stops. 12 in. long flexible risers, and cast brass escutcheon with set screws.

2.3 SINKS

A. SK-A (HDCP):

1. Elkay Lustertone LRAD2219, 22 in. x 19 in. x 6 in. deep, nickel type 302 stainless steel single bowl sink, ADA compliant, three (3) faucet holes, 18 gauge, self rimming for countertop installation, fitted with the following:
 - a. F-O faucet as specified herein.
 - b. Elkay #LKAD18 stamped brass drain outlet with 3 in. perforated grid strainer and LKADOS 1-1/2 in. O.D. offset tailpiece.
 - c. McGuire #8912 semi-cast brass adjustable "P" trap, 1-1/2 in. x 1-1/2 in., with cleanout plug and cast brass escutcheon with set screw.
 - d. McGuire #LF2167LKF, lead-free, 1/2 in. copper sweat supplies with 1/2 in. OD flexible risers, loose key stops and cast brass escutcheons with set screws.

2.4 FAUCETS

A. F-C:

1. Chicago Faucets Hytronic #116.221.AB.1, dual supply, with user adjustable temperature mixing valve and integral checks, CP solid cast brass electronic sensor faucet, battery operated, deck mounted, 4 in. centers, lead-free, cover plate, vandalproof non-aerating spray outlet, stainless steel braided hose supply, ADA compliant and fitted with the following:

- a. 0.50 GPM aerator.
 - b. Chicago #131-ABNF, lead-free, thermostatic mixing valve, 3/8 in. connections
 - c. 6 volt lithium CRP2 battery.
 - d. ADA compliant, chrome plated.
- B. F-L: Chicago Faucets #420-POABCP lift-on/push off single lever lead-free faucet with pop-up waste, 4 in. centers, 4-5/8 in. spout, 1.5 laminar flow outlet, ceramic volume and temperature control cartridge, ADA compliant.
 - 1. Chicago #131-ABNF, lead-free, thermostatic mixing valve, 3/8 in. connections.
- C. F-O:
 - 1. Chicago #431ABCP, single lever washerless sink faucet, integral 9-1/2 in. cast brass swing spout, temperature limiter , deck mounted, 8 in. centers, lead-free, ADA compliant and fitted with the following:
 - a. 1.5 GPM aerator.
 - b. Chicago #131-ABNF, lead-free thermostatic mixing valve, 3/8 in. connections.
 - c. #369 standard lever handles.
 - d. ADA compliant.

2.5 MOP BASINS

- A. MB-A:
 - 1. Fiat Model MSB, molded stone, 24 in. x 24 in. x 10 in. deep, stainless steel flat strainer, 2 in. outlet with the following:
 - a. T&S Brass #B-0665-BSTP, lead-free, exposed wall mounted faucet with integral stops, rough chrome finish, lever handles, top brace spout with bucket hook, hose end and vacuum breaker.
 - b. Fiat # 832AA Hose and Hose Bracket.
 - c. Fiat #889CC Mop Hanger.
 - d. Fiat # E77AA Vinyl Bumper guard on exposed sides.
 - e. Fiat #MSG 2424 Stainless Steel Wall Guard.
 - f. Provide silicone sealant between wall, floor and mop basin.

PART 3 - EXECUTION

3.1 FIXTURES, EQUIPMENT AND SYSTEMS

- A. Install fixtures, equipment and systems as shown on Drawings or specified herein in accordance with provisions of each applicable Specification Section and all local and state codes having jurisdiction.

3.2 INSTALLATION OF PLUMBING FIXTURES

- A. Install plumbing fixtures level and plumb, in accordance with fixture manufacturers written installation instructions.
- B. Carefully drill holes for through bolts to avoid chipping blocks or plaster.
- C. Except where carriers are specified, attach hangers or brackets to walls as follows:
 - 1. Masonry Construction: Secure fixture hangers to partition by thru-bolts extending through a steel plate on opposite side of partition. Obtain Owner's Representative's approval prior to work.
 - 2. Metal Stud Construction: Anchor backing for fixtures or equipment to 1/8 in. x 12 in. steel plate bolted or riveted to at least three studs. Obtain Owner's Representative's approval prior to work.
- D. Anchor carriers to concrete floor with 1/2 in. x 3 in. anchor or thru-bolts and washers. Provide for drilling of floor and installation of expansion shields. Quantity of anchors:
 - 1. Water Closets - Four (4).
 - 2. Lavatories - Eight (8).
 - 3. Urinals - Eight (8).
- E. Seal fixtures in contact with walls, floors and counters using a sanitary-type, one-part, mildew-resistant, silicone caulk. Match color to fixture color.
- F. Set self-rimming lavatories and sinks in a bed of silicone caulk.
- G. Install floor-mounted, floor-outlet water closets with closet flanges and gasket seals.
- H. Install wall-hanging, back-outlet water closets with support manufacturer's tiling frame or setting gage.
- I. Install wall-hanging, back-outlet urinals with gasket seals.
- J. Fasten wall-hanging plumbing fixtures securely to supports attached to building substrate when supports are specified and to building wall construction where no support is indicated.

- K. Fasten counter-mounting-type plumbing fixtures to casework.
- L. Metering faucets shall be adjusted for minimum ten (10) second run time, but not more than 0.25 gallons per cycle.
- M. Immediately after installation, provide protective covering over fixtures and trim.

3.3 MOUNTING HEIGHT AND LOCATION

- A. Mount fixtures at height and location as indicated on Architectural plans and elevations.
- B. Mount accessible fixtures in conformance with the requirements of ANSI A117.1.

3.4 CONNECTIONS

- A. Install piping connections between plumbing fixtures and piping systems and plumbing equipment specified in other sections of Division 22.

3.5 ADJUSTING AND CLEANING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings and controls.
- B. Adjust water pressure at electric water coolers, faucets and flush valves to provide proper flow and stream.
- C. Replace washers of leaking and dripping faucets and stops.
- D. Clean fixtures, fittings, spout and drain strainers with manufacturers' recommended cleaning methods and materials.
- E. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning fixtures and components and retest. Repeat procedure until all units operate properly.

END OF SECTION

SECTION 224000.10 - SUPPLEMENTAL TO FIXTURE SCHEDULE

PART 1 - GENERAL

1.1 BATHTUBS

A. Type A: (cast iron)

1. American Standard #2265.379.
 - a. As required. 5 ft. - 0 in. long x 30 in. wide x 14 in. high, white enameled cast iron, recessed bathtub with slip resistant bottom and the following trim.
 - b. Concealed pop-up waste with overflow, level handle, brass elbows, tee and 1-1/2 in., 17 gauge brass tubing.
2. Accessories:
 - a. Mixing Valve: Equal to Powers Hydroguard Type #410 pressure balancing valve with check stops, level handle, color insert, stainless steel trim and adjustable temperature limit stop.
 - 1) Make: Powers: #802, Symmons, or approved equal.
 - b. Tub Spout.

1.2 SHOWERS

A. All showers Type "A" unless otherwise noted.

B. Type "A":

1. AKER Model NF6034 60 in. x 34 in. x 74 in. one piece shower cabinet (verify sizes with Architect), white acrylic with fiberglass and polyester resin backing, 2 in., chrome plated cast brass drain and arranged for right or left hand valves as indicated on drawings and fitted with the following:
 - a. Textured one piece floor integral threshold and recessed soap dish.
 - b. Provide 1 in. diameter stainless steel curtain rod with 10 oz. white shower curtain with curtain hooks.
 - c. Power #413 Hydroguard mixing valve pressure type with check stops maximum temperature stop and lever handle and escutcheon plate.
 - d. Powers #141-376 deluxe self-cleaning shower head all brass construction, ball joint, spray adjustment, 2.5 gpm flow control, #141-198 heavy duty arm and die cast flange with locking set screw.

1.3 WASHING MACHINE BOX (WMB)

A. Guy Gray, Model DLWB1 space saver washing machine supply and drain fitting.

1. Provide fire rated box where required.

END OF SECTION

SECTION 227010 - NATURAL GAS SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents.

1.2 SUBMITTALS

- A. Provide manufacturer's data sheets and installation instructions for all equipment and accessories in this section in accordance with Basic Mechanical/Electrical Requirements and Division 01.

1.3 QUALITY ASSURANCE

- A. Follow all requirements, recommendations, and appendices to comply with the following publications, codes, standards, and listings:
 - 1. 2020 Fuel Gas Code of New York State.
 - 2. American Gas Association.
 - 3. Local Utility Company.
- B. Provide equipment and accessories that are listed and labeled by a nationally recognized testing laboratory.

1.4 GAS SERVICE

- A. All new underground gas service piping from the street main to, and including, the gas meter will be installed by Orange & Rockland Utilities
- B. The cost of this work shall be included in this Contractor's bid.

1.5 GAS PRESSURE

- A. The maximum allowable gas pressure inside the building is 1/2 psi.

PART 2 - PRODUCTS

2.1 GAS PIPING

- A. Piping Materials: Refer to Specification Section 221010, "Piping Systems and Accessories".
- B. All exposed exterior and interior piping shall be primed and painted with one coat of alkyl primer and two coats of exterior acrylic latex gloss enamel. Color shall be as selected.

2.2 VALVES

- A. Refer to Specification Section 220523, "Valves".

2.3 GAS PRESSURE REGULATORS

- A. By Plumbing Contractor. Cast iron body, die-cast aluminum alloy diaphragm case, field adjustable, removable orifice, internal relief valve, threaded connections, lockup style. Provide if Utility Company service pressure is more than 11" W.C.
- B. Inlet pressure 14 in. wc, outlet pressure 11 in. wc, 0 to 6812 CFH.
- C. Design Equipment: Sensus.

2.4 Manufacturers: Sensus, Fisher Controls or approved equal. FLEXIBLE CONNECTORS

- A. Stainless steel construction and in accordance with ANSI Z21.24.

2.5 LOCATOR TAPE

- A. Yellow plastic tape, intended for direct-burial service, not less than 6 in. wide x 4 mils thick with #10 AWG coated stranded copper wire tracer. Lettering on the tape shall state, "CAUTION: BURIED GAS LINE BELOW".
- B. Manufacturers: Calpico, Griffolyn, Terra Tape or approved equivalent.

PART 3 - EXECUTION

3.1 ARRANGEMENTS

- A. Make arrangements with Orange & Rockland Utilities to provide the gas service and meter at the indicated location.
- B. Contact the utility company for the cost of the service, its fees and required permits. Pay all costs and include within the base bid.
- C. The service load is 6,812,000 Btuh. The pressure at the meter outlet shall be set at 11 in. wc.
- D. Coordinate all service requirements with the utility company.
- E. The contractor shall arrange for the plumbing inspector to inspect the gas piping and vent installations upon completion including underground and rough-ins, as well as installation of gas-fired appliances.

3.2 GAS DISTRIBUTION SYSTEM

- A. Provide distribution system from gas meter outlet, including meter pad, fence enclosure, mains, risers, branches, drips, shut-offs and other required parts. Connect to equipment or appliances indicated or specified as requiring gas for their operation.

- B. Provide shutoff valve at the meter outlet. Provide all parts and accessories needed to connect to meter.
- C. Furnish sleeve and sealing element for above ground gas piping entry through outside wall. Make entry gas and watertight.

3.3 PIPING INSTALLATION

- A. Install gas piping at a uniform slope of 1/4 in. in 15 ft. to prevent traps. Horizontal lines shall slope upward to risers to the equipment.
- B. Drips and Sediment Traps: Install drips at points where condensate may collect. Locate where readily accessible to permit cleaning and emptying. Do not install where condensate would be subject to freezing.
- C. Make reductions in pipe sizes using eccentric reducer fittings installed with the level side down. Connect branch piping from top or side of horizontal piping.
- D. Install unions in pipes 2 in. and smaller, adjacent to each valve, regulator and at final connection to each piece of equipment. Unions are not required on flanged devices.
- E. Provide pressure regulator in supply to each gas fired appliance as required.
- F. Install valve and strainer on the supply side of each gas pressure regulator.
- G. Install vent piping for gas pressure regulators and gas trains, extend outside building and vent to atmosphere. Terminate vents with turned-down reducing elbow fittings with corrosion-resistant insect screens in large end.
- H. Install containment conduits for buried gas piping within building in gas-tight conduits extending 12 in. minimum outside building and vented to atmosphere. Terminate vents with turned-down, reducing elbow fittings with corrosion-resistant insect screens in large end. Prepare and paint outside of conduits with coal tar epoxy.
- I. Install pressure-relief or pressure-limiting devices so they can be readily operated to determine if valve is free; test to determine pressure at which they will operate; and examine for leakage when in closed position.

3.4 WELDING

- A. Welding shall be performed in compliance with the welding procedure specifications prepared by the National Certified Pipe Welding Bureau. Welded pipe fabricated by certified welder. Contractor shall submit proof of current certification of each welder if requested by the Owner. Use full-length pipe where possible; minimum distance between welds, 18 in. on straight runs. Welds must be at least full thickness of pipe with inside smooth; remove cutting beads, slag and excess material at joints; chamfer ends. Minimum gap 1/8 in., maximum 1/4 in. for butt welds. Overlaps on position and bench welds to be not less than 3/4 in. One internal pass and one external pass minimum required on slip-on flanges. Do not apply heat to rectify distorted pipe due to concentrated welding; replace distorted pipe. Exercise caution to prevent heat related damage to plastic parts within the gas meter or regulators.

- B. Welder qualifications: Welded piping fabricated by certified welder. Welder shall be certified under ASME or API Code III.

3.5 CONNECTIONS

- A. Install gas piping next to gas-utilizing equipment and appliances for servicing and maintenance. Connect gas piping to gas-utilizing equipment and appliances with shutoff valves and unions. Make connections to equipment downstream of valves and unions with flexible connectors. Valves, unions and flexible connectors shall be same size as the gas supply piping to the equipment.
- B. Install a gas valve upstream within 6 ft. of each gas-utilizing appliance. Install a union connection downstream from the valve to permit removal of controls.
- C. Sediment Traps: Install full size tee fittings forming drips, as close as practical to gas appliance inlets. Cap or plug bottom outlet.

3.6 UNDERGROUND PIPING INSTALLATION

- A. All underground piping shall be installed by a utility approved contractor in accordance with the gas company's requirements.
- B. Qualification by the utility company is required for the individual making heat-fusion joints.
- C. The service main shall be installed with a minimum 36 in. cover and shall in all cases conform to be requirements of the pipe manufacturer instructions.
- D. Install piping a minimum 5 ft. - 0 in. from buildings.

3.7 LOCATOR TAPE

- A. Install the locator tape with the gas main, which can be used to help determine the location of the gas piping at a future time. Locate directly over the buried gas line at a depth of 6 in. below finished grade.
- B. Terminate tracer wire in cast iron boxes. Maximum spacing between boxes shall be 500 ft.

3.8 GAS PIPING TESTS

- A. Test natural gas systems according to 2020 Fuel Gas Code of New York State and the local utility requirements unless otherwise noted:
 - 1. Test pressure shall be 1-1/2 times working pressure, but not less than 3 psi for two (2) hours for steel piping.
 - 2. Pressure testing of plastic piping shall be per utility's requirements.
- B. Tests shall be witnessed by utility company. Make arrangements, provide all necessary items to complete testing and pay all costs.

- C. All tests shall be performed prior to the connection of equipment. Regulator shall be isolated from test pressures. Soap test shall be conducted on all joints. Repair leaks and defects with new materials. Retest system until satisfactory results are obtained.
- D. Verify correct pressure settings for pressure regulators.
- E. Provide written certification that tests have been conducted and satisfactorily completed. Submit to Owner's Representative.

3.9 GAS LINE PURGING

- A. At completion of pressure test, purge all natural gas systems according to 2020 Fuel Gas Code of New York State and the utility company requirements.
- B. Provide three (3) days notice to utility company to have the meter unlocked for service and equipment start up. Make all arrangements and pay all fees as required by the Utility Company.

END OF SECTION

SECTION 260500 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide all labor, tools, materials, accessories, parts, transportation, taxes, and related items, essential for installation of the work and necessary to make work, complete, and operational. Provide new equipment and material unless otherwise called for. References to codes, specifications and standards called for in the specification sections and on the drawings mean, the latest edition, amendment and revision of such referenced standard in effect on the date of these contract documents. All materials and equipment shall be installed in accordance with the manufacturer's recommendations.

1.2 LICENSING

- A. The Contractor shall hold a license to perform the work as issued by the authority having jurisdiction.
- B. Plumbing contract work shall be performed by, or under, the direct supervision of a licensed master plumber.
- C. Electrical contract work shall be performed by, or under, the direct supervision of a licensed electrician.

1.3 PERMITS

- A. Apply for and obtain all required permits and inspections, pay all fees and charges including all service charges. Provide certificate of approval from the Authorities Having Jurisdiction prior to request for final payment.
- B. Provide electrical inspection certificate of approval from Middle Department Inspection Agency, Commonwealth Inspection Agency, or an Engineer approved Inspection Agency prior to request for final payment.

1.4 CODE COMPLIANCE

- A. Provide work in compliance with the following:
 - 1. 2020 Building Code of New York State.
 - 2. 2020 Fire Code of New York State.
 - 3. 2020 Plumbing Code of New York State.
 - 4. 2020 Mechanical Code of New York State.
 - 5. 2020 Fuel Gas Code of New York State.
 - 6. 2020 Property Maintenance Code of New York State.
 - 7. 2020 Energy Conservation Code of New York State.

8. Accessible and Usable Buildings and Facilities, ICC A117.1 (2009).
9. New York State Department of Labor Rules and Regulations.
10. New York State Department of Health.
11. 2017 National Electrical Code (NEC).
12. Occupational Safety and Health Administration (OSHA).
13. Local Codes and Ordinances.
14. Life Safety Code, NFPA 101.

1.5 GLOSSARY

ACI	American Concrete Institute
AGA	American Gas Association
AGCA	Associated General Contractors of America, Inc.
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AFBMA	Anti-Friction Bearing Manufacturer's Association
AMCA	Air Moving and Conditioning Association, Inc.
ANSI	American National Standards Institute
ARI	Air Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.
ASME	American Society of Mechanical Engineers
ASPE	American Society of Plumbing Engineers
ASTM	American Society for Testing Materials
AWSC	American Welding Society Code
AWWA	American Water Works Association
FM	Factory Mutual Insurance Company
IBR	Institute of Boiler & Radiation Manufacturers
IEEE	Institute of Electrical and Electronics Engineers
IRI	Industrial Risk Insurers
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association

NYS/DEC	New York State Department of Environmental Conservation
SBI	Steel Boiler Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
UFPO	Underground Facilities Protective Organization
UL	Underwriter's Laboratories, Inc.
OSHA	Occupational Safety and Health Administration
XL - GAP	XL Global Asset Protection Services

1.6 DEFINITIONS

Acceptance	Owner acceptance of the project from Contractor upon certification by Owner's Representative.
As Specified	Materials, equipment including the execution specified/shown in the contract documents.
Basis of Design	Equipment, materials, installation, etc. on which the design is based. (Refer to the article, Equipment Arrangements, and the article, Substitutions.)
Code Requirements	Minimum requirements.
Concealed	Work installed in pipe and duct shafts, chases or recesses, inside walls, above ceilings, in slabs or below grade.
Coordination Drawings	Show the relationship and integration of different construction elements and trades that require careful coordination during fabrication or installation, to fit in the space provided or to function as intended.
Delegated-Design Services	<p>Performance and Design criteria for Contractor provided professional services. Where professional design services or certifications by a design professional are specifically required of a Contractor, by the Contract Documents. Provide products and systems with the specific design criteria indicated.</p> <p>If criteria indicated is insufficient to perform services or certification required, submit a written request for additional information to the Engineer.</p> <p>Submit wet signed and sealed certification by the licensed design professional for each product and system specifically assigned to the Contractor to be designed or certified by a design professional.</p> <p>Examples: structural maintenance ladders, stairs and platforms, pipe anchors, seismic compliant system, wind, structural supports for material equipment, sprinkler hydraulic calculations.</p>
Equal, Equivalent, Equal To, Equivalent To, As Directed and As Required	Shall all be interpreted and should be taken to mean "to the satisfaction of the Engineer".
Exposed	Work not identified as concealed.
Extract	Carefully dismantle and store where directed by Owner's Representative

	and/or reinstall as indicated on drawings or as described in specifications.
Furnish	Purchase and deliver to job site, location as directed by the Owner's Representative.
Inspection	Visual observations by Owner's site Representative.
Install	Store at job site if required, proper placement within building construction including miscellaneous items needed to affect placement as required and protect during construction. Take responsibility to mount, connect, start-up and make fully functional.
Labeled	Refers to classification by a standards agency.
Manufacturers	Refer to the article, Equipment Arrangements, and the article, Substitutions.
Prime Professional	Architect or Engineer having a contract directly with the Owner for professional services.
Product Data	Illustrations, standard schedules, performance charts, instructions, brochures, wiring diagrams, finishes, or other information furnished by the Contractor to illustrate materials or equipment for some portion of the work.
Provide (Furnish and Install)	Contractor shall furnish all labor, materials, equipment and supplies necessary to install and place in operating condition, unless otherwise specifically stated.
Relocate	Disassemble, disconnect, and transport equipment to new locations, then clean, test, and install ready for use.
Remove	Dismantle and take away from premises without added cost to Owner, and dispose of in a legal manner.
Review and Reviewed	Should be taken to mean to be followed by "for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents".
Roughing	Pipe, duct, conduit, equipment layout and installation.
Samples	Physical full scale examples which illustrate materials, finishes, coatings, equipment or workmanship, and establishes standards by which work will be judged.
Satisfactory	As specified in contract documents.
Shop Drawings	Fabrication drawings, diagrams, schedules and other instruments, specifically prepared for the work by the Contractor or a Sub-contractor, manufacturer, supplier or distributor to illustrate some portion of the work.
Site Representative	Owner's Inspector or "Clerk of Works" at the work site.
Submittals Defined (Technical)	<p>Any item required to be delivered to the Engineer for review as requirement of the Contract Documents.</p> <p>The purpose of technical submittals is to demonstrate for those portions of the work for which a submittal is required, the manner in which the Contractor proposes to conform to the information given and design concepts expressed and required by the Contract Documents.</p>

1.7 SHOP DRAWINGS/PRODUCT DATA/SAMPLES

- A. Provide submittals on all items of equipment and materials to be furnished and installed. Submittals shall be accompanied by a transmittal letter, stating name of project and contractor, name of vendor supplying equipment, number of drawings, titles, specification sections (name and number) and other pertinent data called for in individual sections. Submittals shall have individual cover sheets that shall be dated and contain: Name of project; name of prime professional; name of prime contractor; description or names of equipment, materials and items; and complete identification of locations at which materials or equipment are to be installed. Individual piecemeal or incomplete submittals will not be accepted. Similar items, (all types specified) shall be submitted at under one cover sheet per specification section (e.g. valves, plumbing fixtures, etc.). Number each submittal by trade. Indicate deviations from contract requirements on Letter of Transmittal. Submittals will be given a general review only. Corrections or comments made on the Submittals during the review do not relieve Contractor from compliance with requirements of the drawings and specifications. The Contractor is responsible for: confirming and correcting all quantities; checking electrical characteristics and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades; and performing his work in a safe and satisfactory manner. If submitting hard copies, submit four (4) copies for review.
- B. If submittals are to be submitted electronically, all requirements in Item A apply. Submittals shall be emailed in PDF format to specific email address provided by the Construction Manager, General Contractor, Architect or Project Manager. Name of project shall be in subject line of email. Send emails to mealbasubmittalclerk@meengineering.com.
- C. Refer to Division 01 for additional requirements.

1.8 PROTECTION OF PERSONS AND PROPERTY

- A. Contractor shall assume responsibility for construction safety at all times and provide, as part of contract, all trench or building shoring, scaffolding, shielding, dust/fume protection, mechanical/electrical protection, special grounding, safety railings, barriers, and other safety feature required to provide safe conditions for all workmen and site visitors.

1.9 EQUIPMENT ARRANGEMENTS

- A. The contract documents are prepared using one manufacturer as the Basis of Design, even though other manufacturers' names are listed. If Contractor elects to use one of the listed manufacturers other than Basis of Design, submit detailed drawings, indicating proposed installation of equipment. Show maintenance clearances, service removal space required, and other pertinent revisions to the design arrangement. Make required changes in the work of other trades, at no increase in any contract. Provide larger motors, feeders, breakers, and equipment, additional control devices, valves, fittings and other miscellaneous equipment required for proper operation, and assume responsibility for proper location of roughing and connections by other trades. Remove and replace doorframes, access doors, walls, ceilings, or floors required to install other than Basis of

Design. If revised arrangement submittal is rejected, revise and resubmit specified Basis of Design item which conforms to Contract Documents.

1.10 SUBSTITUTIONS

- A. If Contractor desires to bid on any other kind, type, brand, or manufacture of material or equipment than those named in specifications, secure prior approval. To request such approval, Contractor shall submit complete information comparing (item-for-item) material or equipment offered with design material or equipment. Include sufficient information to permit quick and thorough comparison, and include performance curves on same basis, capacities, power requirements, controls, materials, metal gauges, finishes, dimensions, weights, etc., of major parts. If accepted, an addendum will be issued to this effect ahead of bid date. Unless such addendum is issued, substitution offered may not be used.

1.11 UTILITY COMPANY SERVICES

- A. Division 26 shall make arrangements with National Grid for electric service to the Owner's distribution equipment. Provide underground or overhead electric service as called for and transformers, meter sockets or meter compartments as required by the Utility Company. Coordinate all activities between the Owner and Utility Company. The installation of the electric service shall comply with the published Utility Company standards
- B. Division 22 shall make arrangements with National Grid for gas service to the Owner's distribution system. Provide service to the building as required by the Utility Company. Coordinate all activities between the Owner and Utility Company. The installation of the gas service shall comply with the published Utility Company standards

1.12 ROUGHING

- A. The Contract Drawings have been prepared in order to convey design intent and are diagrammatic only. Drawings shall not be interpreted to be fully coordinated for construction.
- B. Due to small scale of Drawings, it is not possible to indicate all offsets, fittings, changes in elevation, interferences, etc. Make necessary changes in contract work, equipment locations, etc., as part of a contract to accommodate work to avoid obstacles and interferences encountered. Before installing, verify exact location and elevations at work site. DO NOT SCALE plans. If field conditions, details, changes in equipment or shop drawing information require an important rearrangement, report same to Owner's Representative for review. Obtain written approval for all major changes before installing.
- C. Install work so that items both existing and new are operable and serviceable. Eliminate interference with removal of coils, motors, filters, belt guards and/or operation of doors. Provide easy, safe, and code mandated clearances at controllers, motor starters, valve access, and other equipment requiring maintenance and operation. Provide new materials, including new piping and insulation for relocated work.

- D. Coordinate work with other trades and determine exact route or location of each duct, pipe, conduit, etc., before fabrication and installation. Coordinate with Architectural Drawings. Obtain from Owner's Representative exact location of all equipment in finished areas, such as thermostat, fixture, and switch mounting heights, and equipment mounting heights. Coordinate all work with the architectural reflected ceiling plans and/or existing Architecture. Mechanical and electrical drawings show design arrangement only for diffusers, grilles, registers, air terminals, lighting fixtures, sprinklers, speakers, and other items. Do not rough-in contract work without reflected ceiling location plans.
- E. Before roughing for equipment furnished by Owner or in other Divisions, obtain from Owner and other Divisions, approved roughing drawings giving exact location for each piece of equipment. Do not "rough in" services without final layout drawings approved for construction. Cooperate with other trades to insure proper location and size of connections to insure proper functioning of all systems and equipment. For equipment and connections provided in this contract, prepare roughing drawing as follows:
 - 1. Existing Equipment: Measure the existing equipment and prepare for installation in new location.
 - 2. New Equipment: Obtain equipment roughing drawings and dimensions, then prepare roughing-in-drawings. If such information is not available in time, obtain an acknowledgement in writing, then make space arrangements as required with Owner's Representative.

1.13 COORDINATION DRAWINGS

- A. Before construction work commences, Divisions for all trades shall submit coordination drawings in the form of CAD drawing files, drawn at not less than 1/4 in. scale. Such drawings will be required throughout all areas, for all Contracts. These drawings shall show resolutions of trade conflicts in congested areas. Mechanical Equipment Rooms shall be drawn early in coordination drawing process simultaneous with all other congested areas. Prepare Coordination Drawings as follows:
 - 1. Division 23 shall prepare the base plan CAD coordination drawings showing all ductwork, all pertinent heating piping, and equipment. These drawings may be CAD files of the required Ductwork Shop Drawings. The drawings shall be coordinated with lighting fixtures, sprinklers, air diffusers, other ceiling mounted items, ceiling heights, structural work, maintenance clearances, electric code clearance, reflected ceiling plans, and other contract requirements. Reposition proposed locations of work after coordination drawing review by the Owner's Representative. Provide adjustments to exact size, location, and offsets of ducts, pipes, conduit, etc., to achieve reasonable appearance objectives. Provide these adjustments as part of contract. Minor revisions need not be redrawn.
 - 2. Division 23 shall provide CAD files and submit the base plan CAD Coordination Drawings to all Divisions.
 - 3. Divisions 21 and 22 shall draw the location of piping and equipment on the base plan CAD Coordination Drawings, indicating areas of conflict and suggested resolutions.

4. Divisions 26, 27 and 28 shall draw the location of lighting fixtures, cable trays, and feeders over 1-1/2 in. on the base plan CAD Coordination Drawings, indicating areas of conflict and suggested resolution.
 5. The General Construction Trade shall indicate areas of architectural/structural conflicts or obstacles on the CAD Coordination Drawings, and coordinate to suit the overall construction schedule.
 6. The General Construction Trade shall expedite all Coordination Drawing work and coordinate to suit the overall construction schedule. In the case of unresolved interferences, he shall notify the Owner's Representative. The Owner's Representative will then direct the various trades as to how to revise their drawings as required to eliminate installation interferences.
 7. If a given trade proceeds prior to resolving conflicts, then if necessary, that trade shall change its work at no extra cost in order to permit others to proceed with a coordinated installation. Coordination approval will be given by areas after special site meetings involving all Divisions.
- B. The purpose of the coordination drawing process is to identify and resolve potential conflicts between trades, and between trades and existing or new building construction, before they occur in construction. Coordination drawings are intended for the respective trade's use during construction and shall not replace any Shop Drawings, or record drawings required elsewhere in these contract documents.

1.14 EQUIPMENT AND MATERIAL REQUIREMENTS

- A. Provide materials that meet the following minimum requirements:
1. Materials shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less, in accordance with NFPA 255.
 2. All equipment and material for which there is a listing service shall bear a UL label.
 3. Potable water systems and equipment shall be built according to AWWA Standards.
 4. Gas-fired equipment and system shall meet AGA Regulations and shall have AGA label.
 5. Fire protection equipment shall be UL listed and FM approved.
- B. Exterior and wet locations shall utilize materials, equipment supports, mounting, etc. suitable for the intended locations. Metals shall be stainless steel, galvanized or with baked enamel finish as a minimum. Finishes and coatings shall be continuous and any surface damaged or cut ends shall be field corrected in accordance with the manufacturer's recommendations. Hardware (screws, bolts, nuts, washers, supports, fasteners, etc.) shall be:

1. Stainless steel where the associated system or equipment material is stainless steel or aluminum.
2. Hot dipped galvanized or stainless steel where the associated system or equipment is steel, galvanized steel or other.

1.15 CUTTING AND PATCHING

- A. Each trade shall include their required cutting and patching work unless shown as part of the General Construction Contract. Refer to General Conditions of the Contract for Construction, for additional requirements. Cut and drill from both sides of walls and/or floors to eliminate splaying. Patch cut or abandoned holes left by removals of equipment or fixtures. Patch adjacent existing work disturbed by installation of new work including insulation, walls and wall covering, ceiling and floor covering, other finished surfaces. Patch openings and damaged areas equal to existing surface finish. Cut openings in prefabricated construction units in accordance with manufacturer's instructions.

1.16 PAINTING

- A. Paint all insulated and bare piping, pipe hangers and supports exposed to view in mechanical equipment rooms, penthouse, boiler rooms and similar spaces. Paint all bare piping, ductwork and supports exposed to the out-of-doors with rust inhibiting coatings. Paint all equipment that is not factory finish painted (i.e. expansion tanks, etc.).
- B. All painting shall consist of one (1) prime coat and two (2) finish coats of non-lead oil base paint, unless otherwise indicated herein. Provide galvanized iron primer for all galvanized surfaces. All surfaces must be thoroughly cleaned before painting. Review system color coding prior to painting with the Owner's Representative or Architect.
- C. All items installed after finished painting is completed and any damaged factory finish paint on equipment furnished under this contract must be touched up by the Contractor responsible for same.
- D. Include painting for patchwork with color to match adjacent surfaces. Where color cannot be adequately matched, paint entire surface. Provide one (1) coat of primer and two (2) finish coats or as called for in the Specifications.
- E. All primers and paint used in the interior of the building shall comply with the maximum Volatile Organic Compound (VOC) limits called for in the current version of U.S. Green Building Council LEED Credits EQ 4.1 and EQ 4.2.
- F. Refer to Division 9 - Finishes, for additional information.

1.17 CONCEALMENT

- A. Conceal all contract work above ceilings and in walls, below slabs, and elsewhere throughout building. If concealment is impossible or impractical, notify Owner's Representative before starting that part of the work and install only after his review. In areas with no ceilings, install only after Owner's Representative reviews and comments on arrangement and appearance.

1.18 CHASES

A. New Construction:

1. Certain chases, recesses, openings, shafts, and wall pockets will be provided as part of General Construction Trade. Mechanical and Electrical trades shall provide all other openings required for their contract work.
2. Check Architectural and Structural Design and Shop Drawings to verify correct size and location for all openings, recesses and chases in general building construction work.
3. Assume responsibility for correct and final location and size of such openings.
4. Rectify improperly sized, improperly located or omitted chases or openings due to faulty or late information or failure to check final location.
5. Provide 18 gauge galvanized sleeves and inserts. Extend all sleeves 2 in. above finished floor. Set sleeves and inserts in place ahead of new construction, securely fastened during concrete pouring. Correct, by drilling, omitted or improperly located sleeves. Assume responsibility for all work and equipment damaged during course of drilling. Firestop all unused sleeves.
6. Provide angle iron frame where openings are required for contract work, unless provided by General Construction trade.

1.19 PENETRATION FIRESTOPPING

A. Fire-Stopping for Openings Through Fire and Smoke Rated Wall and Floor Assemblies:

1. Provide materials and products listed or classified by an approved independent testing laboratory for "Penetration Fire-Stop Systems". The system shall meet the requirements of "Fire Tests of Penetrations Fire-Stops" designated ASTM E814.
2. Provide fire-stop system seals at all locations where piping, tubing, conduit, electrical busways/cables/wires, ductwork and similar utilities pass through or penetrate fire rated wall or floor assembly. Provide fire-stop seal between sleeve and wall for drywall construction.
3. The minimum required fire resistance ratings of the wall or floor assembly shall be maintained by the fire-stop system. The installation shall provide an air and watertight seal.
4. The methods used shall incorporate qualities which permit the easy removal or addition of electrical conduits or cables without drilling or use of special tools. The product shall adhere to itself to allow repairs to be made with the same material and permit the vibration, expansion, and/or contraction of any items passing through the penetration without cracking, crumbling and resulting reduction in fire rating.

5. Plastic pipe/conduit materials shall be installed utilizing intumescent collars.
 6. Provide a submittal including products intended for use, manufacturer's installation instructions, and the UL details for all applicable types of wall and floor penetrations.
 7. Fire-stopping products shall not be used for sealing of penetrations of non-rated walls or floors.
- B. Acceptable Manufacturers:
1. Dow Corning Fire-Stop System Foams and Sealants.
 2. Nelson Electric Fire-Stop System Putty, CLK and WRP.
 3. S-100 FS500/600, Thomas & Betts.
 4. Carborundum Fyre Putty.
 5. 3-M Fire Products.
 6. Hilti Corporation.

1.20 NON-RATED WALL PENETRATIONS

- A. Each trade shall be responsible for sealing wall penetrations related to their installed work, including but not limited to ductwork, piping, conduits, etc. See individual specification sections for requirements.

1.21 SUPPORTS

- A. Provide required supports, beams, angles, hangers, rods, bases, braces, and other items to properly support contract work. Modify studs, add studs, add framing, or otherwise reinforce studs in metal stud walls and partitions as required to suit contract work. If necessary, in stud walls, provide special supports from floor to structure above.
- B. For precast panels/planks and metal decks, support mechanical/electrical work as determined by manufacturer and the Engineer. Provide heavy gauge steel mounting plates for mounting contract work. Mounting plates shall span two or more studs. Size, gauge, and strength of mounting plates shall be sufficient for equipment size, weight, and desired rigidity.
- C. For finished areas without a finished ceiling system such as classrooms, offices, conference rooms, etc., where decking and structure is exposed, and ductwork/piping/conduit is exposed: All mounting brackets, channel support systems and mounting hardware for ductwork, piping, lighting, etc. shall be concealed and approved by the Architect/Engineer prior to the installation. AirCraft cable style hanging for ductwork is required. It is recommended that room mockups be done and receive Architect/Engineer approval prior to proceeding with installation.

- D. Equipment, piping, conduit, raceway, etc. supports shall be installed to minimize the generation and transmission of vibration.
- E. Materials and equipment shall be solely supported by the building structure and connected framing. Gypboard, ceilings, other finishes, etc. shall not be used for support of materials and equipment.

1.22 ACCESS PANELS

- A. Provide access panels for required access to respective trade's work. Location and size shall be the responsibility of each trade. Access panels provided for equipment shall provide an opening not smaller than 22 in. by 22 in. Panels shall be capable of opening a minimum of 90 degrees. Bear cost of construction changes necessary due to improper information or failure to provide proper information in ample time. Access panels over 324 square inches shall have two cam locks. Provide proper frame and door type for various wall or ceiling finishes. Access panels shall be equal to "Milcor" as manufactured by Inland Steel Products Co., Milwaukee, Wisconsin. Provide General Construction trade with a set of architectural plans with size and locations of access panels.

1.23 CONCRETE BASES

- A. Provide concrete bases for all floor mounted equipment. Provide 3,000 lb. concrete, chamfer edges, trowel finish, and securely bond to floor by roughening slab and coating with cement grout. Bases 4 in. high (unless otherwise indicated); shape and size to accommodate equipment. Provide anchor bolts in equipment bases for all equipment provided for the project, whether mounted on new concrete bases or existing concrete bases.

1.24 HVAC EQUIPMENT CONNECTIONS

- A. Contractor is responsible for draining, filling, venting, chemically treating and restarting any systems which are affected by work shown on the Contract Documents unless specifically noted otherwise.
- B. Provide final connections to all equipment as required by the equipment. Provide final connections, including domestic water piping, wiring, controls, and devices from equipment to outlets left by other trades. Provide equipment waste, drip, overflow and drain connections extended to floor drains.
- C. Provide for Owner furnished and Contractor furnished equipment all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, insulation, sheet metal work, controls, dampers, as required.

1.25 PLUMBING EQUIPMENT CONNECTIONS

- A. Contractor is responsible for draining, filling, venting, chemically treating and restarting any systems which are affected by work shown on the Contract Documents unless specifically noted otherwise.

- B. Provide roughing and final connections to all equipment. Provide loose key stops, sanitary "P" traps, tailpiece, adapters, gas or air cocks, and all necessary piping and fittings from roughing point to equipment. Provide installation of sinks, faucets, traps, tailpiece furnished by others. Provide cold water line with gate valve and backflow prevention device at locations called for. Provide continuation of piping and connection to equipment that is furnished by others. Provide relief valve discharge piping from equipment relief valves.
- C. Provide valved water outlet adjacent to equipment requiring same. Provide equipment type floor drains, or drain hubs, adjacent to equipment.
- D. Install controls and devices furnished by others.
- E. Refer to Contract Documents for roughing schedules, and equipment and lists indicating scope of connections required.
- F. Provide for Owner furnished and Contractor furnished equipment all valves, piping, piping accessories, traps, pressure reducing valves, gauges, relief valves, vents, drains, as required.

1.26 ELECTRICAL EQUIPMENT CONNECTIONS

- A. Provide complete power connections to all electrical equipment. Provide control connections to equipment. Heavy duty NEC rated disconnect ahead of each piece of equipment. Ground all equipment in accordance with NEC.
- B. Provide for Owner furnished and Contractor furnished equipment all power wiring, electric equipment, control wiring, switches, lights, receptacles, and connections as required.

1.27 STORAGE AND PROTECTION OF MATERIALS AND EQUIPMENT

- A. Store Materials on dry base, at least 6 in. aboveground or floor. Store so as not to interfere with other work or obstruct access to buildings or facilities. Provide waterproof/windproof covering. Remove and provide special storage for items subject to moisture damage. Protect against theft or damage from any cause. Replace items stolen or damaged, at no cost to Owner.
- B. Refer to Division 01 for additional information.

1.28 FREEZING AND WATER DAMAGE

- A. Take all necessary precautions with equipment, systems and building to prevent damage due to freezing and/or water damage. Repair or replace, at no change in contract, any such damage to equipment, systems, and building. Perform first seasons winterizing in presence of Owner's operating staff.

1.29 OWNER INSTRUCTIONS

- A. Before final acceptance of the work, furnish necessary skilled labor to operate all systems by seasons. Instruct designated person on proper operation, and care of

systems/equipment. Repeat instructions, if necessary. Obtain written acknowledgement from person instructed prior to final payment. Contractor is fully responsible for system until final acceptance, even though operated by Owner's personnel, unless otherwise agreed in writing. List under clear plastic, operating, maintenance, and starting precautions procedures to be followed by Owner for operating systems and equipment.

1.30 OPERATION AND MAINTENANCE MANUALS

- A. Submit by email (preferred) or digital media, thru the normal project submittal process. Include a copy of each final approved Shop Drawing, wiring diagrams, piping diagrams, spare parts lists, final testing and balancing report, as-built drawings and manufacturer's instructions. Include typewritten instructions, describing equipment, starting/operating procedures, emergency operating instructions, summer-winter changeover, freeze protection, precautions and recommended maintenance procedures. Include name, address, and telephone number of installing contractor and of supplier manufacturer Representative and service agency for all major equipment items. Provide a table of contents page and dividers based upon specification section numbers. Submit in a compiled and bookmarked PDF format as outlined below.
- B. Provide content for Operation and Maintenance Manuals as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Engineer and Commissioning Agent will comment on whether content of operation and maintenance submittals is acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- C. Submit Operation and Maintenance Manuals in the following format:
 - 1. Submit by uploading to web-based project software site, or by email to Architect, as a formal project submittal in conformance with the project specific submittal procedures. Enable reviewer comments on draft submittals.
 - 2. 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.
 - 3. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in the 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 on opening file.
- D. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing Owner training. Engineer and Commissioning Agent will comment on whether general scope and content of manual are acceptable.

- E. Final Manual Submittal: Submit O&M manual in final form prior to requesting inspection for Substantial Completion and at least 2 weeks before commencing Owner training. Engineer and Commissioning Agent will return copy with review comments.
 - 1. Correct or revise O&M manual to comply with Engineer's and Commissioning Agent's comments. Submit copies of each corrected manual within 2 weeks of receipt of Engineer's and Commissioning Agent's comments.
- F. Refer to Division 01 for additional requirements.

1.31 RECORD DRAWINGS

- A. The Contractor shall obtain at his expense one (1) set of construction Contract Drawings, (including non-reproduction black and white prints or electronic files) for the purpose of recording as-built conditions.
- B. The Contractor shall perform all survey work required for the location and construction of the work and to record information necessary for completion of the record drawings. Record drawings shall show the actual location of the constructed facilities in the same manner as was shown on the bid drawings. All elevations and dimensions shown on the drawings shall be verified or corrected so as to provide a complete and accurate record of the facilities as constructed.
- C. It shall be the responsibility of the Contractor to mark EACH sheet of the contract documents in red and to record thereon in a legible manner, any and all approved field changes and conditions as they occur. A complete file of approved field sketches, diagrams, and other changes shall also be maintained. At completion of the work, the complete set of red marked contract documents, plus all approved field sketches and diagrams shall be submitted to the engineer and used in preparation of the record drawings.
- D. A complete set of red marked contract drawings shall be submitted, at one time, as the "Record" set. If there are no changes to a specific drawing, the contractor shall indicate "NO CHANGES" on that drawing. ALL drawings shall be included in the "Record" set.
- E. The complete set of red marked Contract Documents or electronic files shall be certified by the Contractor as reflecting record conditions and submitted to the engineer for review.
- F. The Contractor shall have the marked up set scanned, if they are not already electronic files, and then submit them to the Engineer as the "Record Set".
- G. Refer to Division 01 for additional requirements.

1.32 FINAL INSPECTION

- A. Upon completion of all Engineering Site Observation list items, the Contractor shall provide a copy of the Engineering Site Observation Report back to the Engineer with each item noted as completed or the current status of the item. Upon receipt, the Engineer will schedule a final review.

1.33 COMMISSIONING

- A. Refer to General Commissioning Requirements in Division 01 for additional requirements.

1.34 TEMPORARY HEATING AND COOLING

- A. Refer to the General Conditions of the Contract for Construction and Supplemental General Conditions.

1.35 MAINTENANCE OF HVAC SYSTEMS DURING TEMPORARY USE PERIODS

- A. Provide each air handling system with a set of prefilters in addition to the permanent filters. Furnish four sets of prefilters for each system for use when system is operated for temporary heating or cooling. During such use, change prefilters as often as directed by Owner's Representative. Provide MERV-8 filters in all open ended ducts, return grilles and registers to keep dust out of ductwork. Change as often as necessary. Remove all such temporary filters upon completion. Use supply fans only. Do not operate return fans.
- B. Blank-off outside air intake opening during temporary heating period. Install first set of permanent filters and prefilters.
- C. Adjust dampers on supply system.
- D. Set all heating coil control valves for manual operation.
- E. Do not install any grilles or diffusers at room terminal ends of ducts until permission is given.
- F. Assume responsibility for systems and equipment at all times, even though used for temporary heat or ventilating. Repair or replace all dented, scratched or damaged parts of systems prior to final acceptance.
- G. Remove concrete, rust, paint spots, other blemishes, then clean.
- H. Just prior to final acceptance, remove used final filter and install new set. Deliver all unused sets of prefilters to the Owner and obtain written receipt. Properly lubricate system bearings before and during temporary use. Maintain thermostats, freeze stats, overload devices, and all other safety controls in operating condition.

1.36 TEMPORARY FACILITIES

- A. Refer to the Division 1 Sections, General Conditions and Supplemental General Conditions.

1.37 TEMPORARY LIGHT AND POWER

- A. Refer to the Division 1 Sections, General Conditions and Supplemental General Conditions.

1.38 CLEANING

- A. It is the Contractor's responsibility to keep clean all equipment and fixtures provided under this contract for the duration of the project. Each trade shall keep the premises free from an accumulation of waste material or rubbish caused by his operations. The facilities require an environment of extreme cleanliness, and it is the Contractor's responsibility to adhere to the strict regulations regarding procedures on the existing premises. After all tests are made and installations completed satisfactorily:
1. Thoroughly clean entire installation, both exposed surfaces and interiors.
 2. Remove all debris caused by work.
 3. Remove tools, surplus, materials, when work is finally accepted.

1.39 SYSTEM START-UP AND TESTING

- A. Prior to commencement of work, the Division(s) effecting such system shall survey all building mechanical, plumbing, fire protection and electrical systems and components and make written notice to the Owner's Representative regarding any damage, missing items and/or incomplete systems. Prior to the conclusion of this project, the Contractor shall verify with the Owner's Representative that all building systems have been returned to their original conditions.

1.40 TRANSFER OF ELECTRONIC FILES

- A. M/E Engineering, P.C. will provide electronic files for the Contractor's use in the preparation of sheetmetal shop drawings, coordination drawings, or record drawings related to the project, subject to a and the following terms and conditions:
1. The Contractor shall submit a formal request for electronic drawing files on the M/E Engineering, P.C. website, by utilizing the following website link:
<http://www.meengineering.com/contact-pages/contractor-request>.
 2. M/E Engineering, P.C. makes no representation as to the compatibility of these files with the Contractor's hardware or the Contractor's software beyond the specific release of the referenced specifications.
 3. M/E Engineering, P.C. can only provide CAD files of M/E/P/FP drawing levels for which we are the Engineer of Record. CAD files of Architectural backgrounds, reflected ceiling plans, structural plans, etc. must be obtained separately from the Architect of Record.
 4. Data contained on these electronic files is part of M/E Engineering, P.C.'s instruments of service shall not be used by the Contractor or anyone else receiving data through or from the Contractor for any purpose other than as convenience in the preparation of shop drawings for the referenced project. Any other use or reuse by the Contractor or by others will be at the Contractor's sole risk and without liability or legal exposure to M/E Engineering, P.C. The Contractor agrees to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against M/E

Engineering, P.C., its officers, directors, employees, agents or sub-consultants which may arise out of or in connection with the Contractor's use of the electronic files.

5. Furthermore, the Contractor shall, to the fullest extent permitted by law, indemnify and hold harmless, M/E Engineering, P.C. from all claims, damages, losses and expenses, including attorney's fees arising out of or resulting from the Contractor's use of these electronic files.
6. These electronic files are not contract documents. Significant difference may arise between these electronic files and corresponding hard copy contract documents due to addenda, change orders or other revisions. M/E Engineering, P.C. makes no representation regarding the accuracy or completeness of the electronic files the Contractor receives. In the event that a conflict arises between the signed contract documents prepared by M/E Engineering, P.C. and electronic files, the signed contract documents shall govern. The Contractor is responsible for determining if any conflicts exist. By the Contractor's use of these electronic files the Contractor is not relieved of the Contractor's duty to comply with the contract documents, including and without limitation, the need to check, confirm and coordinate all dimensions and details, take field measurements, field verify conditions and coordinate the Contractor's work with that of other contractors for the project.

1.41 ENERGY INCENTIVES

- A. The Contractor, his Subcontractors and Suppliers shall provide to the Owner all paperwork necessary to support the Owners pursuit of incentives related to energy conservation as offered by the utility company or state sponsored incentive programs. This shall include at a minimum, receipts, and quantities and data sheets for energy efficient equipment such as: lighting, motors, variable frequency drives, etc.

END OF SECTION

SECTION 260501 - BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The drawings are diagrammatic, unless detailed dimensioned drawings are included, and show only approximate locations of equipment, fixtures, panelboards, conduits, and wiring devices. Exact locations are subject to the approval of the Owner's Representative. The general run of electrical feeders, branch circuits, and conduits, indicated on the drawings, is not intended to be the exact routing. Exact routings of conduit shall suit the job conditions.
- B. Circuit designations, in the form of "Home Runs" on branches, indicate the designation of the branch circuit, the size and the quantity of branch circuit conductors, and the panel board or interconnection box from which the branch circuit is served.
- C. Make measurements at the site and in the building during construction for all systems installed as the work progresses in such a manner that the equipment, piping, vents, ducts, conduit, and boxes will fit in the space available. Maintain headroom and if in unfinished areas, be as neatly installed, as obscure and "out-of-the-way" as physically possible. Where more than one trade is involved in an area, space or chase, all shall cooperate and install their own work to utilize the space equally between them in proportion to their individual requirements. In general, ductwork shall be given preference except where grading of piping becomes a problem, followed by piping then electrical wiring. If, after installation of any equipment, piping, ducts, conduit, and boxes, it is determined that ample maintenance and passage space has not been provided, rearrange work and /or furnish other equipment as required for ample maintenance space.
- D. Any changes in the size or location of the material or equipment supplied, which may be necessary in order to meet field conditions or in order to avoid conflicts between trades, shall be brought to the immediate attention of the Owner's Representative and approval received before such alterations are made.

1.2 QUALITY ASSURANCE

- A. Electric equipment shall be installed in a neat and workmanlike manner. All methods of construction, details of workmanship, that are not specifically described or indicated in the contract documents, shall be subject to the control and approval of the Owner's Representative.
- B. Equipment and materials shall be of the quality and manufacture indicated in their respective sections of the specifications. The equipment specified is based upon the acceptable manufacturers listed. Equipment types, device ratings, dimensions, etc., correspond to the nomenclature dictated by those manufacturers. Where "or equal" is stated, equipment shall be equal in every way to that of the equipment specified and subject to approval. All equipment shall be tested at the factory. Unless specified elsewhere, standard factory inspection and operational tests will be acceptable.

1.3 SUBMITTALS

- A. Submit product data for the following equipment, materials and products, including all fittings and accessories:

1. Conduit
2. Surface Metal Raceway
3. Expansion Fittings
4. Wireway and Wire Trough
5. Channel Support Systems
6. Conductors
7. Poke-Through Service Fittings
8. Terminal and Equipment Cabinets
9. Flush Floor Boxes
10. Wiring Devices Including Dimmers
11. Telephone/Data Communication Outlets
12. Television Outlets
13. Occupancy/Vacancy Sensors
14. Lighting Control Contactors
15. Boiler Shutdown Switches
16. Underground Pullboxes (Handholes) and Covers
17. Manholes and Covers
18. Water Proofing Seals
19. Flashing, Sealing, Firestopping Materials
20. Testing reports prior to energizing equipment and materials.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Conduit, Raceway and Tubing:

1. Rigid Metal Conduit shall be hot-dipped galvanized or electro-galvanized steel, UL listed "rigid metal conduit."
 - a. Acceptable Manufacturers:
 - 1) Republic Conduit
 - 2) Allied Tube and Conduit
 - 3) Wheatland Tube Company
 - 4) Approved equal
2. Electrical Metallic Tubing shall be electro-galvanized steel; UL listed "electrical metallic tubing."
 - a. Acceptable Manufacturers:
 - 1) Republic Conduit
 - 2) Allied Tube and Conduit
 - 3) Wheatland Tube Company
 - 4) Approved equal

3. Flexible Metal Conduit shall be constructed one continuous length of electro-galvanized, spirally wound steel strip with interlocking convolutions and interior surfaces free from burrs and sharp edges. Shall be UL listed "flexible metal conduit" or "liquidtight flexible metal conduit" as required.
 - a. Acceptable Manufacturers:
 - 1) Republic Conduit
 - 2) Allied Tube and Conduit
 - 3) Wheatland Tube Company
 - 4) American Flexible Conduit Company
4. Rigid Non-Metallic Conduit (Schedule 40 for concrete encasement, Schedule 80 for direct burial or where exposed) shall be UL listed "rigid non-metallic conduit" for application in underground, encased, and exposed applications in accordance with Article 352 of the National Electrical Code. The conduit shall be made from polyvinyl chloride (PVC) and shall be rated for 90°C conductors. Conduit and fittings shall be tested in accordance with the testing requirements defined in NEMA TC-2, NEMA TC-3, UL-651 and UL-514.
 - a. Acceptable Manufacturers:
 - 1) Carlon
 - 2) Heritage Plastics
 - 3) PW Eagle
5. Surface Metal Raceway shall be .040 in. steel UL listed "Surface Metal Raceway". Use manufacturer's standard fittings designed to be used with the specific raceway.
 - a. One-Piece Raceway:
 - 1) Buff or ivory finish.
 - 2) Acceptable Manufacturers:
 - a) Wiremold "700" Series (Design Make)
 - b) Mono Systems
 - c) Approved equal
 - b. Two-Piece Raceways:
 - 1) Ivory finish.
 - 2) Duplex or special receptacles as specified in wiring devices.
 - 3) Corners, turns, tees and elbows shall have suitable turning radius for the intended cable.

- 4) Provide divider in raceways utilized for power and communications. Utilize wire clips 18 in. on center to hold in the conductors/cables.
- 5) Utilize rounded head screws for mounting.
- 6) Acceptable Manufacturers:
 - a) Wiremold 6000 (Design Make)
 - b) Mono Systems
 - c) Approved equal

B. Conduit Fittings:

1. Fittings for rigid metal conduit shall be fully threaded and shall be of the same material as the respective raceway system. Fittings for electrical metallic tubing shall be single screw indenter fittings for conduits up to 2 in. and double screw indenter fittings for conduits 2 in. and larger. Connectors shall also have insulated throat up to and including 1 in. size. For sizes 1-1/4 in. and larger, provide plastic insulating bushing. Die-cast, pressure cast fittings shall not be used. Fittings for rigid non-metallic conduit shall be solvent cemented in accordance with the manufacturer's instructions.
 - a. Acceptable Manufacturers:
 - 1) O.Z. Gedney
 - 2) Steel City
 - 3) Thomas & Betts
 - 4) Crouse-Hinds
 - 5) Carlon
2. Expansion Fittings shall be watertight, combination expansion and deflection type designed to compensate for movement in any direction. Fittings shall have flexible copper braid bonding jumpers, neoprene sleeve and stainless steel bands, use aluminum body fittings for rigid aluminum conduit.
 - a. Acceptable Manufacturers:
 - 1) Crouse-Hinds, Type "DX"
 - 2) O.Z./Gedney, Type "DX"
 - 3) Approved equal

C. Wireway and Wire Trough:

1. Wireway and Wire Trough shall be hinged cover type wireway with provisions for full lay-in along the entire length of run. Wireway shall be steel, enclosed with gray enamel finish. Provide NEMA 1 units for interior/dry/clean locations and NEMA 12 for interior dry maintenance/shop/utility locations. Size to meet NEC fill requirements or larger as noted on Contract Documents. Provide knockouts along runs. Recess in wall where required for flush mounted equipment. Hinge shall be on the bottom of front face for horizontal mounting.

Provide all elbows, tees, pullboxes, fittings, hangers, reducers, supports, supports, etc., to meet installation requirements.

a. Acceptable Manufacturers:

- 1) Square D "Square Duct"
- 2) General Electric
- 3) Hoffman
- 4) Meco

D. Channel Support Systems:

1. Channel Support Systems shall be provided for racking of conduit, trapeze suspensions, equipment support, cable racks and panel racks. Provide poured-in-place inserts for supporting channels at poured concrete walls and ceilings. Channel shall be steel with electroplated zinc finish for interior dry locations. Provide necessary accessories such as bolts, screws, anchors, connection plates, and straps as required to perform the necessary functions. Wet location and exterior channel support systems shall be steel with hot dipped galvanized finish and stainless steel hardware as a minimum. Cut ends shall be touched up with suitable matching finish.

a. Acceptable Manufacturers:

- 1) Unistrut
- 2) Globe
- 3) Kindorf
- 4) B-Line

E. Conductors and Cables:

1. Conductors shall be insulated for 600 volts, unless otherwise noted, and shall be standard AWG and kcmil sizes. Conductors shall be 98% copper or 99.5% aluminum (#2AWG and larger), thermal plastic or cross-linked polymer insulated, heat and moisture resistant. Conductors shall be stranded, except for conductors used for fire alarm system wiring. Conductor sizes No. 18 AWG and smaller shall be a solid single strand; No. 16 AWG and larger shall be multiple stranded. Minimum conductor size shall be #12 AWG except smaller sizes may be used for communications and special systems. Conductor sizes shall be as called for. Conductors shall be labeled with UL seal and be marked with the manufacturer's name, wire size and insulation type. Insulation for all 600 volt conductors shall be Type THHN/THWN-2 for conductor sizes #8 AWG and smaller or Type XHHW-2 for conductor sizes #6 AWG and larger, unless otherwise noted. All exterior and underground conductors shall be XHHW-2. Luminaire fixture wire shall conform to the latest Underwriters Laboratories requirements. Flexible cords and cables for general portable use shall be Type SO or SOOW or as noted. Cables for special use shall be of the type specified for the application.

a. Color Coding:

- 1) All circuits shall be color coded according to the following schedule.

	Three Phase 120/208V 240V	Three Phase 277/480V
Ground	Green	Green
Neutral	White	Gray
A or L1	Black	Brown
B or L2	Red	Orange
C or L3	Blue	Yellow

b. Acceptable Manufacturers:

- 1) General Cable
- 2) Prysmian
- 3) South Wire
- 4) Okonite
- 5) Senator

2. Metal Clad, Type "MC" Cable shall consist of thermal plastic insulated copper conductors of size and quantity indicated, protected by a positive interlocked armor of galvanized steel. The conductors shall be twisted together and shall have an overall moisture and fire resistant fibrous covering. The cable shall provide an adequate path for equipment grounding as required by the NEC and have an integral green insulated full size equipment grounding conductor running its entire length. The cable shall meet the requirements of the NEC for "Type MC" Metal Clad Cable and shall bear the UL Label.

a. Acceptable Manufacturers:

- 1) Southwire
- 2) AFC Cable
- 3) Approved equal

F. Permanent Splices:

1. The shielded power cable splice must meet the requirements of ANSI/IEEE and meeting the cable voltage rating. It must be rated for continuous operation at 90°C, with an emergency overload rating of 130°C. The splice shall be made of peroxide cured EPDM rubber. The splice kit must contain all of the necessary materials required to make one inline splice (except for the connector), including a solderless mechanical ground jumper. The splice shall be designed for splicing tape shielded, wire shielded, and UniShield cables without the requirement of additional adapters. It shall be rated for indoor, outdoor and direct burial applications.
2. Acceptable Manufacturers:
 - a. 3M Brand

- b. Elastimold
- c. Raychem
- d. Approved equal

G. Terminal Lugs and Connectors:

1. The copper lug shall be capable of continuous operation at the current rating of the cable it is used on. The lug shall be UL listed per UL 486A, using industry standard crimping tools and dies. Terminal lugs shall be solderless, pressure type with UL label for "CU/AL" conductor terminations. The lug shall be a closed-end compression (crimp) type, constructed of seamless, tin-plated copper. The lug shall be made with a chamfered inside end, for ease of conductor insertion. Both one and two hole lugs shall be NEMA sized for standard stud sizes and spacing. The lug shall be designed for use at voltages up to 35 kV.

a. Acceptable Manufacturers:

- 1) 3M Scotchlok 30,000 and 31,000 Series
- 2) Burndy
- 3) O.Z./Gedney
- 4) Thomas and Betts

2. The copper conductor connection shall be capable of continuous operation at the current rating of the cables it is used on. The connection shall be UL listed per UL 486A, using industry standard crimping tools and dies. The connector shall be an inline compression (crimp) type, constructed of seamless, tin-plated copper. The connector shall be constructed with chamfered inside-ends and with center cable stops. The connector shall be designed for use at voltages up to 35 kV.

a. Acceptable Manufacturers:

- 1) 3M Scotchlok 10,000 and 11,000 Series
- 2) Burndy
- 3) O.Z./Gedney
- 4) Thomas and Betts

3. "Split-bolt" Connectors shall be solderless type.

a. Acceptable Manufacturers:

- 1) Burndy
- 2) Kearney
- 3) O.Z./Gedney
- 4) Thomas and Betts
- 5) Anderson

4. "TWIST ON" Connectors shall be spiral steel spring type and insulated with vinyl cap and skirt.

a. Acceptable Manufacturers:

- 1) 3-M Company "Scotch-Lok"
- 2) Ideal "Wing-Nuts"
- 3) Approved equal

H. Boxes:

1. Outlet boxes shall be galvanized steel, not less than 2-1/8 in. deep, unless restricted by the surroundings, 4 in. square or octagonal, with knockouts. Boxes and associated fittings, plates and devices shall be mechanically fastened (screwed), friction fitting is not acceptable. Outlet boxes exposed to moisture, exterior, wet or damp locations shall be cadmium cast alloy complete with external threaded hubs and gasketed screw fastened covers. Minimum box size shall be as indicated in the NEC for the conductors and devices installed. Boxes shall be approved for the environmental condition where they will be installed.
 - a. Acceptable Manufacturers:
 - 1) Steel City
 - 2) Raco
 - 3) Appleton
 - 4) Crouse Hinds
2. Telephone/Data Communications Outlet Boxes:
 - a. 4 in. x 4 in. x 2-1/8 in. minimum outlet box with single gang plaster ring with cover plate suitable for indicated communications outlet and conduit routed to accessible ceiling space. Cover plate shall match the receptacle cover type.
3. Pull and junction boxes shall be constructed of not less than 14 gauge galvanized steel with trim for flush or surface mounting in accordance with the location to be installed. Provide screw-on type covers. Boxes installed in damp or wet locations shall be of raintight construction with gasketed cover and threaded conduit hubs. In no case shall boxes be sized smaller than as indicated NEC for conduit and conductor sizes installed. Boxes shall be approved for the environmental condition of the location where they will be installed.
 - a. Acceptable Manufacturers:
 - 1) Hoffman
 - 2) Keystone
 - 3) Approved equal
4. Flush floor junction boxes shall be recessed cover boxes designed for flush mounting in masonry. Provide checkered plate gasketed cover suitable for foot traffic. Make: O.Z. Gedney Type YR or approved equal.
5. Flush Floor Boxes: Boxes shall be cast in place with height adjustability prior to pour. Provide power, communication and/or audio/visual outlets as indicated. Installation shall be suitable for the intended floor finish: if carpet, then provide a carpet flange, if tile/terrazzo/concrete finish, then provide a collar flush with

finished floor and no flange. Units shall meet UL scrub water protected requirements. To have integral ground terminal.

a. Acceptable Manufacturers:

1) Acceptable manufactures shall include the following and shall meet the requirements herein.

a) Wiremold - Evolution Series

b) Approved equal.

6. Flush Poke-Through Service Fitting (Power/Communication):

a. Provide flush poke-through suitable for installation in a cored floor opening. Shall be complete with junction box, conduit and flush devices as indicated on plans. The complete assembly shall be suitable for two hour fire rated floors, be UL CEYY listed and have UL scrub water protected metallic color as selected by the Architect and trim ring. Cover shall be suitable for carpet, tile, wood and concrete. Unit protrusion above floor plane shall not exceed 0.2". Extend or reduce unit raceway length as needed to accommodate floor thickness and project conditions. Provide indicated devices in units.

b. Acceptable Manufacturers:

1) Wiremold - Evolution Series

2) Approved equal

I. Terminal and Equipment Cabinets:

1. Terminal and equipment cabinets shall be code gauge galvanized steel with removable endwalls. Fronts shall be of code gauge steel, flush or surface type (as indicated) with concealed trim clamps, concealed hinges, flush lock, and grey baked enamel finish. Boxes and front shall be UL listed and shall be minimum 35 in. H x 24 in. W x 6 in. D. Provide removable insulated plywood terminal board mounted on inside back wall of cabinet.

a. Acceptable Manufacturer:

1) Square D "Mono-Flat"

2) Approved equal

J. Wiring Devices:

1. Wiring Devices (toggle switches, key switches, receptacles, dimmers, occupancy sensors, etc.) shall be specification grade as a minimum. Switch handle and receptacle face shall be as directed by the Architect. Provide device cover plates of satin finish type 302 stainless steel in finished areas and rounded raised (Steel City 450/460 series) only for surface mounted locations in unfinished areas. Provide neoprene gasketed cast aluminum/zinc box with hinged rain tight cast

aluminum/zinc lockable while in use cover with stainless steel hardware for devices designated "WP".

a. Acceptable Manufacturers:

- 1) Pass and Seymour
- 2) Hubbell
- 3) Leviton

2. Toggle/Snap Switches:

- a. Units shall be quiet operation, quick make/quick break, rated for 20A/120-277V/1hp at 120/277V, side/back wired, with nylon/polycarbonate toggle, self-grounding mounting screw clip plate (not staple), ground terminal and silver alloy contacts. Units shall meet latest Federal Specification WS-896, NEMA WD-1 and UL Test 20. Single pole units shall be Hubbell HBL1221, P&S 20AC1 or Leviton 1221-2. Provide two pole, three way, four way, illuminated handle, keyed, etc. type of the same quality and model.

3. Receptacles:

- a. Provide receptacles where indicated on the drawings and where called for. Provide type receptacle as indicated and if not indicated then utilize general receptacle.
- b. General Receptacle: Units shall be NEMA 5-20R, duplex, 20A, 125V, side/back wired, #14 to 10AWG screw terminals with nylon face, indented brass contacts for three point connection, self-grounding mounting screw clip plate (not staple), ground terminal Meet requirements of Federal Specification W-C-596, NEMA WD-6 and UL 498.
- 1) Units shall be: Hubbell 5352, P&S CRB5362 or Leviton 5352.
- c. Ground Fault Interrupting Receptacles: Units shall be as specified above for General Receptacle and have 5mA interrupting ground fault level, test/reset front buttons, full through feed capability, power off on reverse wired sensing, 10kA short circuit current rating, be tamper/weather resistant and in compliance with UL 943. Unit shall self-test function to periodically test the components automatically and indicate a failure condition utilizing an LED. Shall be Hubbell GFR5362, P&S 2096TR or Leviton S7599TR.
- d. Dryer Receptacles: To be NEMA 14-30R single receptacle in suitable box and steel cover plate painted to match the surrounding. Shall be Hubbell, P&S or Leviton highest grade available.
- e. Special Receptacles: provide other type receptacles as indicated herein or on the drawings. Such receptacles shall be Hubbell, P&S or Leviton highest grade available.

4. Lighting Dimmers:

- a. Provide lighting dimmer where indicated suitable for the type of luminaire for even continuous control. Unit shall be rated for the indicated connected load plus 25% minimum (even when ganged). Review luminaire schedule for type and loading. Provide for three-way control as indicated.
- b. Dimmers to be Lutron "Nova" NT-(1000W minimum) with debuzzing coil for incandescent.
- c. Low voltage dimming shall be as recommended by the luminaire manufacturer for magnetic or solid state.
- d. LED dimmers shall be as recommended by the luminaire manufacturer and be listed for use with the associated driver.
- e. Device color shall match the toggle switch.
- f. Acceptable Manufacturers:
 - 1) Lutron
 - 2) Approved equal

5. Television Outlets:

- a. 4 in. x 4 in. outlet box with single gang plaster ring with coax connector and plate and conduit routed to accessible ceiling space. Cover plate shall match the receptacle cover type.

6. Emergency Shutdown Pushbutton:

- a. Where called for provide emergency shutdown/emergency power off push button. Unit shall be Square D Class 9001 Type K NEMA 13 oil tight pushbutton with the following:
 - 1) Red mushroom head 1-1/2 in. button, hinged protective flip up cover, push to operate, pull to reset.
 - 2) Maintained contact operation with one normally open and one normally closed 10A 120V contacts. Provide relay for additional contacts.
 - 3) Red pilot light.
 - 4) Engraved legend plate indicating "XX - Emergency Stop" with XX = the system name.

7. Occupancy/Vacancy (Automatic/Manual) Sensors:

- a. Sensors shall comply with the following as a minimum:

- 1) Zero crossing switching operation (switch on/off only where sine wave is at zero volts) suitable for linear, non-linear and electronic/magnetic fluorescent ballasts for the loads indicated. Where the load to be controlled exceeds the sensor load rating provide a separate relay of adequate rating.
- 2) Failure of the unit shall be to the on/closed position or manual operation.
- 3) Motion sensitivity adjustment (dip switch or dial) and time delay adjustment (5 to 20 minutes minimum, dip switch or dial).
- 4) Line voltage input and switching. Field selectable for 120 or 277 VAC, 60 Hz.
- 5) UL listed and have a five (5) year manufacturer full replacement warranty.
- 6) Test mode feature to override the set time delay to allow adjusting of the sensitivity.
- 7) Sensor locations shall be adjusted during construction and at occupancy as recommended by the manufacturer for optimal sensing and operation.
- 8) Operation shall have adjustable time delay. Occupancy sensors shall have automatic on and vacancy sensors shall have manual on.
- 9) Adjustable controls/settings shall only be accessible when the front cover is removed or from the back of the unit.
- 10) Unit color shall match the project devices except for the ceiling mounted units which shall match the ceiling color. All color selections shall be by the Architect.
- 11) Ultrasonic sensing shall not be affected by air movement and shall operate at 32 kHz minimum (shall not interfere with hearing aids or other equipment).
- 12) Provide components as needed for the indicated control.
- 13) A factory authorized representative shall coordinate and instruct the start up services of the sensors providing placement recommendations, connection guidance and start up supervision and adjustment.

b. Wall Mounted - Passive Infrared (PIR):

- 1) Unit shall fit into a standard single gang electrical box, have an on/off button and utilize PIR technology motion sensing. Selectable manual or automatic on mode.
 - 2) Minimum Switching Capacity: 120 V - 800 W, 277 V - 1200 W.
 - 3) The sensing shall be 180° and the sensitivity area to be a minimum of:
 - a) Major Motion (Walking/Arm Wave): 35 ft. x 30 ft.
 - b) Minor Motion (Small Motion at Desk): 20 ft. x 15 ft.
 - 4) Ambient light level sensing (adjustable 20-300 fc) to prevent "on" operation when the ambient light level is greater than the set point level.
 - 5) High impact resistant sensor lens.
 - 6) Acceptable Manufacturers:
 - a) Pass & Seymour Model OS300S (Design Make)
 - b) Hubbell
 - c) Watt Stopper
 - d) Sensor Switch
- c. Wall Mounted - Dual Technology (PIR and Ultrasonic):
- 1) Unit shall fit into a standard single gang electrical box, have an on/off button and utilize PIR and ultrasonic technology motion sensing. Both types of sensing are needed for contact closure but only one is needed to keep it closed. Selectable manual or automatic on mode.
 - 2) Minimum Switching Capacity: 120 V - 800 W, 277 V - 1200 W.
 - 3) The sensing shall be 180° and the sensitivity area to be a minimum of:
 - a) Major Motion (Walking/Arm Wave): 35 ft. x 30 ft.
 - b) Minor Motion (Small Motion at Desk): 20 ft. x 15 ft.
 - 4) Ambient light level sensing (adjustable 20-300 fc) to prevent "on" operation when the ambient light level is greater than the set point level.
 - 5) High impact resistant sensor lens.
 - 6) Acceptable Manufacturers:

- a) Hubbell Model AD2000 (Design Make)
- b) Watt Stopper
- c) Cooper
- d) Sensor Switch

d. Ceiling Mounted - Occupancy Sensor - Dual Technology:

- 1) Unit shall mount to standard octagonal box, have adjustable sensitivity/time delay, have auxiliary contact (form C, 0.5A at 24 VDC) and utilize PIR and ultrasonic technology motion sensing. Both types of sensing are needed for contact closure but only one is needed to keep it closed. Auxiliary contact shall indicate movement sensing and be selectable to utilize time delay or not.
- 2) Shall have self contained rated contacts or control a separate switch pack. If a self contained unit then the ratings and function shall meet or exceed the switch pack specifications.
- 3) Sensing shall be 360° with a minimum operating area of:
 - a) Major Motion (Walking/Arm Wave): 50 ft. x 30 ft.
 - b) Minor Motion (Small Motion at Desk): 40 ft. x 20 ft.
 - c) Corridor (Major Motion): 50 ft. x 16 ft.
- 4) Units shall be suitable for overlap of motion detection areas without reduction in spacing and false operation.
- 5) Sensing shall be suitable for a ceiling/mounting height of up to 12 ft. minimum.
- 6) The maximum depth shall be 1.5 in. below the ceiling/box.
- 7) Acceptable Manufacturers:
 - a) Hubbell Model ATD2000CRP (Design Make)
 - b) Watt Stopper
 - c) Cooper
 - d) Sensor Switch

e. Ceiling Mounted - Vacancy Sensor - Dual Technology:

- 1) Unit shall mount to standard octagonal box, have adjustable sensitivity/time delay, have auxiliary contact (form C, 0.5A at 24 VDC) and utilize PIR and ultrasonic technology motion sensing. Both types of sensing are needed for contact closure but only one is needed to keep it closed. Operation shall require manual operation of momentary wall switch for lighting to be switched on and automatic off. Auxiliary contact shall indicate movement sensing and be selectable to utilize time delay or not.

- 2) Shall have self contained rated contacts or control a separate switch pack. If a self contained unit then the ratings and function shall meet or exceed the switch pack specifications.
 - 3) Sensing shall be 360° with a minimum operating area of:
 - a) Major Motion (Walking/Arm Wave): 50 ft. x 30 ft.
 - b) Minor Motion (Small Motion at Desk): 40 ft. x 20 ft.
 - c) Corridor (Major Motion): 50 ft. x 16 ft.
 - 4) Units shall be suitable for overlap of motion detection areas without reduction in spacing and false operation.
 - 5) Sensing shall be suitable for a ceiling/mounting height of up to 12 ft. minimum.
 - 6) The maximum depth shall be 1.5 in. below the ceiling/box.
 - 7) Provide momentary switch(es) and any other needed equipment for indicated operation.
 - 8) Acceptable Manufacturers:
 - a) Hubbell Model ATD2000CRP (Design Make)
 - b) Watt Stopper
 - c) Cooper
 - d) Sensor Switch
- f. Switch Pack:
- 1) Provide a minimum of one (1) switch pack for each ceiling mounted occupancy sensor. Provide additional units for multiple circuits (quantity to match the quantity of circuits).
 - 2) Unit shall be plenum rated with line voltage side into a metallic box.
 - 3) Low voltage power shall be suitable for a minimum of three (3) occupancy sensors. Multiple sensors shall be able to control a single switch pack.
 - 4) Minimum switching capacity shall be 20A (all types of loads) at 120/277VAC.
- g. Testing:
- 1) Each occupancy sensor shall be fully tested for proper operation of all functions after installation.

- 2) Testing shall include sensitivity, time delay, ambient lighting level, etc.
- 3) Operation and settings shall be acceptable to the Owner.

K. Underground Pullboxes (Handholes):

1. Sidewalk and Grass Areas: Boxes shall be comprised of composite material with stainless steel hardware and ANSI Tier 8 rating minimum. Provide conduit/duct openings per the plans/schematics with spare capacity for 2 - 2" in each side wall, minimum. Box shall be minimum 2'-0" wide x 2'-0" long x 3'-0" deep inside dimensions, or larger as required to meet NEC requirements. Cover shall be imprinted with either "Electric", "Telephone", etc. to designate type of service. Provide 18 in. of #2 crushed stone under pullbox and 18 in. beyond. Refer to drawings per details and locations.

a. Manufacturers:

- 1) Quazite
- 2) Old Castle
- 3) Approved equal

2. All Other Areas: Boxes shall have ANSI Tier 22 rating (22,500lb weight rating) and be comprised of steel reinforced concrete walls and bottom sections using 5,000 psi, minimum concrete. Bottom shall have 12 in. diameter sump opening and 3/4 in. ground rod opening. Knockouts and openings shall be positioned for conduits/ducts. Provide two (2) rows of anchor bolt inserts for cable rack supports to permit installation of two (2) cable rack supports on each side wall and one (1) cable rack support on each end wall. Provide hot dipped galvanized steel pulling irons at 45° angle between floor and wall opposite each opening. Provide 24 in. x 24 in. opening for frame and cover and a suitable masonry "Throat" between top of box and cover frame to allow for variation in final finished grade. Frame and cover shall be case iron. Provide 4 in. drain to local site daylight. Refer to drawings per details and locations.

a. Manufacturers:

- 1) Pullbox: Lakelands precast.
- 2) Cover: Neenah Foundry Company, roadway type.
- 3) Approved equal.

L. Ductbanks:

1. Ductbanks shall be rigid non-metallic conduit system. Provide all sleeve joints, couplings, bend sections, bends, elbows, offsets, angle couplings, bell ends, caps, base spacers and intermediate spacers as required to meet field conditions. All bends, stub-ups and wall, slab or floor-building penetrations shall be rigid steel conduit without exception.

M. Waterproofing Seals:

1. Provide expanding link type seal, for installation between duct/conduit, and sleeve or core-drilled hole in concrete.
2. Make: Link Seal, manufactured by Thunderline Corp., or approved equal.

N. Flashing, Sealing, Fire-stopping:

1. Fire-Stopping for Openings Through Fire and Smoke Rated Wall and Floor Assemblies:
 - a. Provide materials and products listed or classified by an approved independent testing laboratory for "Through-Penetration Fire-Stop Systems". The system shall meet the requirements of "Fire Tests of Through-Penetration Fire-Stops" designated ASTM E814.
 - b. Provide fire-stop system seals at all locations where piping, tubing, conduit, electrical busways/cables/wires, ductwork and similar utilities pass through or penetrate fire rated wall or floor assembly. Provide fire-stop seal between sleeve and wall for drywall construction.
 - c. The minimum required fire resistance ratings of the wall or floor assembly shall be maintained by the fire-stop system. The installation shall provide an air and watertight seal.
 - d. The methods used shall incorporate qualities, which permit the easy removal or addition of electrical conduits or cables without drilling or use of special tools. The product shall adhere to itself to allow repairs to be made with the same material and permit the vibration, expansion and/or contraction of any items passing through the penetration without cracking, crumbling and resulting reduction in fire rating.
2. Acceptable Manufacturers:
 - a. Dow Corning Fire-Stop System Foams and Sealants
 - b. Nelson Electric Fire-Stop System Putty, CLK and WRP
 - c. S-100 FS500/600, Thomas & Betts
 - d. Carborundum Fyre Putty
 - e. 3-M Fire Products

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Unless otherwise noted, wiring for all systems indicated in the contract documents shall consist of insulated conductors installed in raceways. Raceways shall be continuous from outlet box to outlet box and from outlet box to cabinet, junction or pull box. Secure and bond raceways to all boxes and cabinets so that each system of raceways is electrically continuous throughout. Unless otherwise indicated on the drawings, install all wiring in the following raceway system:

1. Wiring 600 Volts or Less in Dry Locations: Electrical metallic tubing or type MC cable.
2. Wiring 600 Volts or Less in Outdoors, Above Grade Locations: Rigid metal conduit.
3. Wiring 600 Volts or Less Installed Below Grade, in Concrete Floor Slabs or Below Ground Floor Slab: Rigid non-metallic conduit with rigid metal conduit bends and penetrations through building floors and walls.
4. Flexible metal conduit shall be used for final connection to all motors, final connection to rotating or vibrating equipment, final connections to dry type transformers and final connections to recessed lighting fixtures. Liquidtight flexible conduit shall be used in all wet or damp locations. Maximum length of flexible conduit shall be 36 in., except that from outlet boxes to lighting fixture maximum length shall be 6 ft. Provide green insulated equipment grounding conductor in all flexible metal conduit.
5. Surface metal raceway may be used for surface runs in finished area where concealed conduit cannot be run or where specifically indicated on drawings. Submit detailed description and/or layout for approval prior to roughing.
6. Where allowed, branch circuits may be type MC cable between homerun junction box and equipment/device connection in drywall partitions only. Homerun junction box to be a maximum of 20 ft. from equipment/device.

B. Raceways:

1. Sized as indicated on the drawings. Where sizes are not indicated, raceways shall be sized as required by the National Electrical Code in accordance with the quantity, size, and type of the insulation conductors to be installed. Raceways shall be minimum 1/2 in. trade size for branch circuit wiring and minimum 3/4 in. trade size for all telephone intercommunications, instrumentation, fire alarm, television and computer systems and for all branch circuit "Home Runs" to panelboards.
2. Installed to provide adequate grounding between all outlets and the established electrical system ground.
3. Cut square, free of burrs due to field cutting or manufacture, and bushed where necessary.
4. Installed with exterior surfaces not less than 6 in. from any surface with normal operating temperature of 200°F or higher.
5. Plugged at the ends of each roughed-in raceway with an approved cap or disc to prevent the entrance of foreign materials during construction.
6. Concealed throughout except where exposure is permitted by the Owner's Representative. All exposed raceways shall be painted to match existing adjacent surface finish as directed by the Architect.

7. Installed parallel or perpendicular to floors, walls and ceilings where exposed wiring is permitted.
8. Installed with a minimum of bends and offsets. All bends shall be made without kinking or destroying the cross section contour of the raceway. Factory made bends are acceptable and should be considered for raceways larger than 2 in.
9. Installed with UL approved rain-tight and concrete-tight couplings and connectors.
10. Firmly fastened within 3 ft. of each outlet box, junction box, cabinet or fitting. Raceways shall not be attached to or supported by wooden plug anchors or supported from mechanical work such as ductwork, piping, etc.
11. Installed with a #14 AWG fish wire in all telephone, intercommunication, "Spare" or "Empty" conduit runs to facilitate future installation of conductors.
12. Installed with expansion fittings at all building expansion joints such that no undue stress is placed on any electrical raceway due to the proper functioning of expansion joints.
13. Arranged in a neat manner for access and allow for access to work installed by other trades.
14. Raceways installed in concrete slabs shall be located so as not to affect structural integrity of slab, and such that conduit shall have a minimum of 1 in. of concrete cover on all sides. Obtain approval from the Owner's Representative prior to installing conduit larger than 1 in. trade size in concrete slabs. Raceways in slabs shall be for floor box use only.
15. Raceways installed below ground floor slab shall be encased in concrete with 3 in. minimum coverage on all sides. Where possible, install conduit directly below slab with concrete envelope poured monolithic with slab. Where this is not possible, support raceways and envelop maximum 5 ft. - 0 in. on centers from underside of structural slab by means of galvanized pipe hangers. Pipe hangers shall be coated with asphalt mastic. Installation shall maintain integrity of waterproofing membrane.
16. If it is necessary to burn holes through webs of beams or girders, call such points to the attention of the Owner's Representative and receive written approval both as to location and size of hole before proceeding with work. All holes shall be burned no larger than absolutely necessary.
17. Become familiar with the general construction of the building and place sleeves, inserts, etc., as required. All penetrations through existing floors shall be core drilled and sleeved.
18. Wherever a cluster of four (4) or more raceways rise out of floor exposed, provide neatly formed 6 in. high concrete envelop, with chamfered edges, around raceways.

19. All raceways shall be supported adequately by malleable iron pipe clamps or other approved methods. In exterior or wet locations, supports shall allow not less than 1/4 in. air space between raceway and wall. Firmly fasten raceway within 3 ft. of each outlet box, junction box, cabinet or fitting. The following table lists maximum spacing between conditions, strength of supporting members, etc.
20. Furnish and install such supports at no additional cost to owner.

Conduit Trade Size	Type of Run	Horizontal Spacing in Feet	Vertical Spacing in Feet
1/2 in., 3/4 in.	Concealed	7	10
1 in., 1-1/4 in.	Concealed	8	10
1-1/2 in. and larger	Concealed	10	10
1/2 in., 3/4 in.	Exposed	5	7
1 in., 1-1/4 in.	Exposed	7	8
1-1/2 in. and larger	Exposed	10	10

21. Where raceways puncture roof, install pitch pockets as required in order that the roof warranty is maintained. Coordinate with representative of roofing material manufacturer.
22. At each flush mounted panelboard, terminal cabinet, control cabinet, etc., provide four (4) spare 3/4 in. raceways from panelboard, etc., to an area above the nearest accessible ceiling space. Make 90° turn above the ceiling, arranged for further continuation of raceway, and cap.
23. Provide a bushing at each conduit termination unless fitting at box where conduit terminates has hubs designed in such a manner to afford equal protection to conductors. Provide grounding type insulated bushings on all conduit sizes 1-1/4 in. trade size and larger, and on all feeder raceways regardless of size. Provide standard bushings for conduits 1 in. and smaller unless otherwise stated.
24. Differing Temperatures: For raceways routed between areas with differing temperatures (interior to exterior, walk in coolers/freezers, environmental chambers, etc.) install raceway as follows:
- Provide a thermal break, 4 in. minimum of stainless steel or Schedule 40 PVC conduit within space wall/separation.
 - Seal raceway penetration through the wall/separation.
 - Provide a box on each side of the space wall/separation.
 - Provide raceway interior sealant (duct seal or suitable foam) to provide a complete air barrier after conductors are installed.
 - Mounting of raceway and boxes on equipment shall be coordinated and approved by the equipment manufacturer.

25. Raceway installed in wet, damp or exterior walls shall have a spacer provided to maintain a space/void between the mounting surface and the raceway.

C. Underground Raceways and Ductbanks:

1. Encase all underground raceways in concrete, No. 1 (NYSDOT 0703-02) crushed stone or pea stone (NYSDOT 0702-0203). Where concrete is called for, form concrete envelope around raceways, 3 in. minimum thickness concrete at top, bottom and sides of raceways, conduits on 7-1/2 in. centers both directions with concrete between raceways. Top of concrete envelope shall be finished not less than 24 in. below finished grade, except where under building slabs. Open trench for its complete length before concrete is poured; if any obstructions are encountered, make provisions to avoid them. Support raceways minimum 3 in. above bottom of trench before pouring. Furnish and install precast concrete, plastic or fiber spacers. Stagger couplings. When concrete is specified, securely tie raceways in place to prevent floating. Pour concrete as soon as possible after placing and securing of raceways. Pull iron-shod mandrel, not more than 1/4 in. smaller than bore of raceway to remove concrete and other obstructions. Clean raceway by drawing through properly sized cylindrical brushes as many times as necessary to remove dirt. Concrete envelopes shall contain reinforcing rods wherever non-metallic raceways are used. Reinforcing shall be continuous runs of No. 4 deformed rods located in all four corners as well as top and bottom of envelope between each raceway. In locations where non-metallic raceways are used, change to heavy wall metallic conduit of same internal diameter before rising out of ground; provide metallic conduit elbows at conduit rise. Carry concrete envelope to a point 12 in. minimum above grade or floor slab at rise point if allowed by site conditions and equipment to be installed. Slope top of concrete away from raceway, chamfer edges. Where raceways pass between exterior and interior and terminate in building, switchgear, pullbox, etc. provide conduit sealing bushing (O-Z Gedney CSB or approved equal) in each raceway to fill all voids around conduit and cables. Upsize the conduit as needed for suitable sealing bushing. Cap all empty conduits watertight. Place conduit in straight lines. Seal, completely waterproof, all duct joints, then complete concrete encasement. Place direct-bury conduit tier-by-tier method, backfilling each layer to achieve proper spacing. Elbows shall have a minimum radius of 42 in. Follow proper low temperature installation procedures as recommended by PVC conduit vendor. Provide marking tape in soil above all duct banks per NEC. Repair or replace all existing utilities and facilities damage, due to ductbank installation, as part of contract.

D. Wiring Methods:

1. Conductors shall not be installed until raceway system, including all outlets, cabinets, bushings and fittings, is completed. Verify that all work of other trades which may cause conductor damage is completed. Use only U.L. approved cable lubricants when necessary. Do not use mechanical means to pull conductors No. 8 or smaller.
2. In general, conductors shall be the same size from the last protective device to the load.

3. All wiring systems shall be properly grounded and continuously polarized throughout, following the color-coding specified. Connect branch circuit wiring at panelboards, as required, in order to provide a "balanced" three-phase load on feeders.
4. Provide insulated green ground conductor in each branch circuit.
5. All feeder connections shall be made to bus and other equipment using solderless, pressure type terminal lugs.
6. For splices and taps, No. 10 AWG and smaller, use solderless "twist on" connectors having spiral steel spring and insulated with a vinyl cap and skirt.
7. For splices and taps, No. 8 and larger, use insulated solderless set screw AL/CU or hydraulically compressed sleeve fittings suitable for the intended use.
8. Use cast connections for ground conductors.
9. Provide minimum 6 in. of spare/slack of each conductor in each junction or pull box and termination.
10. Make all splices and connections in accessible boxes and cabinets only.
11. Cover uninsulated splices, joints, and free ends of conductor with rubber and friction tape of PVC electrical tape. Plastic insulating caps may serve as insulation. Heat shrink sleeves shall be acceptable for crimp type splices.
12. On termination at branch circuit outlets, leave a minimum of 8 in. free conductor for installation of devices and fixtures.
13. Feeder conductors shall be continuous from point of origin to load termination without splice. If this is not practical, contact the Owner's Representative and receive written approval for splicing prior to installation of feeder(s). Where feeder conductors pass through junction and pull boxes, bind and lace conductors of each feeder together. For parallel sets of conductors, match lengths of conductors as near equal as possible.
14. Branch circuit conductors installed in panelboards, and control conductors installed in control cabinets and panels shall be neatly bound together using "Ty-Raps" or equal.
15. Lighting fixtures, detectors, etc., in mechanical equipment, boiler and pump rooms shall be installed with exposed wiring after equipment, ductwork, piping, etc., are in place. In general, lighting shall be as located on the drawings; where conflicts exist, locate lights for best distribution.
16. Provide cable/conductor vertical support in accordance with the NEC.

17. Handholes:

- a. Provide separation of conductors of different systems per NEC requirements.
- b. Pitch all raceways toward the manhole/handhole.
- c. Mortar and brick the throats of manholes/handholes to grade level. Set cover rim to 1 in. above grass areas and flush with finished areas. Waterproof throat with elastic bituminous plastic cement coating.

E. Outlet Boxes:

1. Consider location of outlets shown on drawings as approximate only. Study architectural, process piping, mechanical, plumbing, structural, roughing-in, etc., drawings and note surrounding areas in which each outlet is to be located. Locate outlet so that when fixtures, motors, cabinets, equipment, etc., are placed in position, outlet will serve its desired purpose. Where conflicts are noted between drawings, contact Owner's Representative for decision prior to installation. Comply with the NEC relative to position of outlet boxes in finished ceilings and walls.
2. Prior to installation, relocate any outlet location a distance of 5 ft. in any direction from location indicated on drawings if so directed by the Owner's Representative. Prior to completion of wall construction, adjust vertical height of any outlet from height indicated if so directed by Owner's Representative. The above modifications shall be made at no additional cost to the Owner.
3. Where outlets at different mounting heights are indicated on drawings adjacent to each other (due to lack of physical space to show symbol on drawings), install outlets on a common vertical line.
4. Where switch outlets are shown adjacent to strike side of door, locate edge of outlet box approximately 3 in. from door frame.
5. Outlet boxes in separate rooms shall not be installed "back-to-back" without the approval of the Owner's Representative.
6. Outlet boxes shall be sized to accommodate the wiring, splices and device(s) to be installed in accordance with the NEC.
7. Outlet boxes installed in plaster, gypsum board or wood paneled hollow cavity walls shall be installed flush with raised plaster covers or raised tile covers. Boxes shall be mechanically fastened and supported by two (2) adjacent structural members (studs) with cross brackets (Garvin Industries Model BMB or approved equal).
8. Outlet boxes installed in tile, brick or concrete block walls shall be installed flush and have extra-deep type raised tile covers or shall be 3-1/2 in. deep boxes with square corners and dimensions to accommodate conductors installed.

9. Surface ceiling mounted outlet boxes shall be minimum 4 in. square, 1-1/2 in. deep, galvanized sheet metal.
 10. Surface wall mounted outlet boxes shall be cast type boxes.
 11. Floor outlet boxes shall be installed flush with finished floor, adjust level and tile as required. Where finished floor is terrazzo, provide boxes specifically designed for installation in terrazzo. Where floors are to receive carpet or flooring material, coordinate with appropriate trade and provide insert. Rectangular covers shall be parallel and perpendicular with the building and, if used, floor tile/floor joints/pattern. Coordinate cover type with the flooring and device type.
 12. Install a device cover plate over each and every outlet indicated on drawings. Do not install plates until painting, cleaning and finishing of surfaces surrounding the outlet are complete. Install single one-piece multi-gang covers over multi-gang devices.
- F. Toggle Switches:
1. Switches shall be installed in accessible locations near room/space entryway(s).
 2. Provide lighted handle switches in mechanical rooms, elevator pits, electric rooms, etc.
- G. Junction and Pull Boxes:
1. Install junction and pull boxes in readily accessible locations. Access to boxes shall not be blocked by equipment, piping, ducts and the like. Provide all necessary junction or pull boxes required due to field conditions and size as require by the National Electrical Code.
- H. Equipment Mounting Heights:
1. Unless otherwise noted, mount devices and equipment at heights measured from finished floor to device/equipment centerline as follows:
 - a. Toggle switches (up position "on") 46 in.
 - b. Receptacle outlets (long dimension vertical, ground" pole farthest from floor) 18 in.
 - c. Receptacle outlets above counters 8 in. above counters
 - d. Receptacle outlets, above hot water or steam baseboard heaters. Do not install receptacle outlets above electric baseboard heaters 30 in.
 - e. Receptacle outlets, for refrigerators 48 in.

- | | | |
|----|--|---|
| f. | Receptacle outlets, weatherproof, above-grade | 24 in. |
| g. | Telephone outlets | 18 in. |
| h. | Telephone outlets, wall mounted | 46 in. |
| i. | T.V. outlet | 18 in. |
| j. | Fire alarm manual stations | 46 in. |
| k. | Fire alarm combination audio/visual and standalone visual device (entire strobe lens at heights indicated) | 80 in. to bottom of the notification device |
| l. | Standalone fire alarm audio device | 90 in. (min) to 96 in. (max) |
| m. | Distribution panelboards, to top of backbox | 72 in. |
| n. | Terminal cabinets, control cabinets, to top of backbox | 72 in. |
| o. | Disconnect switches, motor starters, and enclosed circuit breakers. | 48 in. |
2. Where structural or other interferences prevent compliance with mounting heights listed above, consult Owner's Representative for approval to change location before installation.

I. Hangers and Supports:

1. Provide steel angles, channels and other materials necessary for the proper support and erection of motor starters, distribution panelboards, large disconnect switches, large circuit breakers, pendant mounted lighting fixtures, etc.
2. Panelboards, disconnect switches, circuit breakers, cabinets, large pull boxes, adjustable speed drives, cable support boxes and starters shall be secured to the building structure and not supported from conduits. Small panelboards, etc., as approved by Owner's Representative, may be supported on walls. Racks for support of conduits and heavy electrical equipment shall be secured to building construction by substantial structural supports.

J. Identification:

1. Provide engraved lamicoid identification nameplates on switchboards, main service disconnects, transfer switches, and on all panelboards using designation shown in panelboard schedule. Include voltage, phase, equipment served, voltage source to panel or equipment.

2. Provide engraved lamicaid identification nameplates for each circuit breaker in the main distribution panel listing the panelboard or equipment connected to each device.
3. Provide engraved lamicaid identification nameplates on all items of equipment including individual circuit breaker enclosures and disconnect switches, listing the equipment connected to the particular device provided under Specification Section 262000, including, but not limited to: starters, disconnect switches, adjustable speed drives, circuit breakers, etc. Include voltage, phase, equipment served, voltage source to panel or equipment.
4. Provide complete type written directory for each panelboard listing room number, function, etc., for each circuit breaker.
5. Identify junction and pullboxes for particular service and circuit such as power, lighting, fire alarm, telephone, interphone, public address, nurse call, etc. using stencil lettering on cover.
6. Provide signage at each electrical service room indicating "DANGER - HIGH VOLTAGE - KEEP OUT". Utilize adhesive backed, yellow background, block lettering signage at door.
7. Using adhesive backed printed tape label all receptacle and switch coverplates, power poles, etc. listing panel designation and circuit number. Tape shall be attached to inside of receptacle or switch coverplates.

K. Spare Parts:

1. Deliver to Owner and obtain receipt for spare parts including key switches, fuses, etc.

3.2 TESTS

- A. Branch circuits shall be tested during installation for continuity and identification and shall pass operational tests to determine that all circuits perform the function for which they are designed. For all feeder wiring rated 600 volts or less, provide 1,000 volt "Megger" insulation test prior to energizing feeders. Use a 1,000-volt motor driven megger for all tests. Test voltage shall be applied until readings reach a constant value, and until three (3) equal readings, each one (1) minute apart, are obtained. Minimum megger reading shall be 45 megohms for feeder conductors. Document test results and submit for approval prior to energizing conductors.

END OF SECTION

SECTION 260526 - GROUNDING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide grounding system equal to or exceeding the requirements of NEC and as indicated in the contract documents. Raceway system which includes metal conduit, wireways, pullboxes, junction boxes, busway, wire ways, cable trays, enclosures, motor frames, etc., shall be made to form a continuous, conducting permanent ground circuit of the lowest practical impedance to enhance the safe conduction of ground fault currents and to prevent objectionable differences in voltage between metal non-load current carrying parts of the electrical system.
- B. Provide solid grounding of building structures and electrical and communications systems and equipment. It includes basic requirements for grounding for protection of life, equipment, circuits and systems. Types of grounding systems include the following:
 - 1. Electrical Service and Transformer Grounding
 - 2. Building Grounding
 - 3. Equipment Room Ground Terminal Bar
 - 4. Electrical Equipment Grounding

1.2 QUALITY ASSURANCE

- A. All methods of construction, details of workmanship, that are not specifically described or indicated in the contract documents, shall be subject to the control and approval of the Owner's Representative. Equipment and materials shall be of the quality and manufacture indicated in their respective sections of the specifications. The equipment specified is based upon the acceptable manufacturers listed. Equipment types, device ratings, dimensions, etc., correspond to the nomenclature dictated by those manufacturers. Where "or equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval. All equipment shall be tested at the factory. Unless specified elsewhere, standard factory inspection and operational tests will be acceptable.
- B. Electrical Components, Devices and Accessories: Listed and labeled as defined in the NEC by Nationally Recognized Testing Laboratory (NRTL) and marked for intended use.
- C. Comply with UL 467 for grounding and bonding materials and equipment.

1.3 REQUIREMENTS

- A. Grounding conductors, bonding conductors, jumpers, grounded conductors, etc. shall be sized in accordance with the NEC.
- B. Equipment and materials shall be installed in accordance with the manufacturer's recommendations.

- C. Provide ground system coordinated with and in accordance with the utility company requirements.

1.4 SUBMITTALS

- A. Provide submittals for the following:
 - 1. Ground rods and connectors.
 - 2. Ground bars.
 - 3. Building ground resistance test results.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Conductors:
 - 1. Exposed grounding components such as bars, straps, cables, flexible jumpers, braids, shunts, etc., shall be bare copper unless otherwise indicated.
 - 2. Grounding conductors in raceway with 600V circuiting shall be insulated to match the circuit conductors with green color.
 - 3. Grounding conductors used with system voltage greater than 1000V shall be bare unless otherwise indicated.
 - 4. Grounding conductor size shall be as indicated or as required by the NEC whichever is larger, stranded, soft drawn or soft annealed copper, unless otherwise indicated. Sizing shall take into account circuit voltage drop.
 - 5. Acceptable Manufacturers:
 - a. Same make as for 600 volt conductors.
- B. Ground Rods:
 - 1. Provide solid copper or copper clad steel cylindrical rods, 3/4 in. minimum diameter and minimum 10 ft. long with pointed end. Provide units suitable for extension connection when ground rods longer than 10 ft. are indicated.
 - 2. Acceptable Manufacturers:
 - a. Copperweld
 - b. Erico
 - c. Burndy
 - d. Approved equal.
- C. Connectors, Clamps and Terminals:

1. Mechanical connectors and clamps shall be made of copper alloy or silicon bronze. Solderless compression terminals shall be copper, long-barrel, NEMA two bolt. Bolts and washers (Belleville) shall be of comparable material or stainless steel.
 - a. Acceptable Manufacturers:
 - 1) Burndy
 - 2) Hubbell Anderson Corp.
 - 3) Thomas & Betts
 - 4) Approved equal
2. Exothermic Welds:
 - a. Provide exothermic welds designed for size and type of intended cable, rods, structure, etc. Solder prohibited for connections, except for medium and high voltage cable metallic tape shields (utilize mechanical and solder).
 - b. Acceptable Manufacturers:
 - 1) Erico "Cadweld"
 - 2) Burndy "ThermOweld"
 - 3) Approved equal
3. Pipe Clamp:
 - a. Pipe clamp for bonding to pipe type electrode (water pipe, etc.) shall be a suitably sized copper alloy clamp.
 - b. Acceptable Manufacturers:
 - 1) Burndy GAR-BU
 - 2) O-Z Gedney Type CG
 - 3) Burndy "Durium"
 - 4) AFL Global "Everdur"
 - 5) Approved equal
4. Flexible Strap:
 - a. Flexible grounding straps shall be of braided high conductivity copper with two-hole connector. Strap shall have equal to or greater than ampacity of the system it is bonding to. Strap shall provide flexibility in all directions when installed properly.
 - b. Acceptable Manufacturers:
 - 1) Burndy
 - 2) OZ Gedney
 - 3) Approved equal

5. Electrostatic Floor Bonding:
 - a. Listed grounding kit for bonding ESD carpet, vinyl, rubber and epoxy floor coverings and coatings to ground with the following components:
 - 1) 1 in. wide copper grounding tape.
 - 2) Heavy gauge stainless steel ground termination plates with double sided conductive tape and 20 in. long lead wire with a #10 terminal ring at the end.
 - 3) Acceptable Manufacturers:
 - a) Ground Zero Electrostatics Inc. "Zerostat" Floor Termination and Grounding Kits.

D. Ground Bars

1. Provide ground bars where indicated. Ground bars shall be:
 - a. 98% conductive copper, minimum.
 - b. 4 in. x 1/4 in. thick minimum with length as indicated with minimum 36 in. for electric room/MDF and all other minimum of 24 in.
 - c. Standard NEMA bolt hole patterns with maximum quantity of lug locations. Spacing of 1-1/8 in. apart.
2. Bar shall be mounted to an accessible wall location with galvanized steel hardware and 2000V rated insulators. Mounting shall be suitable for full complement of cabling.
3. Unit shall conform to EIA/TIA standards.
4. Acceptable Manufacturers:
 - a. Erico
 - b. Newton Instrument
 - c. Burndy
 - d. Harger

PART 3 - EXECUTION

3.1 INSTALLATION

A. Grounding Conductors:

1. Provide grounding conductor(s) with all power circuits. Conductor shall be sized as indicated or as required by the NEC as a minimum and shall be terminated on the equipment, device, enclosure, etc. grounding terminal. Conductor size shall

be for the entire length unless approved by the Engineer where oversized for voltage drop.

2. Conductors above grade to ground electrodes (water piping, structural column, etc.) and to equipment (service entrance, ground bars, ground halos, etc.) shall be installed in metallic conduit with ends bonded to the conduit.
3. Grounding conductors shall be installed to have a minimum radius of 3 in.
4. Grounding conductors in a raceway system shall be terminated/bonded to each box, cabinet, enclosure, etc. through which it passes or terminates.
5. Grounding conductors routed with underground circuits shall be bonded to each ground electrode and metallic cable support system within the raceway system including pull and access locations.
6. Stranded conductors penetrating vapor barriers, foundations, slab on grade and water stop membranes shall have the interstitial spaces between strands filled with solder 4 in. beyond the membrane each side. The conductor shall be sealed to the membrane with a manufacturer approved method.

B. Raceway Systems:

1. All metal supports, cable trays, messenger cables, frames, sleeves, brackets, braces, etc. for the raceway system, panels, switches, boxes, starters controls, etc., which are not rigidly secured to and in contact with the raceway system, or which are subject to vibration and loosening, shall be bonded to the raceway system.
2. Termination of rigid conduit at all boxes, cabinets, and enclosures shall be made up tightly with a double locknut arrangement and a bushing, bushings being of the insulated type. Utilize grounding bushings as specified elsewhere in these specifications.
3. Conduit which runs to or from boxes, cabinets, or enclosures having concentric or eccentric knockouts which partially perforate the metal around the conduit and hence impair the continuity of system ground circuits shall be provided with bonding jumpers connected between a grounding type bushing/locknut on the conduit and a ground bus or stud inside the box, cabinet, or enclosure and attached thereto.
4. Conduit expansion joints and telescoping sections of metal raceways shall be provided with bonding jumpers sized in accordance with the NEC.

C. Ground Rods:

1. Ground rods shall be driven vertically the full length plus 24 in., minimum.
2. Ground rods shall be located in virgin soil or loamy compacted soil.

3. Provide one (1), minimum, ground rod inspection test well for each ground rod/electrode system or as indicated.

D. Connectors Clamps and Terminals:

1. Connectors utilized above grade in dry accessible locations shall be mechanical or exothermic type.
2. Connectors in damp locations, below grade or if not indicated shall be exothermic type.
3. Clean the area near the connecting surfaces prior to any connection to ensure effective contact. Cleaning shall be to the bare metal. Wire brush area if needed to remove rust scale paint, dirt, etc. to expose bare metal.
4. Exothermic connections shall be installed in accordance with the manufacturer's recommendations and tested with heavy blow of a five pound sledge.

E. Flexible Strap:

1. Flexible straps shall be used when bonding vibrating/moveable equipment, with expansion fittings and where recommended by the manufacturer.
2. Sufficient slack shall be provided to compensate for the anticipated vibration, movement and expansion.

F. Ground Grid:

1. Provide a ground electrode grid consisting of a minimum of three (3) 10 ft. ground rods arranged in a delta configuration with a minimum spacing of 20 ft. apart and connected together.
2. Connecting conductors shall be bare #4/0 AWG minimum, buried a minimum of 24 in. below grade.
3. Connect the ground grid to the building electric service and to the main ground bar.

G. Secondary Electrical Systems:

1. The neutral (grounded) conductor of each low voltage, single and/or polyphase system or distribution system, except special isolated double insulated systems, shall be solidly connected to ground at the transformer neutral bushing, or at the main secondary switchgear to the system ground, and shall be sized for current carrying capacity, not to be less than as required by the NEC. Ground connection shall be to the building grounding system, building steel, building water service, building concrete reinforcement and as indicated.
2. Equipment grounding conductors shall extend from the point of termination back to the ground bus of the source panelboard, switchboard, or switchgear.

H. Equipment Grounding:

1. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch circuit conductors.

I. Communications Rooms:

1. For each building communications room or closet provide one (1) wall mounted ground bar bonded to the main building ground bar or electrical service ground with insulated #2 AWG conductor.
2. Local cable trays, equipment racks, etc. shall be bonded to the ground bar by others.

J. Emergency Generators with Three Pole Transfer Switch(es):

1. Generator neutrals are not to be bonded to ground at the generator.
2. Generator neutral shall be connected to the secondary electrical distribution system neutral conductor or bus. Connection shall be made at the transfer switch neutral lug.
3. Generator frames shall be bonded to the ground system with a conductor sized in accordance with the NEC.

K. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors in conduit from building's main service equipment or grounding bus to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes using a bolted clamp connector or by bolting a lug-type connector to a pipe flange using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

L. Power Company Requirements:

1. Size #6 ground conductor from service entrance equipment to meter panel.
2. One size 3/4 in. diameter by 10 ft. ground rod and size #6 circuitry at riser pole.
3. Meet power company requirements.

M. Underground Distribution:

1. Manholes and Handholes: Provide a driven ground rod through opening in the floor/bottom with 4 in. exposed. If necessary due to the site conditions, install the ground rod prior to manhole/handhole installation and provide a #1/0AWG bare conductor from the ground rod with an exothermic connection in the manhole/handhole. Seal the opening with waterproof non-shrinking grout.
2. Bond exposed parts within manhole/handhole such as inserts, pulling rings, cable racks, ladders and cable shields to the ground rod with #2AWG bare conductor minimum. Conductors shall be neatly installed around the perimeter of the unit and support 3 ft. on center with non-corrosive support and hardware.

3.2 GROUND TERMINAL BUS INSTALLATION

- A. Install ground terminal bar in rooms where shown on the drawings. Mount bar 18 in. above finished floor by anchors and bolts using 1-1/2 in. long insulated spacer between bar and wall. Use a minimum of two (2) supports 18 in. on center. Connect all grounding electrode system conductors, system enclosure ground bus, and other indicated electrode systems to the terminal bar.
- B. Label grounding conductors terminated to bus for equipment, location, electrode, etc served.

3.3 TESTS

- A. Test the building ground system before backfilling to ensure continuity and determine system resistance value.
- B. Testing procedure shall be a fall of potential type with a moving auxiliary electrode in accordance with IEEE Standard 142 and reviewed/approved by the Engineer. Sufficient test points shall be taken for accurate resistance value.
- C. Make resistance measurements in dry weather, no earlier than 48 hours after rainfall. Provide tabulated test results indicating distance between rods and resistance readings on a plotted graph.
- D. Test each ground electrode system separately prior to connection to the system or main building ground bar. Test each system ground electrode system a second time after backfilling has occurred and all final connections (building steel, water service, etc.) have been made.
- E. Soil type, date, time, meter manufacturer/model number, person performing the test, test witnesses and most recent rainfall shall be noted in test submittal.

END OF SECTION

SECTION 262000 - ELECTRIC DISTRIBUTION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide a complete electrical service, and distribution system as indicated on the Contract Documents and as specified herein.

1.2 QUALITY ASSURANCE

- A. All methods of construction, details of workmanship, that are not specifically described or indicated in the contract documents, shall be subject to the control and approval of the Owner's Representative. Equipment and materials shall be of the quality and manufacture indicated in their respective sections of the specifications. The equipment specified is based upon the acceptable manufacturers listed. Equipment types, device ratings, dimensions, etc., correspond to the nomenclature dictated by those manufacturers. Where "or equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval. All equipment shall be tested at the factory. Unless specified elsewhere, standard factory inspection and operational tests will be acceptable.
- B. Installation shall be in accordance with NFPA-70 (National Electrical Code), National Electrical Safety Code (NESC), state codes, local codes, and requirements of authority having jurisdiction.
- C. Equipment shall be designed, manufactured, assembled, and tested in accordance with the latest revisions of applicable published ANSI, NEMA, UL and IEEE Standards.

1.3 SUBMITTALS

- A. Submit the following product data/information:
 - 1. Manufacturer and equipment type.
 - 2. Standard catalog information sheet.
 - 3. Detailed shop drawings indicating plan, elevation, end and isometric views. Top and bottom conduit areas shall be clearly shown and dimensioned on the drawings.
 - 4. Single-line diagram.
 - 5. Complete Bill of Materials.
 - 6. All relevant ratings including, but not limited to, voltage, current, interrupting and withstand.
 - 7. Overcurrent Device Information. Model number, available settings, setting ranges, capabilities, etc.

8. Submit available and final settings, programming and adjustments.
- B. Submit product data and information for the following equipment, materials, products, etc.:
 1. Switchboards.
 2. Distribution and branch circuit panelboards.
 3. Enclosed circuit breakers.
 4. Disconnect switches.

1.4 WARRANTY

- A. Provide full system warranty (labor, travel, equipment, etc.) in accordance with Division 1 and a minimum of one (1) year from acceptance.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Distribution Switchboard:
 1. Provide distribution switchboard as specified and scheduled herein and shown on the associated drawings. The switchboard shall meet Underwriter's Laboratories enclosure requirements and be furnished with an Underwriter's Laboratory label for service entrance equipment.
 2. The switchboard shall be dead front with front accessibility only required. The switchboard framework shall consist of steel channels welded or bolted to the frame to rigidly support the entire shipping section for moving on rollers and floor mounting. The framework is to be formed, code gauge steel, rigidly welded and bolted together to support all cover plates, bussing and component devices during shipment and installation. Each switchboard section shall have an open bottom and an individual removable top plate for installation and termination of conduit. Top and bottom conduit areas are to be clearly shown and dimensioned on the shop drawings. The wireway front covers are to be hinged to permit access to the branch circuit breaker load side terminals without removing the covers. All front plates used for mounting meters, selector switches or other front mounted devices shall be hinged with all wiring installed and laced with flexibility at the hinged side. All closure plates shall be screw removable and small enough for easy handling by one man. The paint finish shall be grey ANSI Standard No., 61 enamel over a rust-inhibiting phosphate primer.
 3. The switchboard bussing shall be plated copper and of sufficient cross-sectional area to continuously conduct rated full load current with a maximum average temperature rise of 50°C above an ambient temperature of 25°C. Provide grounding bus. The main horizontal or through-bus shall be rated as indicated on the drawings. The bus bars shall be rigidly braced to comply with the withstand rating of the switchboard. The main horizontal bus bars between sections shall

be located at the back of the switchboard to permit a maximum of available conduit area. The end section shall have bus bar provisions for the addition of a future section. The provisions shall include the bus bars installed and extended to the extreme side of the section and fabricated in such a fashion that the addition of a future section would require only the installation of a single splice bus connection per phase and neutral. The horizontal main bus bar supports, connections, and joints shall be bolted with carriage bolts and Belleville washers. The vertical bus shall be the same rating as the horizontal bus.

4. Each switchboard, as a complete unit, shall be given a single withstand short circuit current rating by the manufacturer. The withstand short circuit current rating shall certify that all equipment is capable of withstanding the stresses of a fault equal to the interrupting capacity rating of the smallest overcurrent protective device contained therein. Such rating shall be established by actual tests by the manufacturer on equipment constructed similarly to the subject switchboard. This test data shall be available and shall be furnished to the Architect/Engineer with the shop drawings submittal.
5. Main disconnect device shall be a molded case circuit breaker, up to 2500A, totally front accessible and front connectable. Main disconnect device shall be a molded case circuit breaker, up to 2500A, totally front accessible and front connectable. Line side circuit breaker connections are to be jaw-type plug on. Provide auxiliary tripping functions as called for. UL Listed as suitable for use as service equipment.
6. Distribution molded case circuit breakers shall be group mounted and shall be totally front accessible and front connectable. The circuit breakers shall be mounted in the switchboard to permit installation, maintenance and testing without reaching over any line side bussing. The circuit breakers shall be removable without disturbing either the line side or load side cable terminations and all line and load side connections are to be individual to each circuit breaker. No common mounting brackets or electrical bus connectors will be acceptable. Line side circuit breaker connections shall be bolt-on type. Provide an externally operable mechanical means to trip the circuit breaker, enabling maintenance personnel to verify the ability of the circuit breaker trip mechanism to operate as well as exercise the breaker latch and operating mechanisms. Each type of circuit breaker assembly shall have undergone and passed heat tests according to UL test procedures and be UL Listed.
7. Ratings shall be as indicated in the Contract Documents. Circuit breakers within the switchboard shall be fully rated for the scheduled interrupting rating. Reducing breaker ratings on the basis of "series rating" is not acceptable.
8. Manufacturers: Subject to compliance with contract documents, the following manufacturers are acceptable:
 - a. Square D "QED Power-Style" - Design Make.
 - b. Eaton Corporation "Pow-R-Line".
 - c. General Electric by ABB "AV-Line".
 - d. Siemens "SB Series".

B. Branch Circuit Panelboards (208Y/120 volt):

1. Provide branch circuit panelboard as indicated in the "Panelboard Schedule" and as located on the drawings. Panelboards shall be equipped with quick make/quick break thermal-magnetic, molded case circuit breakers as scheduled.
2. Panelboard bussing and lugs shall be copper. Provide grounding bus in each panelboard, securely bonded to the box. Panelboard bus structure and main lugs or main circuit breaker shall have current ratings as indicated. Such ratings shall be established by heat rise tests, conducted in accordance with UL Standard 67.
3. Provisions for additional circuit breakers shall be such that field addition of connectors or mounting hardware will not be required to add circuit breakers to the panelboard. Bus connections shall be bolt-on.
4. Each panelboard, as a complete unit, shall have a short circuit current rating equal to or greater than the rating shown on the Panelboard Schedule or on the plans. All panelboards shall be fully rated. "Series Ratings" are NOT acceptable. Reducing breaker ratings on the basis of series rating is not acceptable.
5. The panelboard bus assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be specified in UL Standard 50 cabinets. Wiring gutter space shall be in accordance with UL Standard 67 for panelboards. Each front shall include a door and have a flush, stainless steel, cylinder type lock with catch and spring-loaded door pull. All panelboard locks shall be keyed alike. Doors shall be mounted by completely concealed steel hinges. A circuit directory frame and card with a clear plastic covering shall be provided on the inside of the door. Fronts shall be of code gauge, full-finished steel with rust inhibiting iron phosphate sealer and baked enamel finish. Minimum box width shall be 20 in. Provide door-in-door construction
6. Panelboards with main circuit breaker shall have inherent and listed coordination of the main and branch circuit breakers.
7. Ratings shall be as indicted on the Panelboard Schedule.
8. Manufacturers: Subject to compliance with Contract Documents, the following manufacturers are acceptable:
 - a. 208Y/120 Volt and 240/120 Volt:
 - 1) Square D "NQ" - Design Make.
 - 2) Eaton Corporation "PRL1".
 - 3) General Electric by ABB "AQ".
 - 4) Siemens.

C. Circuit Breakers:

1. Circuit breakers below 400 amp frame shall be molded case with inverse time and instantaneous tripping functions, unless indicated otherwise in contract documents.
2. Circuit breakers 400 amp frame and above shall be 100% rated and equipped with adjustable solid state trip units with front adjustable short time, short time delay, long time, long time delay, and instantaneous trip functions as indicated.
3. Listed combination of coordinated circuit breakers shall be verified by the equipment manufacturer utilizing published data sheets. Confirm listings shall be submitted.
4. Lugs shall be mechanical, rated for 60/75° AL/Cu.
5. Branch circuit breakers shall be quick-make, quick-break, thermal-magnetic and trip indicating, and multipole breakers shall have common trip. Single pole 15 and 20 ampere circuit breakers shall be UL listed as "Switching Breakers" at 120V ac or 277 V ac and carry the SWD marking.
6. Ground-Fault circuit breakers shall be quick-make, quick-break, thermal-magnetic, 5 milliampere ground fault sensing and trip indicating, and multipole breakers shall have common trip. The ground fault circuit breakers shall not occupy any more space than a standard breaker of the same number of poles.
7. Arc Flash Energy Mitigation:
 - a. Provide the following arc flash energy mitigation system for all circuit breakers 1200A and larger.
 - b. Arc Energy Reduction Maintenance Switch
 - 1) Equipment main circuit breaker shall have a selector switch in the front of the unit enclosure for maintenance periods. The switch shall be labeled "Normal" and "Maintenance". The normal position shall utilize the standard trip settings of the breaker. The maintenance position shall utilize a quicker series of trip settings to reduce the potential arcing energy. The selector switch shall have a protective flip up cover. LED warning light on the face of the unit enclosure shall indicate when in the maintenance mode and have appropriate signage. The system shall be fully wired and tested by a factory authorized/trained technician.
8. Ratings shall be as indicated in the Contract Documents.
9. Manufacturers: Subject to compliance with contract documents, the following manufacturers are acceptable:
 - a. Square D Micrologic trip unit - Design Make.

- b. Eaton Corporation Optim 550 trip units for circuit breakers 400 - 1600 amp frame or RMS 610 trip units for 2000 amp frame to 6000 amp frame.
 - c. General Electric Spectra RMS or MicroVersa trip unit.
 - d. Siemens Sentron Sensitrip III trip unit.
- 10. Enclosed circuit breakers shall be molded case, thermal-magnetic type, ratings as noted, with overcenter, trip-free, toggle-type operating mechanism, quick make/quick break action and positive handle indication. Multiple pole breakers shall be common trip type. Each circuit breaker shall have a permanent trip unit containing individual thermal and magnetic trip elements in each pole. Provide provisions for padlocking in the "off" position. Breakers shall be calibrated for operation in an ambient temperature of 40°C and shall be suitable for mounting and operating in any position. Breakers shall have removable lugs, UL listed for copper and aluminum conductors. Breakers shall be installed in NEMA 1 general purpose, surface enclosures, unless otherwise noted.
 - a. Manufacturers: Subject to compliance with Contract Documents, the following manufacturers are acceptable:
 - 1) Square D
 - 2) Cutler Hammer
 - 3) General Electric by ABB
 - 4) Siemens

D. Power Meter

- 1. Where indicated on the drawings, provide a factory installed unit mounted power meter with the following parameters:
 - a. LCD or LED display.
 - b. Line voltage control power.
 - c. Voltage input with overcurrent protection and disconnecting means.
 - d. True RMS voltage and current measurement.
 - e. Metered parameters: Phase current, line voltage, phase voltage, frequency, power factor per phase and three phase total, real power per phase and total, reactive power per phase and total, apparent power per phase and total, total real energy, total reactive energy, total apparent energy, user configured sliding window for real, reactive and apparent power peak demand. Sampling rate shall be 512 sample points per cycle minimum. Waveform capture with adjustable triggers.
 - f. Accuracy: Energy, and demand power: 0.2% in accordance with ANSI C12.20Instrument current transformers shall be factory wired to shorting blocks to prevent open-circuiting the current transformers under energized conditions. The meter shall also be user programmable for current to any CT ratio.

- g. Capable of metering up to 480 volts without external potential transformers. The meter shall also be user programmable for voltage range to any PT ratio.
- h. Communications: Modbus RTU, TC/IP, etc.
- i. Acceptable Manufacturers:
 - 1) Equipment (Unit Manufacturer)
 - 2) Square D
 - 3) Eaton
 - 4) Shark

E. Disconnect Switches:

- 1. Shall be heavy-duty type three-pole, with "Quick Make/Quick Break" operating handle mechanically interlocked with the cover, horsepower and voltage rated to match equipment served. Where indicated switches shall be provided with dual-element, time delay, rejection type fuses. Switches shall be installed in NEMA 1, 12 for indoor use, NEMA 4X for outdoor use. Provide provisions for padlocking in the "off" position. Provide neutral bar in single phase or three phase, four wire circuits, and ground bar in all switches. Provide auxiliary contacts where called for.
- 2. All disconnects connected downstream of ASD's shall have a normally open and normally closed auxiliary contacts which shall be wired to the ASD to indicate disconnect is open.
- 3. Manufacturers: Subject to compliance with Contract Documents, the following manufacturers are acceptable:
 - a. Square-D - Design Make.
 - b. Cutler Hammer.
 - c. General Electric.
 - d. Siemens.

F. Elevator Control Switch:

- 1. Provide elevator control switch in a single NEMA 12 enclosure with required relays, control transformer and other options listed below.
- 2. The elevator control switch shall be constructed, listed and certified to the standards listed below:
 - a. Enclosure Switches; UL 98.
- 3. All work shall be performed in accordance with the latest edition of the following:
 - a. NFPA 70 - Section 620-51 (a-c), 620-62, 620-91 (c).

- b. ANSI/ASME A17.1 - Section 102.2 (c) (3).
 - c. BOCA 3006.2.3.
 - d. NFPA 72 - Section 3-9.4.4.
- 4. The elevator control switch shall have an ampere rating as indicated on drawings and shall include a horsepower rated fusible switch with shunt trip capabilities.
 - 5. Provide with current limiting fuses at 200,000 amp RMS symmetrical of size(s) coordinated by the elevator manufacture for protection of their equipment.
 - 6. The elevator control switch shall include a 100VA control power transformer with primary and secondary fuses 120 volt secondary.
 - 7. The elevator control switch shall include an isolation relay external dry contact indication (3PDT, 10 amp, 120 volt).
 - 8. A normally open dry contact from the fire alarm system shall energize an isolation relay and activate the shunt trip solenoid.
 - 9. The switch shall include a 120 volt key test switch and a 1-NO/1-NC mechanically interlocked auxiliary contacts rated 5 amp, 120 volt AC.
 - 10. The switch shall also include the following:
 - a. "On" pilot light (green).
 - b. Isolated full capacity neutral.
 - c. Fire alarm monitor relay.
 - d. Main switch auxiliary contacts (1-NO/1-NC).
 - 11. Design Make: Eaton Corp.
 - 12. Approved Manufacturers: Littlefuse, VTI, Siemens.

G. Fuses:

- 1. All fuses rated 600 volts and below shall be rejection type dual-element, time-delay type. Provide two (2) complete sets of fuses for all fusible devices. Deliver spare fuses to the Owner and obtain receipt.
- 2. Manufacturers: Subject to compliance with Contract Documents, the following manufacturers are acceptable:
 - a. Fuses 600 Amperes and Below: Bussman Type FRS-R (600 volts), Bussman Type FRN-R (300 volts) or equivalent.
 - b. Fuses Rated Above 600 Amperes: Bussman Type KRP-C or equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All equipment shall be grounded per the NEC.
- B. Electrical distribution equipment shall have lugs/terminations suitable for the indicated conductor size. Where conductors have been oversized for voltage drop and where approved by the Engineer it shall be allowed to reduce the conductor size using hydraulically crimped splice in a box next to the distribution equipment to allow for standard lug termination.
- C. Distribution switchboards shall be mounted on 4 in. high concrete pads which shall extend 3 in. on all sides. Securely bolt the unit to the pads for proper horizontal and vertical alignment.
- D. Provide pad lockable branch circuit breaker device to hold circuit breaker in the closed position, but not prevent overcurrent protection, for all branch circuits serving fire alarm controls panels, emergency lighting and life safety branch circuits.
- E. Identification:
 - 1. Identify all items of equipment as described in Section 260501-3.1, Identification. Identification shall be provided for switchboards, panelboards, transformers, ASD's, motor starters, disconnect switches, enclosed circuit breakers, switchboard main/distribution breakers, MCC's automatic transfer switches, UPS's, generators, surge suppression devices, control panels, switchgear, etc.
 - 2. Switchboards, panelboards, etc. shall have a label indicating name/tag ID, feeder source, conductor color convention and for service entrance locations the available short circuit current.

3.2 ELECTRICAL LOAD TEST

- A. Conduct a load test prior to request for final payment and comply with the following:
 - 1. Energize maximum normal light and power load for a period of two hours when scheduled.
 - 2. Record voltage at service and at each panel.
 - 3. Measure current in each phase of all feeders.
 - 4. Adjust transformer taps as directed by engineer after review of report.
 - 5. Provide and install all necessary metering equipment.
 - 6. Owner's Representative or Site Representative shall witness the test.

7. Before final acceptance specified test shall be completed to the satisfaction of the Owner's Representative who shall be sole judge of the acceptability of such tests and who may direct the performance of such additional tests as deemed necessary in order to determine the acceptability of the systems, equipment, material and workmanship. Additional tests required by the Owner's Representative shall be provided at no additional cost. Protective equipment shall be actuated in a manner that clearly demonstrated their workability and operation.

3.3 CLEANING

- A. At the completion of the project, while equipment is de-energized, it shall be thoroughly cleaned to a shipped condition using methods in accordance with the manufacturer's recommendations. Utilize vacuum for cleaning and not compressed gas.

3.4 SPARE PARTS

- A. Deliver loose equipment to the Owner and obtain receipt for fuses, keys to panelboards, etc.

3.5 DISCONNECT DEVICES

- A. All disconnect devices downstream of ASD's: Provide wiring, conduit and connections between ASD and disconnect auxiliary switch to ASD.

END OF SECTION

SECTION 262713 - ELECTRIC SERVICE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide labor, materials, equipment and services for the complete installation of an electric service and related Work required in these Contract Documents. The Utility Company is National Grid.

1.2 UTILITY COMPANY

- A. Include all utility company fees and charges for service as part of contract.

1.3 QUALITY ASSURANCE

- A. All methods of construction, details of workmanship, that are not specifically described or indicated in the contract documents, shall be subject to the control and approval of the Owner's Representative. Equipment and materials shall be of the quality and manufacture indicated in their respective sections of the specifications. The equipment specified is based upon the acceptable manufacturers listed. Equipment types, device ratings, dimensions, etc., correspond to the nomenclature dictated by those manufacturers. All equipment shall be tested at the factory. Standard factory inspection and operational tests will be acceptable.
- B. Installation shall be accordance with utility requirements NFPA 70 (National Electrical Code), National Electrical Safety Code (NESC), state codes, local codes, and requirements of authority having jurisdiction.
- C. Equipment shall be designed, manufactured, assembled, and tested in accordance with the latest revisions of applicable published ANSI, NEMA and IEEE Standards.

1.4 SUBMITTALS

- A. All items of equipment and accessories including the following:
 - 1. Underground ductbank materials.
 - 2. Billing Instrument transformer enclosure.
 - 3. Utility Company mast anchoring detail.
 - 4. Equipment pad/vault.
- B. Send three copies of submittals to the Utility Company for review before sending submittals to Engineers. Include one (1) Utility Company approved copy with submittal drawings for review.

1.5 SERVICE CHARACTERISTICS

- A. Secondary Service:

1. Low Voltage: 208/120 grounded, wye, three phase, four wire, 60 Hz.
2. Source:
 - a. Utility Company pad mount transformer, for underground service.

1.6 UTILIZATION VOLTAGES

- A. Building power system shall be a nominal 208/120 volt, three phase, four wire, solidly grounded, 60 Hz system.

1.7 UTILITY COMPANY COORDINATION

- A. Coordinate entire electric service with Utility Company.
- B. Do not interrupt electric system until approved in writing, coordinated so outages occur at Project Site convenience.
- C. Coordinate switching requirements with utility company, as approved in writing by the Owner.

1.8 DEMAND CONTROL SYSTEM INTERFACE

- A. Coordinate with utility company, and provide all requirements for interfacing demand pulse signaling equipment on utility company kWH/demand metering instrument, and pay all fees and charges.

PART 2 - PRODUCTS

2.1 UNDERGROUND SERVICE DUCTBANK

- A. Refer to Section 260501.

2.2 TRANSFORMER PAD

- A. Refer to Drawings.

2.3 UTILITY COMPANY METERING ACCOMMODATION

- A. Verify all requirements with Utility Company before proceeding.
- B. Utility Company shall furnish all billing instrument CT and PT transformers.
- C. Provide code gauge metal cabinet, as approved by Utility Company, to house billing instrument transformers.
- D. Provide Meter Backboard:
 1. Use 3/4 in. x 5 ply marine grade plywood.
 2. Paint front and back of plywood with two (2) coats of exterior gray paint.

3. Size as required by utility company.

PART 3 - EXECUTION

3.1 UTILITY COMPANY METERING ACCOMMODATION

- A. Verify all installation requirements with utility company before proceeding.
- B. Install meter backboard. Space board from wall when located on outside wall. Provide required clearances.
- C. Mount CT cabinet where called for and as directed by the Utility Company.
- D. Install instrument current and potential transformers in cabinet.
- E. Provide 1-1/2 in. rigid galvanized steel conduit from the instrument transformer location to the meter backboard.
- F. Install all test devices furnished by the Utility Company.
- G. Utility Company shall provide all Utility Company metering instruments. Install all meter sockets as required.
- H. Provide wiring from meter instrument to metering transformers as directed by Utility Company.
- I. Provide grounding, connections and miscellaneous materials required.

3.2 INSTALLATION AT RISER POLE

- A. Terminate at existing riser pole.
- B. Stub conduit at position directed by Utility Company.
- C. Provide hot dipped galvanized steel rigid conduit at riser.
- D. Stub active conduit to height directed by Utility Company and cap.
- E. Stub spare conduit to height directed by Utility Company and cap waterproof with threaded cap.
- F. Strap conduit to pole every 4 ft.
- G. Ground as directed by Utility Company.

END OF SECTION

SECTION 263213 - POWER GENERATION - GENERATOR, AUTOMATIC TRANSFER SWITCH
AND ACCESSORIES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services for the complete installation of generator, automatic transfer switch and related work required in these Contract Documents.

1.2 QUALITY ASSURANCE

- A. All methods of construction, details of workmanship that are not specifically described or indicated in the contract documents, shall be subject to the control and approval of the Owner's Representative. Equipment and materials shall be of the quality and manufacture indicated in their respective sections of the specifications. The equipment specified is based upon the acceptable manufacturers listed. Equipment types, device ratings, dimensions, etc. correspond to the nomenclature dictated by those manufacturers. All equipment shall be tested at the factory. Unless specified elsewhere, standard factory inspection and operational tests will be acceptable.
- B. Installation shall be accordance with NFPA 70 (National Electrical Code), NFPA 110 (Standard for Emergency and Standby Power Systems), National Electrical Safety Code (NESC), state codes, local codes, and requirements of authority having jurisdiction.
- C. Equipment shall be designed, manufactured, assembled, and tested in accordance with the latest revisions of applicable published ANSI, NEMA, UL and IEEE Standards. If skintight enclosure is used, the equipment shall conform to UL 2200.
- D. System emissions shall meet or exceed the EPA and Code of Federal Regulations 40CFR.

1.3 SUBMITTALS

- A. Submit shop drawings only for manufacturers named. Submission of other manufacturers will be rejected unless the terms of equivalents and substitutions stated in the General Provisions are followed.
- B. Submit shop drawings on equipment and accessories to include the following:
 - 1. Engine-generator set, including engine, radiator, alternator, circuit protection, fuel consumption, exhaust flow/temperature, noise (dBA), performance ratings (kW, starting kVA, pf, voltage, etc.), thermal ratings, heat generation.
 - 2. Engine controls, including starting controls, governor, etc.
 - 3. Generator instrumentation, voltage regulator, insulation class, etc.
 - 4. Catalog cuts, bill of materials, descriptive data, spare parts list for specified equipment.

5. Mounting arrangement, floor plans, elevations, overall dimensions including accessories, foundation, bedrail, and/or bolts, power and control conduit entrance space.
6. Weatherproof enclosure: dimensions, elevation, plan, attenuation, cooling, accessories, etc.
7. Batteries, mounting rack, accessories.
8. Gas regulator.
9. Automatic transfer switch and accessories.
10. Remote annunciator panel.
11. Software and details of remote monitoring system.
12. Wiring diagrams of all equipment, external and internal connections and interconnections.
13. Emergency shutdown switch.
14. Factory tests and field supervision reports as called for. Include information described in 1.4 below pertaining to field supervision.

C. Composite Instruction Books shall include as a minimum the following:

1. Instructions covering overall equipment.
2. Instructions covering all major and serviceable components, and accessories.
3. Recommended spare parts with current prices.
4. Complete renewal parts information.
5. Quantities of oil/coolant/etc.
6. Instructions, both individually and collectively, shall adequately describe receipt, handling, care, inspection, installation, operation, and maintenance of equipment.
7. Instruction books shall be used for equipment installation, and submitted prior to project closeout.
8. Factory trained maintenance provider contact information.
9. System error code (alarms, faults, etc.) list with descriptions.

1.4 STANDARDS AND TESTS

- A. Equipment covered by these specifications shall be designed, manufactured, assembled, and tested in accordance with the latest revisions of all applicable published ANSI,

NEMA, and IEEE Standards, the requirements of NEC, NFPA 37, NFPA 110, UL 1008 and UL 2200 Standards. State and local requirements.

- B. Furnish submittals of field test reports covering field tests and inspections performed and conducted by manufacturer's representative.

1.5 FIELD SUPERVISION

- A. Submittal shall state that adequate local within 75 mile radius of project locations field supervision and service, by competent qualified representative of the manufacturer, who is regularly engaged in working on this type of equipment, will be available at any time.
- B. Submittal shall state address of nearest vendor's place of business, telephone number and name of person to contact for field service.
- C. Provide field supervision/service at no additional cost to cover inspection, test, and start-up of this equipment.
- D. Submittal shall state the amount of field supervision/service recommended by vendor to cover critical points of installation, inspection, test, and start-up.
- E. Provide proposal for a yearly maintenance agreement for time beyond the warranty period.
- F. The above data shall be included with submittals.

1.6 RIGGING

- A. Provide rigging to unload, move, transport, set in place, erect, etc.

1.7 WARRANTY

- A. Provide a warranty for the specified equipment to be free from defects in materials and workmanship, whether functional or nonfunctional, replace or repair without cost, defects which, with normal usage, appear within one (1) year of project closeout.
- B. During the warranty period provide preventative maintenance as recommended by the manufacturer for the system every six (6) months.

1.8 TRAINING

- A. Provide verbal and written training to facility appointed personnel in the proper and safe manner of operating equipment.
- B. Training shall be at a time convenient for the Owner, not during system start up/testing and be a minimum of 4 hours or as needed for the Owner personnel to understand the system operation and maintenance.

1.9 DESCRIPTION OF SYSTEM OPERATION

A. Provide Engine-Generator System to meet the following functions:

1. Arrange system for automatic starting upon failure of normal source voltage.
2. Provide programmable one-second time delay, field adjustable from 0 to 9999 seconds. Delay time between normal source failure and engine(s) starting.
3. Initiate engine(s) starting cycle from transfer switch auxiliary dry contact.
4. Transfer loads from normal source power to emergency source when engine-generator reaches 90% of its rated voltage.
5. Retransfer emergency loads from emergency generator to normal source ten (10) minutes after normal source has reached 90% or more of normal voltage. Control shall be field programmable from 0 to 9999 seconds.
6. Retransfer emergency loads from emergency generator to normal source instantaneously when normal source has reached 90% or more of normal voltage, if emergency generator has failed while supplying load.
7. Run engine for a period of ten (10) minutes after retransfer of emergency loads to normal source. Engine-generator(s) will then shut down, automatically resetting and leaving all controls ready for the next emergency start condition. Period shall be programmable from 0 to 9999 seconds.
8. Use integral automatic transfer switch time clock to automatically exercise engine once every four weeks for 1 hours. Time clock contacts shall simulate loss of normal voltage; start engine, and shut engine down after fifteen minutes of operation. The load shall not transfer to the emergency source during the exercise time. Provide a selector switch to permit cycling engine-generator under load or no-load conditions.
9. Provide interconnection with Facility building management system. Communication shall be through the Facility network system and shall communicate generator status including, faults.
10. Shall shutdown via remove emergency shutdown button.

PART 2 - PRODUCTS

2.1 ENGINE-GENERATOR SET

A. General: The system shall meet the following parameters.

1. 208Y/120 volts, 12 lead, three phase, four wire, connected, 60 Hz.
2. 300 kW stand-by rating at 0.8 power factor.

3. Minimum motor starting kVA rating shall be 730, based on 30% instantaneous voltage dip.
 4. Suitable for ambient conditions:
 - a. Ambient Temperature: -25°C to 40°C.
 - b. Altitude: 1000ft above sea level.
 5. Maximum of 247.5 in. L x 71 in. W x 80 in. H (with silencer).
 6. 7-11 in. WC of utility natural gas pressure.
 7. Maximum allowable combustion exhaust of 0.5 in. WC.
 8. Combustion exhaust temperature shall not exceed 1,277°F and 2,113 CFM.
 9. System fuel consumption shall not exceed 4,140 CFH GPH.
- B. Engine - Gaseous Fuel:
1. Single fuel carburetion for natural gas.
 2. Minimum six cylinder, four stroke cycle, 1800 rpm.
 3. Stand-by rating shall be adequate to provide maximum kW output of generator under full load and motor starting kVA requirements. The engine generator set shall be capable of picking up 100% of nameplate kW, after adjusting for site conditions (altitude, temperature), in one step with the engine generator set at operating temperature, in accordance with NFPA-110. A resistive load bank (1.0 pf) shall be acceptable for meeting the load requirements.
 4. Carburetor, secondary gas regulator, electric solenoid shutoff valve, strainer (fuel filter), gas shutoff cock.
 5. Provide primary gas regulator if required by characteristics of local utility gas supply. Gas pressure available at engine regulator is 7-11 in. WC.
 6. Full pressure lubrication system with positive displacement, mechanical, full pressure gear type oil pump, full flow oil filters with replaceable filter element, equipped with spring-loaded bypass valve as an insurance against stoppage of lubricating oil in the event filter becomes clogged; water-cooled oil cooler and thermostat.
 7. One or more oil or dry type air cleaners of sufficient capacity to protect engine working parts from dust and dirt.
 8. Water cooled with skid mounted, closed loop type radiator, belt-driven pusher fan, centrifugal water circulating pump, thermostat temperature control, liquid-cooled exhaust manifolds suitable for unit full load operation and 50°C ambient

condition. Provide radiator with duct connection flange. Rotating parts shall be protected against accidental contact. The cooling system shall be rated for full rated load operation in 50°C ambient conditions. Low coolant level sensor alarm and shutdown.

9. Provide 50/50 solution of propylene glycol for engine closed loop cooling system.
10. Provide thermostatically controlled water jacket heater suitable for the intended location and wiring, rated for 120 volt, single phase operation. Unit shall be sized to maintain unit temperature for optimum starting conditions. Provide circuit for this from a normal power source.
11. Engine speed isochronous (0% droop) electronic governing system capable of parallel operation with load sharing controls.
12. Battery starting system per manufacturer's recommendations. Voltage shall be suitable for the needed starting capability, batteries and voltage drop.
13. Engine mounted battery charging alternator (belt driven), 35 ampere minimum, and solid-state voltage regulator. Higher charging current unit shall be provided as recommended by the manufacturer.
14. An electric starter capable of three complete cranking cycles without overheating, before overcrank shutdown. Shall comply with NFPA 110.
15. The engine-generator set shall be mounted with vibration isolators on a heavy duty steel rail base to maintain proper alignment between components. The engine-generator set shall incorporate a battery tray with battery hold down clamps within the base rails. Provisions for stub up of electrical and fuel connections shall be within the footprint of the generator set base rails.

C. Generator/Alternator:

1. Synchronous, four pole, compatible with unit rpm, revolving field, fireproof construction. Brushless, permanent magnet exciter with solid state voltage regulator.
2. Insulation rating of alternator shall, at a minimum, meet requirements of NEMA Class H construction to comply with NEMA standard MG1-22.40 and 16.40. Temperature rise of rotor and stator shall be limited to Class F (155°C or 105°C maximum temperature rise of winding, measured by resistance method, at 40°C ambient) for standby rating.
3. Insulation rating of alternator shall, at a minimum, meet requirements of NEMA Class H 180°C construction to comply with NEMA standard MG1. Temperature rise of rotor and stator shall be limited to 150°C maximum temperature rise of winding, measured by resistance method, at 40°C ambient) for standby rating.

4. Voltage regulation within 0.5% plus or minus of rated voltage for any constant load from no load to full load.
5. Frequency regulation shall be isosynchronous from steady state no load to steady state rated load. Speed variations for constant loads from no load to rated load shall not exceed $\pm 0.25\%$ of rated speed, with constant ambient and operating temperature.
6. Provide plus or minus 5% voltage adjustment.
7. Total harmonic distortion (THD) shall not exceed 5% of rated voltage and no single harmonic shall exceed 3% of rated voltage.
8. Telephone influence Factor; TIF shall be less than 50 per NEMA MG1-22-43.
9. Terminal voltage re-established to within 2% of rated voltage within two seconds following any sudden change in load between no load and full load or between full load and no load.
10. Sealed, permanently lubricated ball bearings.
11. Direct-driven generator cooling blower.
12. Provide fixed field connections to AC output leads in extra-large terminal box with removable cover.
13. Provide adequate wiring space for conduits. Power cables shall exit the bottom of the generator.
14. Exciter shall be brushless, permanent magnet type.

D. Generator Auxiliary Equipment:

1. Provide generator output circuit breaker, three pole, common trip, thermal magnetic type, to completely protect the generator from overloads; frame size and trip rating as called for. Provide solid state trip unit and 100% rating for circuit breakers 250A and above with long time, short time and instantaneous adjustable settings.
2. Provide and install a clearly identified NEMA 12 surface mounted remote shutdown switch per generator manufacturer's recommendation similar to ASCO 12404. Provide wiring in conduit per manufacturer's recommendation.
3. Outdoor weather-protective housing with exhaust muffler installed and located within the housing. The housing shall have hinged side-access doors and rear control door. All doors shall be lockable. All sheet metal shall be primed for corrosion protection and finish painted with the manufacturer's standard color. All hardware (hinges, screws, bolts, door operator, etc.) to be stainless steel. Input and output air dampers with controlled damper motorized actuators shall be spring open and held closed when not in use. Unit sound attenuation shall limit

the noise level to 78 dB at 23 ft. Provide concrete pad as detail on the drawings. Generator unit shall be UL 2200 labeled with enclosure installed.

4. Battery Heater: Provide pad type battery heater suitable for intended location. Provide circuit for this from a normal power source.

E. Acceptable Manufactures:

1. Cummins/Onan
2. Generac
3. Caterpillar (Design Make)
4. MTU/Detroit Diesel
5. Kohler

2.2 MICROPROCESSOR ENGINE-GENERATOR SET CONTROL

- A. The control shall have automatic remote start capability. Starting cycle shall be initiated by auxiliary contact(s) in automatic transfer switch. A panel mounted switch shall stop the engine in the STOP position, start and run the engine in the RUN position, and allow the engine to start and run by closing a remote contact, and stop by opening the remote contact when in the REMOTE or AUTOMATIC position.
- B. The control shall include a cycle cranking function. The cranking cycle, nonadjustable, shall consist of an automatic crank period of approximately 15 seconds duration followed by a rest period of approximately 15 seconds duration. Cranking shall cease upon engine starting and running. Two (2) means of cranking termination shall be provided, one as a backup to the other. Failure to start after three cranking cycles (75 seconds) shall shutdown and lockout the engine, and visually indicate an overcrank shutdown on the panel.
- C. The control shall shut down and lock out the engine upon: failing to start after the specified time (over crank), overspeed, low lubricating oil pressure, high engine temperature, or operation of a remote manual stop station. Provide audible alarm and visual indication of the particular contact that operated, and reset pushbutton. Provide common fault contacts, wired to terminal board for remote alarm indication.
- D. The control shall provide a twelve light (LED) minimum engine monitor on the control panel; one red light for each of the five shut downs (except the remote manual stop), and one yellow light each for the high engine temperature and low engine oil pressure prealarms, and one green run light. The control panel monitor shall include; a flashing red light to indicate the generator set is not in automatic start mode, a yellow light to indicate low coolant temperature, a yellow light to indicate low fuel, a red light to indicate battery charger failure, and one red light for auxiliary use (for a total of twelve). A panel mounted switch shall reset the engine monitor and test the lamps. The engine-generator set starting battery(ies) shall power the monitor. Operation of shut down circuits shall be independent of indication and prealarm circuits. Individual relay signals shall be provided for each indication for external circuit connections (not to exceed 1/2 amp draw) to a remote annunciator. A common contact for external connection to an audible alarm shall be provided.

- E. Provide a low coolant level shutdown, which shall be indicated as a high engine temperature fault.
- F. The NEMA 1 enclosed control panel shall be mounted on the generator set with vibration isolators. The control shall include surge suppression for protection of solid state components. A front control panel illumination lamp with On/Off switch shall be provided. Control panel mounted indicated meters and devices shall include: Engine Oil Pressure, Oil Temperature, Coolant Temperature, low coolant alarm/shutdown, DC Voltmeter, and Running Time Meter (hours); Voltage adjusting rheostat, locking screwdriver type, to adjust voltage $\pm 5\%$ from rated value; Analog AC voltmeter, dual range, 90 degree scale, 2% accuracy; Analog AC Ammeter, dual range, 90 degree scale, 2% accuracy; Analog Frequency meter, 45-65 Hz, 90 degree scale, ± 0.6 Hz accuracy; kW; kVA; power factor; Seven position phase selector switch with OFF position to allow meter display of current and voltage in each generator phase. Provide shorting-type terminal boards for all current transformer secondary windings. Liquid crystal display (LCD) shall be utilized for display of metered items and alarm/trouble indication.
- G. Control panel shall have an interior RJ45 outlet for Ethernet connection and provide all information indicated herein for remote monitoring utilizing the manufacturer software.
- H. Provide remote annunciator at first floor Aide Station for engine-generator alarm function. Alarm functions for generator are as follows:
 - 1. Visual signals for: Battery charger AC supply failure, battery charger DC output failure, engine-generator running.
 - 2. Visual and audible signals for: Overspeed, low lube oil pressure, high and low water temperature, overcranking (failure to start), overload.
 - 3. Provide all of the indications and audible alarms called for above. Provide alarm silence and lamp test switches.

2.3 BATTERIES

- A. Provide batteries as follows:
 - 1. Lead acid type, VDC, quantity and connections as recommended by the generator set manufacturer.
 - 2. Provide corrosion-resistant battery mounting rack, battery interconnecting cables and terminals, etc.
 - 3. Provide battery heating pad suitable for the intended location, 120 VAC and power connection to maintain 10 second starting time.

2.4 AUTOMATIC TRANSFER SWITCH (ATS)

- A. Description:

1. The automatic transfer switch shall consist of a power transfer switch and a microprocessor based control module, interconnected to provide complete automatic operation. Double throw, mechanically and electrically interlocked. All main contacts shall be of silver composition. The operating transfer time shall be a maximum of 1/2 of a second. Transfer switch shall be capable of manual transfer in order to meet the requirements of UL 1008 and UL listing requirements as described UL's "Electrical Construction Materials."
2. Operated by momentary energization of a single coil with mechanical latching in both normal and emergency positions.
3. Operating voltage for transfer obtained from source to which load is to be transferred.
4. Three phase, four wire, three pole, solid neutral 120 volt normal and emergency power source contacts.
5. Ampere rating as called for, rated for continuous duty.
6. Provide magnetic blowout coils and arc barriers on each pole.
7. Provide voltage supervisory relays on each phase of both normal and emergency sources, such that transfer and engine start is affected should any one phase of the three phase supply be below 80% of normal voltage.
8. Three-cycle closing and withstand rating minimum 35,000A rms symmetrical amperes without the use of current limiting fuses.
9. Manufacturer's standard mechanical type lugs suitable for aluminum or copper conductors. Provide lugs for each power cable, phase and neutral. Cable size and conductor type as called for. Terminals front connected.
10. Provide dual transfer switch operator with adjustable time delay 0-9999 seconds set at 3 seconds for a neutral position to allow motor loads residual voltage to decay between the time that the closed source is opened and the open source closed.
11. Provide pilot lights (LED's) as follows:
 - a. Green, indicating normal switch position.
 - b. Red, indicating emergency switch position.
 - c. Fuse for each light.
12. Provide the following accessory features:
 - a. Adjustable time delay before engine starting, field programmable from 0-9999 seconds. Factory set at 1s.

- b. Adjustable time delay on transfer to emergency, field programmable from 0-9999 seconds. Factory set at 3s.
- c. Adjustable time delay on retransfer to normal field programmable from 0-9999 seconds, factory set at 300 seconds. Final delay to be coordinated with elevator installation.
- d. After retransfer to normal, the engine generator set shall be allowed to run, unloaded, for an additional 0-9999 seconds, factory set to 300 seconds.
- e. Test switch, engine start and transfer.
- f. Pushbutton to bypass time delay on retransfer back to "normal" position.
- g. Engine start contact.
- h. Time clock exerciser with transfer. Retransfer shall be automatic at end of exercise period. Provide a bypass switch for manual exercise and a selector switch to permit cycling engine-generator under load or no-load conditions.
- i. Auxiliary contacts for normal, emergency and neutral position, two form C for each position. No common wires for auxiliary contacts. Bring wires to terminal block, suitably labeled.
- j. Accommodate control input for load shedding. Signal shall drive ATS to neutral position.
- k. A contact which closes when normal source fails for initiating engine starting, rated min, 10A @ 32 VDC.
- l. A contact which closes when unit is on emergency power and normal power returns and is suitable for use. Contact shall be wired to elevator controller.
- m. Provide ground studs to enclosure for mechanical lugs for size #4/0 copper cables.
- n. Provide any other accessories as may be required to achieve operation as described in Article 1.9.
- o. Provide box of spare fuses and LED's for pilot lights.
- p. Provide NEMA 12 sheet metal enclosure for all mounting, front door hinged.
- q. All time delay relays shall be field programmable and shall show the actual setting time in minutes or seconds.

- B. Design Equipment: Russelectric RMT (single operator) or RMTD (dual operator) series.
- C. Make: ASCO, or acceptable generator set manufacturer's ATS utilizing specified make's transfer switch.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

- A. General Requirements:
 - 1. Completely coordinate installation, assure that elements of the system are compatible, operational and correct.
 - 2. Provide rigging to unload, move, and set/bolt in place engine-generator and ATS. Provide concrete pad as detailed on the drawings.
 - 3. Provide miscellaneous bolts, washers, nuts, clips, lockwashers, small hardware, etc., of durium or equal rust resistant material, to make installation complete.
 - 4. Refer to "Grounding" section of specifications.
 - 5. Install equipment plumb, level, and true.
 - 6. Leave maximum space available in front, alongside, etc., all items of equipment, to allow easy access and servicing of serviceable components. Meet NEC requirements.

3.2 WIRING

- A. Install power and control wiring between engine-generator set, transfer switch, battery charger, louvers, dampers, controls, coolers, batteries, day tank and all other various and related equipment. Provide all necessary wiring and interface equipment to interconnect generator system with the Facility building management system.
- B. Comply with Manufacturer's Instruction Books.
- C. Maintain phasing standards as called for and rest of the system.
- D. Color code and identify control and power wires and cables as called for.
- E. Provide copper, 600 volt insulation minimum, control wiring; do not splice.
- F. Provide "crimp-on" type terminal for control wire terminations, as called for.
- G. Provide liquid-tight jacketed flexible conduit for all connections to engine, generator, and to day tank. All connections shall account for the anticipated vibration.
- H. Provide green ground conductor in each conduit run.

3.3 ENGINE - GENERATOR INSTALLATION

- A. Install where indicated. Refer to drawings for installation details, pad details, etc.
- B. Provide necessary anchor bolts at proper locations, place by templates if required, for proper setting of engine-generator.
- C. Manufacturer's Representative shall provide lube oil and anti-freeze for initial start-up. Electrical Contractor shall provide all fuel for start-up and testing and leave tank at the full level upon completion.
- D. Entire system shall be complete and operational and shall be test operated, including simulated loss of normal power, all control devices shall be operated to test their function.
- E. Determine exact requirements, verify locations, and comply with applicable regulations in installing equipment.
- F. Provide the services of the manufacturer's representative to check out the system and instruct the Owner in the operation of the system. Furnish written statement to the Owner's Representative that the checkout and instruction service has been provided. Include statement that system operates properly, as called for. Submit statement as a submittal for review.

3.4 FUEL PIPING

- A. Division 22 shall provide natural gas piping to engine-generator and make final connection.
- B. Provide fuel filter, fuel solenoid valve, secondary regulator, gas shutoff cock, flexible fuel piping and fuel piping diagram.
- C. Coordinate fuel piping size with these items.

3.5 IDENTIFICATION

- A. For installations that have a single grounding location (connected to the main service entrance) provide signage indicating the following: "WARNING - SHOCK HAZARD EXISTS IF GROUNDING ELECTRODE OR BONDING JUMPER IN THE EQUIPMENT IS REMOVED WHILE ALTERNATE SOURCE(S) IS ENERGIZED."

3.6 ELECTRICAL LOAD TEST

- A. Conduct a resistive load bank test to the full capacity of the generator for four hours after completion of installation, but before connecting to the building system. Record system voltage, current, kW, pf, oil pressure and temperature every 15 minutes with the manufacturer recommended values in the test report. Upon successful completion of load bank test, complete connections to building system and perform an operational test as outlined in "B" below.

- B. Conduct a full operational test of complete system prior to request for final payment and comply with the following:
1. Start the generator by simulating a loss of utility power at each transfer switch.
 2. Energize maximum emergency light and power load for a period of one hour when schedule.
 3. Record voltage at generator and at each panel, using the same digital meter at each location.
 4. Measure current in each phase of all feeders, using the same digital meter at each location.
 5. Record the time from power loss to engine start and power transfer for each transfer unit.
 6. Reconnect circuits in an effort to provide balanced (within 10%) load on all feeders.
 7. Provide and install all necessary metering equipment.
 8. Owner's Representative shall witness the test.
 9. Provide complete test report with attendees, time, date, initial parameters, test results and sign off.
 10. Before final acceptance, specified tests shall be completed to the satisfaction of the Owner's Representative who shall be sole judge of the acceptability of such test and who may direct the performance of such additional tests as deemed necessary in order to determine the acceptability of the systems, equipment, material and workmanship. Additional tests required by the Owner's Representative shall be provided at no additional cost. Notify Engineer when load bank test is scheduled two (2) weeks prior to actual test.

3.7 EQUIPMENT PROTECTION

- A. Provide repair or replacement for all damage and defacement, whether functional or nonfunctional, to all equipment from the time it is unloaded, during installation, and during period of beneficial use, and until installation is accepted.

END OF SECTION

SECTION 265000 - LIGHTING

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 DESCRIPTION

- A. Provide interior and exterior lighting systems, including luminaires, hangers, supports, fittings, lamps, wiring, connections and controls, as indicated in the Contract Documents for complete and operational systems. Luminaires, in general, have been specified for the particular type of ceiling in which they are to be installed. Verify the ceiling construction details and provide luminaires suitable for the respective ceiling types and room finish schedule.

1.3 REFERENCES

- A. The following standards, criteria, codes, etc. shall be followed in the manufacture and installation of the lighting systems.
 - 1. NFPA
 - 2. NEC
 - 3. IESNA
 - 4. NEMA
 - 5. ANSI
 - 6. UL

1.4 ENERGY CONSERVATION WORK

- A. Work installed as part of this Contract will be eligible for energy rebates/incentives available. The energy rebate shall be paid directly to the Owner. The Division 26 contractor shall cooperate with the Owner and the funding source to provide proof of purchase information, quantities involved, fill out forms, etc., to accommodate all required paperwork. Include all costs associated with this requirement.

1.5 QUALITY ASSURANCE

- A. Luminaires shall be as specified in the "Luminaire Schedule". Luminaire types, appearance, characteristics, photometrics, finishes, etc., correspond to the specified manufacturer and associated series or catalog number listed in the "Luminaire Schedule". Products of other listed acceptable manufacturers shall be equivalent in every way to that of the luminaire specified. The Engineer reserves the right to disapprove any luminaire type submitted which they feel is not equal in quality, appearance or performance to the luminaire specified.
- B. Manufacturer's luminaire series or catalog numbers listed in the "Luminaire Schedule" indicate quality, type, and style, but may not cover required special design details.

Provide luminaires having such special details as noted in the "Luminaire Schedule", as indicated by the specified luminaire model number and as required for proper installation.

- C. All luminaires shall be new and bear a Nationally Recognized Testing Laboratories (NRTL) label for the service intended.
- D. Luminaires shall be products of manufacturers regularly engaged in the manufacture of the type of luminaires specified and shall be the manufacturer's latest standard design that complies with specification requirements.
- E. Verify the availability of all luminaires proposed to be used in the execution of the work prior to submitting same for approval. The discontinuance of production of any luminaire after such approval has been granted shall not relieve the Contractor from furnishing an approved luminaire of comparable quality and design at no additional cost.
- F. Photometric and operational data shall be provided only by qualified and certified organizations. Certification documentation shall be submitted with the luminaire information.
- G. Should there be any difference between drawings and schedules, secure from Architect/Engineer such information as necessary prior to providing proposal. When finishes are not definitely specified, they shall be as selected by the Architect and not be limited to standard finishes.
- H. Locations indicated for luminaires are approximate. Field coordinate exact locations as near as possible to the location indicated. Coordinate with the Engineer for any major location changes.

1.6 SUBMITTALS

- A. Product Data: For each luminaire type, include in a single submittal, in order of luminaire designation, the catalog "cut" sheet with complete manufacturer and model number. Product data should include the following:
 - 1. Manufacturer and Catalog Number.
 - 2. Features, accessories, materials and finishes.
 - 3. Physical description and dimensions of luminaires.
 - 4. Life, power input, output (lumens, distribution, CCT, and CRI) and energy-efficiency data.
 - 5. Photometric data and adjustment factors based on laboratory tests (space to mounting height ratio, coefficient of utilization complete values, IES distribution, candlepower distribution by angle and luminaire efficiency). Format shall be in accordance with IES TM-27.
 - 6. Power, signal, and control wiring diagrams between luminaires and controllers.
 - 7. Lens/Louver Type.

8. Driver/ballast with each type luminaire as applicable (type, sound rating, overload protection, voltage, input/fixture wattage, ballast factor, power factor, etc.).
 9. Integral battery inverters.
 10. Emergency lighting units, including batteries and chargers.
 11. Certification of IES LM-79, IES LM-80 and TM-21 testing for LED luminaires. Luminaires shall be tested in accordance with IES LM and TM standards.
 12. Proof of Energy Star listing.
 13. Warranty.
- B. Coordination Drawings: Provide coordination drawings in accordance with Section 260500. Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Luminaires.
 2. Suspended ceiling components.
 3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches of the plane of the luminaires.
 4. Structure members to which equipment and or luminaires will be attached.
 5. Initial access modules for acoustical tile, including size and locations.
 6. Items penetrating finished ceiling, including other luminaires, air outlets and inlets, speakers, sprinklers, access panels, ceiling mounted projectors, etc.
- C. Color Chips: Provide color chips of available finishes for luminaires upon request of Architect/Engineer.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Luminaires and equipment shall be delivered with NRTL and manufacturer's labels intact and legible. Broken, cracked and damaged materials and equipment shall be removed from the site immediately and be replaced with new materials and equipment. Luminaires and accessories shall be stored in protected dry locations in their original unbroken package or container. Luminaires shall be protected from dust and dampness both before and after installation. Luminaires shall be protected from paint and cleaning solvents during all phases of construction.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division hazard by a NRTL.

- C. UL Compliance: Comply with UL 1598 and UL 8750.
- D. Recessed Luminaires: Comply with NEMA LE 4.

2.2 LIGHT-EMITTING DIODE (LED) LUMINAIRES

- A. Luminaires shall be identical in construction features, options and appearance to the luminaires specified in the Luminaire Schedule. LED luminaires include white and RGBW systems as indicated on the luminaire schedule.
- B. Luminaires shall be provided with all cables, controllers, power supplies, drivers, connectors, terminators and accessories required for a complete installation. LED system shall utilize pulse width modulation, non-linear scaling techniques and reverse polarity protection.
- C. Provide dimming down to 10% as a minimum, or to percentage indicated or called for on the drawings. Unless otherwise indicated, the dimming control shall be a 0-10VDC signal
- D. RGBW LED systems where indicated shall be capable of at least 8-bit control of red, green, blue and white module. RGBW LED system shall be capable of setting each module with a unique and individual address. Each address shall be controlled independently by DMX or alternate method protocol. All RGB LED fixtures shall undergo a minimum of eight-hour burn-in testing during manufacturing.
- E. LED luminaires shall be high brightness and binned for forward voltage, luminous flux and wavelength.
- F. LED luminaires shall be tested in accordance with IESNA LM-79 (luminous output, power input, luminaire efficacy (lumens/watt), color temperature and color rendering index), IESNA LM-80 (L70, output luminous maintenance, 10,000 hour minimum test, calculation method is not acceptable) and IESNA TM-21/28. Luminaire output shall be a minimum of 100 lumens/watt. Rated life shall be a minimum of 50,000 hours at 70% output. Testing shall be performed by a US Department of Energy (DOE) accredited laboratory.
- G. Drivers shall be solid state Class 1 power supply/driver with universal input (120-277V). The system shall have a minimum 90% power factor, 3.5 maximum crest factor, minimum efficiency of 90%, a maximum of 20% THD and overload protection. Adequate heat sink capability shall be provided to ensure the rated life. Unit shall meet FCC rules and regulations.
- H. Where indicated luminaires shall have color tuning capability and control. System to have separate dimming (5-100%) and color (3000K to 5000K, or as indicated on drawings) adjustability. Control shall be Dali or DMX512 for controllability as indicated. The system shall utilize the most recent settings when energized.
- I. The luminaire (to include LED sources and drivers) shall have a full five (5) year minimum warranty for replacement and labor.
 - 1. Acceptable LED Node Manufacturers:

- a. Philips
- b. Osram
- c. Cree
- d. Nichea
- e. Lumiled

J. LED Emergency Drivers:

1. LED emergency drivers shall have the following minimum requirements:
 - a. Operate indicated fixtures at full illumination for 90 minutes minimum.
 - b. Universal voltage input (120 to 277V).
 - c. Upon loss of normal power, fixtures shall automatically switch to battery power.
 - d. Upon restoration of normal power, fixture shall return to normal mode and charge battery.
 - e. Battery shall be maintenance free, nickel cadmium type with a minimum life expectancy of seven (7) years.
 - f. Driver shall be suitable for the environment installed.
 - g. Driver shall be Class 2 and enclosed entirely in the fixture (except for down lights and exterior locations).
 - h. Units shall be listed for UL924 -Emergency Lighting and Power Equipment.
 - i. Minimum five (5) year non-prorated full warranty.
 - j. Factory installed.
 - k. Shall include an emergency system test switch integral to fixture.
 - l. Unit shall be self-testing and provide indication of unit failure.
 - m. Design Make: Iota, ILB-CP series or approved equal.

2.3 LUMINAIRE CONSTRUCTION

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

- B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- C. Lenses:
 - 1. Shall be listed materials tested in accordance with ASTM D-635, "Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position" and burns less than 2/5 inches per minute.
 - 2. The products shall have a smoke density of less than 75 when tested in accordance with ASTM D-2843, standard test method for "Density of Smoke from the Burning or Decomposition of Plastics".
 - 3. The flame spread rating shall not exceed 0-25 and smoke developed rating shall not exceed 450 in accordance with ASTM E-84, standard test method for "Surface Burning Characteristics of Building Materials".
 - 4. Self-ignition shall not occur below 600°F, in accordance with ASTM D-1929, standard test method for "Ignition Properties of Plastics".
 - 5. Materials shall remain in place 15 minutes at 175°F and fall from frame at 200° below ignition temperature in accordance with ASTM D-648, "Deflection Temperature of Plastics Under Flexural Load".

2.4 LUMINAIRE SCHEDULE

- A. Luminaire schedule is found on the contract drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 GENERAL INSTALLATION

- A. Comply with NECA 1.
- B. All luminaires shall be installed as per manufacturer furnished installation instructions.
- C. Provide for every luminaire as shown on the plans, or as scheduled on the drawings.

- D. Location of all ceiling and wall mounted luminaires shall be as indicated on the Architectural and Electrical drawings. The contractor shall verify ceiling type, construction, and material prior to ordering.
- E. Provide luminaires with an IC rating for luminaires installed in direct contact with insulation.
- F. Provide plaster frames for plaster ceilings and flanged frames for drywall ceilings.
- G. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- H. Luminaires shall be suitable and as recommended by the manufacturer for the actual intended mounting method and materials.
- I. Supports:
 - 1. Sized and rated for luminaire weight.
 - 2. Able to maintain luminaire position after cleaning and relamping.
 - 3. Provide support for luminaire without causing deflection of ceiling or wall.
 - 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.
- J. Flush-Mounted Luminaires:
 - 1. Secured to outlet box.
 - 2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
 - 3. Trim ring flush with finished surface.
- K. Wall-Mounted Luminaires:
 - 1. Attached to structural members in walls, to a minimum 20 gauge backing plate attached to wall structural members, or using through bolts and backing plates on either side of wall.
 - 2. Do not attach luminaires directly to gypsum board.
- L. Suspended Luminaires:
 - 1. Pendant and Rods:
 - a. Pendant mount luminaires from 1/4 in. threaded rods of required length.
 - b. Sleeve threaded rods with 1/2 in. EMT painted with color as directed by Architect/Engineer.

- c. Brace pendants and rods longer than 48 inches to limit swinging.
 - 2. Aircraft Cable:
 - a. Cables shall be 1/16 in. aircraft cable with end safety fittings. Cable shall be provided with 2 in. diameter mini-canopy and threaded coupler for attachment to a 1/4 in.-20 threaded stud extending 3/4 in. below ceiling.
 - b. Cable assembly shall include a spring-loaded adjustment device mounted in the fixture.
 - c. The Contractor shall be responsible for providing required supports for cable attachment.
 - d. For cord feed to the luminaire provide continuous cord clip of matching color to attach the cord to the cable.
 - e. Support per manufacturer's recommendations.
 - 3. Support stem mounted, single unit luminaires with approved outlet box and accessories that hold tem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
 - 4. Use tubing or stem for wiring at one point of continuous rows of luminaires and tubing, rod, or wire support for suspension for each unit of length of luminaire chassis, including one at each end.
- M. Ceiling-Grid-Mounted Luminaires:
- 1. Secure to any required outlet box.
 - 2. Use approved devices and support components to connect luminaire to building structure in a minimum of four locations, spaced near corners of luminaire. Utilize #10 steel wire; similar to that used to support the ceiling grid.
 - 3. Provide UL listed seismic hold-down clips and fasten to luminaires and to ceiling grid members at or near each luminaire corner.
 - 4. Install luminaires of sizes less than ceiling grid as indicated on reflected ceiling plans or center in acoustical panel and support luminaire independently with at least two metal channels spanning and secured to ceiling tees.
- N. Cove Lighting:
- 1. Installed so as to produce a continuous and unbroken band of light with no shadows or light gaps.
- O. In-Grade Luminaires:

1. Provide a minimum of 6 in. peat gravel at the bottom of luminaire to allow for drainage. When installed in a concrete walkway, secure luminaire to rebar to prevent luminaire from "floating" when concrete is poured.
 2. Seal conduit entry into luminaire to prevent moisture penetration into luminaire from conduit system.
 3. Secure faceplate of in-grade luminaires in accordance with manufacturer directions to compress gasket evenly to form a waterproof seal. The use of power tools to secure faceplate is not permitted.
- P. Provide all necessary accessories for "end-to-end" mounting where continuous rows of luminaires are indicated. All luminaire assemblies shall be grounded.
- Q. Luminaires installed in continuous rows may be fed by a single outlet if luminaires are UL approved and suitable for through wiring in luminaire raceway.
- R. New luminaires may be provided to replace existing luminaires indicated to remain or be reused, subject to shop drawing approval.

3.3 REMOTE BALLASTS/DRIVERS

- A. Remote ballasts shall be mounted in an approved NEMA 1 enclosure. Remote ballasts shall be located in areas easily accessible to maintenance personnel.
- B. Wiring from luminaire to remote ballast shall not exceed the ballast manufacturer's recommendations for distance.
- C. Remote ballast shall be clearly labeled indicating fixture served, voltage, panelboard and circuit number served from.

3.4 GROUNDING

- A. Ground all non-current carrying parts of all lighting luminaires.
- B. All grounding shall be accomplished with NRTL tested grounding connectors suitable for this purpose.

3.5 LABELING

- A. Attach a self-adhesive red dot label, 1/2 in. in diameter, to all luminaires with an integral battery backup and/or those tied into an emergency generator. Labels shall be attached to these fixtures or to adjacent ceiling tiles so that they are readily discernible for testing and maintenance purposes.

3.6 FINAL CLEANING

- A. Immediately prior to acceptance, damp clean diffusers, glassware, luminaire trim, reflectors, lamps, louvers, lens and similar objects of all luminaires. Remove all dirt, corrosion, foreign material, finger marks, and blemishes. Replace all burned out lamps and failed components.

3.7 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 - 2. Test of Emergency Lighting: Under supervision of Engineer, interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.
- D. Replace luminaires damaged during shipment, construction, or installation.

3.8 STARTUP SERVICE

- A. Comply with requirements for startup specified in Section 260936 "Lighting Controls."

3.9 ADJUSTING

- A. Provide adjusting the direction of aim of luminaires to suit occupied conditions. Adjustment may be required during hours of darkness.
- B. Final distribution shall be acceptable to the Owner and may take several attempts.

END OF SECTION

SECTION 270510 - COMMUNICATIONS, GENERAL

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services to perform operations required for the complete installation and related Work as required in Contract Documents. This section specifies general wiring requirements for systems provided under 27 Series sections of these specifications.

1.2 SUBMITTALS

- A. Refer to particular Specification Sections covering all systems. Submit system test reports as called for.

1.3 GENERAL REQUIREMENTS

- A. Provide conduit systems and special systems as called for.
 - 1. Provide conduit, wireway, wire terminations, etc., necessary to provide for system functions.
 - 2. Cross-sectional area of wires installed in a conduit shall not exceed 40% of the cross-sectional area called for in the National Electrical Code.
 - 3. Provide separate circuit power source for each system.
 - 4. Where allowable by Code and contract documents, special systems wiring may be installed without conduit. Installation and wire insulation types shall be as described by NEC, Article 725. All low voltage wiring circuits 50V and under shall:
 - a. Be adequately supported using bridle rings or other approved method when installed horizontally above accessible ceilings or run exposed in unfinished areas.
 - b. Be run in wall cavity or surface metal raceway where no access is available to wall cavity, in finished areas.
 - c. Be installed in conduit when installed vertically in Mechanical Rooms from panels and devices up to ceiling.
 - d. Be installed in conduit in all cases not specifically covered by the above cases, or where subject to physical damage.
 - e. Have the proper insulation and meet the requirements of NEC Article 300-22 when installed in plenums or other spaces used for environmental air.

- B. Identification:
 - 1. Provide consistent color code wiring and identify with permanently attached number to each end of each wire, except where color coding is prohibited to meet UL burglary protection requirements.
- C. Termination:
 - 1. Unless special terminations are required, such as coaxial cable termination, wires shall be terminated on screw type terminal blocks with metal terminal cabinets.
- D. Wiring Diagrams:
 - 1. Install systems in accordance with manufacturer's certified correct wiring diagrams.
 - 2. Provide record drawings for each system, with wire identification, numbers and colors, as installed.

PART 2 - PRODUCTS

2.1 MAKE AND SERVICE

- A. Provide devices and equipment by an established manufacturer for respective systems. All devices and equipment for which there is a listing shall be UL listed and FM approved.
- B. Provide system equipment and devices of one manufacturer who maintains a competent service organization and who shall be prepared to offer a service contract for maintenance of the respective system.
- C. Provide three service organization inspections for each system at four-month intervals during the year following final acceptance.
- D. Correct defects found in the system at the time of these inspections.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide complete installation in a neat and workmanlike manner including all accessories and appurtenances for a complete operating system, including equipment mounting backboards, power supplies, wiring, etc.
- B. Each system installation shall be supervised, tested, adjusted and approved by authorized representative of the manufacturer of the system devices and equipment.
- C. Provide written statement from the authorized representative of the manufacturer of the system devices and equipment that the completed system has been inspected and tested and is approved.

- D. Riser and wiring diagrams are not intended as final installation drawings but only as a guide for bidding. Install system based on final wiring drawings prepared by the manufacturer of the system.

3.2 WIRING

- A. Wire sizes shall be as recommended by system manufacturer.
- B. #14 AWG wire, minimum unless otherwise called for.
- C. #12 AWG wire, minimum for alarm signal circuits and all power supplies.
- D. Provide #20/2 copper minimum twisted and shielded with overall jacket for audio frequency circuits. Shield shall be Mylar backed aluminum foil with drain wire, or copper braid. Do not provide spiral wrap shielding.
- E. Provide coaxial cable as called for, for video and RF distribution.
- F. Do not install low level lines such as microphone wires in same conduit with high level lines such as speaker wires.
- G. All final wire connections and terminations shall be performed by an authorized representative of the equipment manufacturer who is regularly engaged in, and experienced in this type of work. Subcontracting this work to others is not acceptable.

END OF SECTION

SECTION 272100 - LOCAL AREA NETWORK SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment, services, etc. for a Local Area Network (LAN) system. Provide cabling and final terminations to head end equipment furnished by others.
- B. The systems to be provided shall be for a switched LAN environment. The system shall hereafter be referred to as the Data Network System.
- C. Basic Intent:
 - 1. Located throughout the building as shown on the drawings, are places where computers and associated equipment are intended to be placed and connected to the network for the purposes of utilizing common resources.
 - 2. The telecommunications room for the data network in the building is located as shown on the drawings.
 - 3. From the telecommunications room, data cables are to be run to the data jacks indicated on the drawings.
- D. Scope of Work:
 - 1. The scope of work shall include the items listed below, as described herein and as indicated on the Contract Documents:
 - a. Horizontal cabling.
 - b. Complete raceway system (cable tray, J hooks, and conduit) for cabling distribution.
 - c. Ground of all racks, raceway and equipment.
 - d. Power for the telecommunication rooms.

1.2 REFERENCE STANDARDS

- A. ANSI/TIA/EIA Telecommunications Building Wiring Standards.
- B. IEEE Telecommunications Standards.
- C. BICSI Methods Manuals.

1.3 QUALITY ASSURANCE

- A. Work shall be as specified herein and it shall be neat and orderly installation. All methods of construction, details of workmanship that are not specifically described or indicated in the contract documents, shall be subject to the control and approval of the Owner's Representative.
- B. Unless specified elsewhere, standard factory inspection and operational tests will be acceptable.
- C. Installation shall be accordance with NFPA-70 (National Electrical Code), TIA/EIA, IEEE, IEC, state codes, local codes, and requirements of the authority having jurisdiction.
- D. Equipment shall be designed, manufactured, assembled, and tested in accordance with the latest revisions of applicable published ANSI, NEMA/IEC, TIA/EIA and IEEE Standards.
- E. Each item shall be NRTL tested and listed.
- F. The system provider must:
 - 1. Provide equipment from manufacturers for which they maintain a contract, distributorship, are an agent, or other formal arrangement for which documentation can be produced showing authority to sell and service the equipment in this territory.
 - 2. Demonstrate that they have successfully installed these systems, utilizing their standard products, for a period of five (5) years.
 - 3. Maintain a service organization to provide both normal and emergency service. Emergency service must be available 24 hours per day; 365 days per year and staff must be adequate to respond within 2 hours of an emergency call.
 - 4. Maintain adequate spare parts inventory to provide both normal and emergency service.
 - 5. Employ service technicians who are trained in accordance with the systems manufacturer's recommendations.
 - 6. Own and demonstrate proficiency in the use of the required test equipment, tools, etc. for the proper installation, set-up, testing and maintenance of the system. If requested, must provide a listing of tools and/or equipment and where appropriate, certifications in the proper training and use of the tools and/or equipment.

1.4 SUBMITTALS

- A. Provide the following in a single clear and organized submittal. Package shall be submitted as specified in:
 - 1. Manufacturers catalog sheets, specifications and installation instructions for all components.
 - 2. Dimensioned drawings of all system control cabinets and layouts for all equipment rooms.
 - 3. Cut sheets on all cables.

1.5 SYSTEM DESCRIPTION

- A. Provide cabling and raceways for a state of the art Category 6 Local Area Network (LAN).
- B. The system shall include, but is not limited to, the following:
 - 1. Equipment cabinets and racks.
 - 2. Premises wiring.
 - 3. Modular jacks, backboxes and faceplates.
 - 4. Terminations and testing.
 - 5. Raceways.
- C. The work included in this section is shown on the drawings or described in the specifications, and consists of furnishing all labor, material, services, and skilled supervision necessary for the construction, erection, installation, and connection of all circuits, apparatus, and equipment specified herein or shown on the drawings in a first class, workmanlike manner, and its delivery to the Owner ready for use.
- D. Each part of work is to be complete in detail and operable in unison with all other sections, to constitute completely installed computer network systems and connections of same, as shown on drawings and described in specifications.
- E. Any other electrical work not listed in this scope of work but shown or specified in the contract documents.
- F. Deliver all materials to be stored on site in protective containers. These protective containers shall be clearly marked with unit designation as indicated on drawings or specifications.
- G. Owner shall provide the network electronics.

PART 2 - PRODUCTS

2.1 HORIZONTAL SYSTEM PARAMETERS

A. Category 6 UTP Cable:

1. Initially, the manufacturer shall perform qualification tests on each cable. These tests shall be performed in accordance with the latest revision of the ANSI/TIA/EIA 568-B.2 standard prior to shipment.
2. The completed cable, while on the shipping reel, shall be tested at room temperature to insure it meets or exceeds the design specifications. Submit test results to Engineers for review and comment before proceeding.
3. Certification shall be provided to show the results of the tests for each reel.
4. Date of Manufacture: No insulated cable over one year old, from date of manufacture when installed, shall be acceptable.
5. Cable shall have a ripcord.
6. Cable shall be plenum rated, 4 pair, 100 OHM, 23 AWG.
7. Cable shall meet all requirements of FCC 68, the latest revision of the TIA/EIA 568B and Addendums.
8. Cable shall have blue colored thermoplastic jacket with overall diameter not to exceed .365" x .165".
9. The cable pulling tension shall be rated for 25 pounds minimum.
10. Cable shall be able to withstand a minimum bend radius of 1.0 inches at - 20°C without insulation cracking.
11. Cable shall be color coded in accordance with the latest revision of the TIA/EIA T568B polarization sequence.
12. Cable shall not exceed maximum length of 90 meters.
13. Performance:
 - a. Less than 9.000 ohm per 100 m DC resistance.
 - b. Less than 15 pF/ft. at 1 KHz, mutual capacitance.
 - c. Characteristic impedance shall be 100 ohm $\pm 22\%$ from 1 MHz to 350 MHz.
 - d. Return loss > 17.3dB at 250 MHz.

- e. Insertion Loss < 32.8 dB/100M at 250 MHz.
 - f. Near end cross talk (NEXT)> 38.3 dB at 250 MHz.
 - g. Power Sum - near end cross talk (PS-NEXT)> 36.3 dB at 250 MHz.
 - h. Equal level far end cross talk (ELfEXT) > 19.8 dB at 250 MHz.
 - i. Power Sum - equal level far end cross talk (PS-ELfEXT) > 16,8 dB at 250 MHz.
 - j. DC resistance unbalance between any two conductors of any pair shall not exceed 3%.
 - k. The capacitance unbalance of any pair to ground shall not exceed 33.0pF per 100 meters.
 - l. Delay < 538 ns at 100MHz.
 - m. Delay skew < 45 ns at 100MHz.
 - n. Cable shall be ANSI/TIA/EIA-568.B.2 Category 6 compliant. The cable shall be tested and characterized by the manufacturer to 500 MHz.
14. Acceptable Manufacturers:
- a. Belden
 - b. Berk-Tek
- B. UTP Telecommunications Outlets/Connectors:
1. Physical Specifications:
- a. Shall be 8-pin connector compatible with the latest revisions to match the cable characteristics.
 - b. Shall be modular and snap-in to user configurable faceplates for future retrofits meeting durability requirements specified in the latest revision of the CEI/IEC standard.
 - c. Shall be IDC type suitable for eight 22-24 AWG wires with a gas-tight connection.
 - d. Each contact surface shall have at a minimum, copper alloy with 50 micro-inches gold over nickel and a minimum contact force of 100g.
 - e. Conductors shall be separated and aligned internally by jack comb.

- f. Shall have easy to read 568A/B color scheme to prevent termination errors.
 - g. Wired in accordance with TIA/EIA polarization sequence specified in Patch Panel section of this specification.
 - h. Transmission characteristics shall meet the requirements for the UTP cabling specified.
 - i. Minimum durability shall be 1000 mating cycles.
- 2. Acceptable Manufacturers:
 - a. Ortronics
 - b. Panduit
 - c. Belden

C. Color Coding:

- 1. Cable outer jacket shall follow the color coding scheme as follows. Jacket color shall be continuous. Patch cords shall also follow this.
- 2. Copper Cable:
 - a. Data Communication:
 - 1) Category 6 - Blue
 - b. Voice Communication:
 - 1) Category 6 - Blue
 - c. WiFi - Green / Purple
 - d. CCTV - Green / Mauve
 - e. Data - Blue / Yellow
 - f. Voice - Beige / Gray
 - g. Paging - White

2.2 LABELING

A. Copper Data:

- 1. Cabling
 - a. Specifically label cables at each termination point indicating the destination room, rack number and port number.

2. Field Outlets:
 - a. Each data port shall have an identical label to the opposite end port.
 - b. The Contractor shall utilize Interlink-Label for Windows 2 or approved equal; Network Labeling System to label all patch panel ports. Labels shall be installed in a workman-like manner and fit completely in the recessed area of the labeled location.
 - c. Contractor shall utilize Interlink Icon labels at Poke-thru locations and any other locations that do not have a label location.
 3. Each label shall contain the Telecommunication Room designated, the room number and the port number in the room. Verify color of label and size of font prior to completion. Provide samples as required.
 4. Labels shall correspond to the room/names/numbers upon completion of the project. Contractor shall not necessarily utilize existing room/names/numbers or those indicated on the blueprints.
- B. Contractor shall record each data port label on all record drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Cable:
1. Provide a minimum of one (1) UTP cable to each RJ45 jack from respective equipment/telecommunications room as called for. Quantity of data jacks equals minimum quantity of UTP cables (typical).
 2. All risers, and wiring concealed in walls or soffits, shall be installed in metal conduits.
 3. All cable above accessible ceilings shall be installed in cable tray or J-hook style cable rings 3 ft. O.C. Refer to Specification Section 260501.
 4. Provide wire management and Velcro cable wraps every 6 inches throughout closets. Provide Velcro cable wraps every 36 inches elsewhere.
 5. Verify all wiring requirements with the Manufacturer. If the manufacturer recommends larger wire sizes, they shall be provided. However, smaller sizes or lower cable categories are not acceptable.
 6. Install UTP cable in accordance with latest revision of TIA/EIA 568 standards.

7. The Contractor shall be responsible for replacing all cables that do not pass required bandwidth and throughput tests.
8. All raceways and closets shall be installed in accordance with latest revision of TIA/EIA-569.
9. All cables shall be labeled in accordance with latest revision of TIA/EIA 606.
10. All horizontal cables shall be terminated in patch panels at the distribution frames, and at the UTP jack at the telecommunications outlet.
11. Maximum length shall be 90 meters.

B. Terminations:

1. All terminations shall be made by a manufacturer's authorized representative.
2. Use termination kits for fiber and UTP that are approved by manufacturer of the cable.
3. All backbone cable shall be terminated in a patch panel and all connections between horizontal and backbone cables shall be via cross connect cable.

C. Equipment and Devices:

1. Install all devices where shown on drawings. Provide all necessary conduit outlet boxes, junction boxes, supports, etc. Verify all required box sizes with the system supplier. All devices shall be modular for future moves and changes.
2. Install all equipment in specified 19 in. racks/cabinets leaving minimum 30 in. of access space on sides and back of rack and 36 in. in front of rack.
3. Provide all power outlets and plug strips required for system operation but not shown on plans.

D. Raceways:

1. Minimum size raceway shall be 1 inch.
2. Minimum back box size for telecommunications outlet locations shall be two-gang; no single-gang boxes allowed.

E. Data Network Ground System:

1. Provide grounding system for all equipment rooms and telecommunication rooms as called for in Specification Section 260526.
2. Provide 3/4" x 4' high continuous plywood backboard with two coats of medium gray fireproof paint in telecommunications room.

3.2 TESTING

- A. Copper Cable: System supplier shall channel test end-to-end each permanent link connection using latest 500 MHz for Cat 6a 1000 Mbps IEEE testing procedure. (Tester must conform to the latest standards at the time of testing not time of bid). Provide a full test using Fluke DTX-1800 with latest software version, or approved equivalent. Testing shall be performed by a technician trained with the specific testing equipment. Testing shall be witnessed by the Owner's Representative.
- B. Replace any cables and connectors that do not meet or exceed standards referenced and stated herein and then tested. Testing shall be end-to-end / port-to-port for each cable.
- C. Test equipment shall be in good condition and working order, calibrated within one year of its use and utilize leads without twisting and kinks. Unit calibration shall be in accordance with Level III Field Tester per ANSI/TIA 1152.
- D. Test Reporting
 1. The field testing shall be accurately documented for submission, inclusion in O&M Manuals and for Owner future use.
 2. Test reports shall include data directory table cross-referencing room numbers and cable numbers with the test report. Post copies of directory at telecommunications room location.
 3. Report shall utilize electronic Windows based documenting with a hard and electronic copy provided to the Owner.
 4. The report documentation for each cable test shall include the following as a minimum:
 - a. Project name.
 - b. Test equipment manufacturer and model number, and last calibration date.
 - c. Date and time of the test.
 - d. Patch panel identification.
 - e. Cable identification.
 - f. Cable type.

- g. Pass/Fail: Pass indicating meeting or exceeding the identified criteria or standard (whichever more stringent) for all parameters. Fail indicating test not meeting identified criteria for one or more parameters.
- h. Cable length.
- i. Propagation delay and attainable bandwidth.
- j. List of tested parameters with test and allowable values. Any failed parameters shall be noted or highlighted.

3.3 WARRANTY

- A. All cable plant parts shall be warranted to the owner for a period of 15 years as a complete end-to-end system.
- B. All network equipment shall be warranted to the owner for a period of one (1) year two (2) years. Provide technical support at no charge to the customer for a period of one (1) year after system has been commissioned.
- C. Make available an extended warranty to the customer.
- D. Warranties shall commence upon final acceptance of the system.

END OF SECTION

SECTION 283102 - ANALOG ADDRESSABLE FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide labor, materials, equipment and services to perform operations required for the complete installation of a fully operational analog addressable fire alarm system and related Work as described in the Contract Documents.
- B. Provide system as approved by local Fire Marshal and the Authority Having Jurisdiction (AHJ). System materials and installation shall be in accordance with the manufacturer's recommendations.

1.2 QUALITY ASSURANCE

- A. All methods of construction, details of workmanship that are not specifically described or indicated in the contract documents, shall be subject to the control and approval of the Owner's Representative. Equipment and materials shall be of the quality and manufacture indicated in their respective sections of the specifications. The equipment specified is based upon the acceptable manufacturers listed. Equipment types, device ratings, dimensions, etc. correspond to the nomenclature dictated by those manufacturers. All equipment shall be tested at the factory. Unless specified elsewhere, standard factory inspection and operational tests will be acceptable.
- B. Installation shall be in accordance with NFPA-70 (National Electrical Code), NFPA-72 (National Fire Alarm Code), AHJ, state codes, local codes, requirements of authority having jurisdiction and the contract documents. Installer shall be certified in the State of New York for fire alarm installation.
- C. Equipment shall be designed, manufactured, assembled, and tested in accordance with the latest revisions of applicable published UL, NFPA, ANSI, NEMA and IEEE Standards. All system equipment shall be compatible and of the same manufacturer.
- D. Each item of the fire alarm system shall be listed as a product of a single fire alarm system manufacturer and shall bear the UL Label.
- E. System installation shall be under the supervision of an accredited factory representative. Final connections to the FACP, annunciator panel and any other panels shall be by the factory representative.
- F. The system provider must:
 - 1. Provide equipment from a single manufacturer for which they maintain a contract, distributorship, are an agent, or other formal arrangement for which documentation can be produced showing authority to sell and service the equipment in this territory.
 - 2. Demonstrate that they have successfully installed these systems, utilizing their standard products, for a period of five (5) years minimum.

3. Maintain a service organization to provide both normal and emergency service. Emergency service must be available 24 hours per day, 365 days per year and staff must be adequate to respond within 2 hours of an emergency call.
4. Have a service location not more than 50 miles from the project location.
5. Maintain adequate spare parts inventory to provide both normal and emergency service.
6. Employ service technicians who are trained in accordance with the systems manufacturer's recommendations.
7. Own and demonstrate proficiency in the use of the required test equipment, tools, etc. for the proper installation, set-up, testing and maintenance of the system. If requested, provide a listing of tools and/or equipment and where appropriate, certifications in the proper training and use of the tools and/or equipment.
8. Provide all system programming to deliver a customized system to the Owner ready for use.
9. All system programming is to be completed to the satisfaction of the Owner. If after preliminary use of the system, and/or training, the increased understanding of the system's features and capabilities necessitates reprogramming to any extent, it is to be performed at no additional cost.
10. Provide a minimum of two system inspections/tests each year during the warranty period as described in NFPA 72. Needed and requested system programming changes shall be provided at these times.
11. Warranty period shall be as described elsewhere with two years being minimum. Provide a service contract for the Owner review for two years beyond the warranty period. Warranty shall include all parts, materials, labor, transportation, etc.

1.3 SYSTEM DESCRIPTION

- A. The system shall constantly monitor all initiation devices and notification circuits for any abnormalities or alarm conditions. System shall sample/poll each addressable device no less than every 10 seconds.
- B. The system operation subsequent to the alarm activation by any initiating device (manual station, automatic detector, sensor, sprinkler flow switch, etc.) shall be as follows:
 1. All audible alarm notification appliances within corresponding building or designated area shall provide a common audible fire alarm signal until the System Reset Key or the Signal Silence Key is depressed.
 2. All visual alarm notification appliances shall flash continuously and synchronized until the system is reset or silenced.
 3. The remote central monitoring station shall be notified automatically until the System Reset Key or the Signal Silence Key is depressed.

4. Shutdown of the corresponding HVAC system equipment shall occur with a supervisory alarm until the system is reset. All fans over 2000 cfm shall be shut down.
 5. Activation of all programmed outputs assigned to the initiating device shall occur until the system is reset or the silence key is depressed.
 6. The alarm shall be displayed at the local Fire Alarm Control Panel (FACP) and the fire alarm annunciator panel.
 7. The system alarm LED shall flash on the control panel and the fire alarm annunciator panel until the alarm has been acknowledged/reset. Once acknowledged, this same LED shall latch on. A subsequent alarm received shall flash the system alarm LED on the control panel and annunciator. The LCD display shall show the new alarm information.
 8. A pulsing audible alarm tone shall occur within the local building control panel and, where applicable, the fire alarm annunciator panel until the event has been acknowledged.
 9. Alarms shall be entered into the system event log history.
 10. Refer to Appendix A for operational/sequence matrix.
- C. Any subsequent alarm shall follow the operation described above.
- D. The activation by any system smoke detector or sensor shall initiate an alarm verification operation whereby the panel will reset the activated detector and wait for a second alarm activation. If, within a preset time after resetting, a second alarm is reported from the same or any other smoke detector, the system shall process the alarm as described previously. If no second alarm occurs within the prescribed time, the system shall resume normal operation. The alarm verification shall operate only on smoke detector alarms. Other activated initiating devices shall be processed immediately. The alarm verification operation shall be selectable by device.
- E. A manual evacuation (drill) switch shall be provided to operate the alarm notification appliances without causing other control circuits to be activated. However, should an actual alarm occur, all alarm functions shall occur as described previously.
- F. The system shall have a password(s) to allow the operator to display all alarms, troubles, and supervisory service conditions log history including the time of each occurrence. This shall be able to be viewed from the front of the control panel, annunciator panel or from a computer connected to the FACP.
- G. The actuation of the "walk test" program at the control panel shall activate the "Walk Test" mode of the system which shall cause the following to occur:
1. The remote central monitoring station connection shall be bypassed.
 2. Only audible and visual appliances shall be operated. Other alarm functions (elevator recall, HVAC shutdown, etc.) shall not be affected.

3. Walk test shall be selectable by circuit or circuits.
 4. Actual alarms received during a "Walk Test" shall cause the control panel to go into alarm and override the walk test mode.
 5. The control panel shall show trouble conditions.
 6. The walk test activation of any initiation device shall cause the audible signals to activate for two seconds or a distinguishable audible.
 7. The panel shall automatically reset itself after signaling is complete.
 8. The control panel shall automatically return to normal condition if there is no activity on a walk test circuit for a period of 30 minutes.
- H. Any momentary opening of an initiating or notification appliance circuit wiring shall cause an audible signal to sound at the Fire Alarm Control Panel and, where applicable, the annunciator panel for four seconds indicating a trouble condition.
- I. Elevator Operation:
1. Provide the following equipment as a minimum and as indicated on the drawings:
 - a. Smoke detection in the elevator equipment room.
 - b. Smoke detection at each elevator lobby.
 - c. Smoke detection in the elevator shaft if a smoke hatch.
 - d. Heat detection in the equipment room and shaft (high and low) if a sprinkler system is in the area. Detectors shall be within 2 ft. of the individual sprinkler heads.
 - e. Detection devices located in elevator lobbies, elevator hoistways and elevator machine rooms shall be used for elevator recall. Hoistway and equipment room heat detection shall initiate power shut down prior to water flow. Operation shall be in accordance with ASME A17.1, Safety Code for Elevators and Escalators. Signals shall be provided to the elevator controls for main level lobby alarm, any lobby alarm, elevator equipment room alarm and elevator hoistway alarm as a minimum. Provide addressable control modules for the signals to the elevator controls.
- J. Alarm initiation of a detector associated with a smoke hatch or fire barrier shall initiate a system alarm. Also, provide connections between the auxiliary contacts on the detectors or addressable control module and the associated smoke hatches and fire barriers such that the smoke hatch or fire barriers will be operated upon its respective detector activation. Provide power supplies, wiring and accessories for fire alarm system and all supervisory functions required for proper smoke hatch and fire barriers operation.

- K. Duct mounted smoke detectors associated with duct dampers shall have an addressable control module to operate the duct damper. In the event of an alarm initiation by the duct mounted smoke detector or the associated air handling unit/fan shut down the duct damper shall be closed. Control wiring shall be provided to shut the damper(s) when the associated air handling unit is not operational. Provide power supplies, wiring and accessories as needed for this operation.
- L. Provide wiring and equipment such that alarm initiation of a heat detector located in the elevator machine room and/or the elevator shaft shall provide suitable voltage from the fire alarm control panel to be applied to the shunt trip coil of the elevator's supply circuit breaker. No fire alarm devices except the heat detectors in the elevator machine rooms and shaft shall cause this. Also, alarm initiation of these heat detectors shall initiate the system alarm functions described above. Provide an addressable control module with a Form C contact at the elevator controllers, which shall be normally closed and shall open upon alarm initiation of any of these heat detectors; this contact shall be used to disconnect the battery-powered emergency return unit if so equipped with the use of a relay suitable for the emergency power circuit. Also, provide an auxiliary contact on the main line disconnect switch (four pole unit) and two (2) #12 in conduit to the elevator controller from this contact for the same purpose.
- M. Provide a minimum of two Form C contacts at the building's fire alarm control panel. This contact shall activate upon activation of any fire alarm initiating device.

1.4 SUPERVISION

- A. The system shall utilize independently supervised initiation device circuits. The alarm activation of any initiation device shall not prevent the subsequent alarm operation of any other initiation device.
- B. Notification appliance circuits shall be supervised to indicate an open or short circuit condition.
- C. The incoming power to the system shall be supervised so that any power failure must be audible and visually indicated at the control panel and the remote annunciator. A green "power on" LED shall be displayed continuously while incoming power is present. This shall be a trouble alarm.
- D. The system batteries shall be supervised so that a low battery condition or disconnection of the battery shall be audibly and visually indicated at the control panel and the remote annunciator. This shall be a trouble alarm.
- E. The system shall have provisions for disabling and enabling all circuits individually for maintenance or testing purposes.

1.5 SUBMITTALS

- A. Provide a complete system submittal prior to ordering of equipment and installation including but not limited to:
 - 1. Complete equipment list.

2. Catalog descriptive literature for all equipment. This shall include a description of the unit, ratings, functions, capability, materials and compatibility with other components.
 3. Riser Wiring Diagram showing all equipment, devices, device addresses, connections, control connections, remote notification connection(s), wire quantities and sizes.
 4. Floor plan indicating equipment and device locations, addresses, power circuit information with power panel location, notification circuiting, initiation circuiting, control circuiting and any system applicable building characteristics (ceiling heights, structural members impeding detection, etc.). Contact the Engineer for an electronic copy of the project floor plans. Engineer logo shall be included in final drawing.
 5. Typical Terminal Wiring Diagram for each type of device.
 6. Terminal wiring Diagram for all Fire Alarm equipment.
 7. Calculations including:
 - a. Battery sizing calculations indicating total number of power devices, load associated with each type device, backup period and recommended battery capacity (AH).
 - b. Voltage drop calculations with actual equipment loads used to derive battery back-up ampere-hour rating and individual circuit voltage drop (indicate the wire size to be used and the associated voltage drop with the allowed voltage drop) for each circuit.
 8. Complete console enclosure and equipment configuration.
- B. Submittal package, calculations and system wiring shall be performed/collected/signed by a NICET Level III technician.
- C. If required by the Authority Having Jurisdiction (AHJ) provide a submission of all requested information for review and comment by the AHJ. All AHJ comments shall be incorporated and resubmitted until approved.
- D. Test reports at the completion of the project. Testing shall be of all system devices, equipment, circuits, features and functions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. The project fire alarm system shall comply with and be in accordance with the drawings and specifications. All system equipment and materials shall be of the same manufacturer unless otherwise indicated. System and component acceptable manufacturers include the following unless otherwise indicated:

1. Notifier (Basis of Design)
2. Simplex
3. Pyrotronics - Siemens
4. EST - GE

2.2 FIRE ALARM SYSTEM

- A. The fire alarm system shall be comprised of the components specified as a minimum and also include components not indicated but required for a complete and operable system as described herein.
- B. The system and all its components shall be UL listed and in accordance with NFPA 72, local and state codes.
- C. The system shall have 25% spare capacity. This shall include all individual notification circuits, initiation circuits, initiating modules, alarm modules, power supplies, batteries, central processing unit memory and printed circuit card space. System initiation device and control device capacity shall be a minimum of the indicated percentage over the shown quantity or 250 whichever is greater.
- D. Each initiating device shall have an individual address for system communication. The system addresses shall not exceed seven digits. Each address, initiation circuit, notification circuit and control point shall have an individual identification description.
- E. System shall shut down all air handlers more than 1,000 cfm upon an alarm.

2.3 FIRE ALARM CONTROL PANEL (FACP)

- A. The system shall be entirely solid state, microprocessor based, use digital transmission and shall be field programmable. All system programming including field modifications shall be stored in non-volatile memory. Field modifications shall be automatically stored without special actions. The panel shall be designed and manufactured expressly for the intent to detect the presence of fire and to provide indication of such detection. Panel shall contain as a minimum power supply(s), control module, main control printed circuit board, initiation modules, notification modules, terminals and back up battery(s). Control module shall have 80 character backlit LCD display and twelve control buttons (four being field assignable), minimum. Display shall indicate the battery voltage at all times.
- B. The system shall be modular in design to allow for future expansion with a minimum of hardware additions.
- C. The FACP shall be located where shown on the drawings. Enclosures shall accept all system items for an aesthetically suitable operator's console. Enclosures shall be of modular size to allow surface mounting of multiple boxes adjacent to each other, shall have hinged solid metal doors and contain a lock with a key common to all system devices. Enclosure shall have a red finish.

- D. The FACP shall operate its integral LCD Display through an RS-232C port operating up to 9600 baud to indicate all operator transactions, alarms, trouble reports and any other conditions specified by system programming.
- E. Conditions of the system shall be indicated at the operator interface by LED's. These conditions shall be alarm, supervisory, trouble and alarm silenced. An LCD 2 line, 40 character per line display shall also be included. It shall display "SYSTEM IS NORMAL" with the date and time under normal circumstances. The LCD display shall also indicate type of alarm, point status, number of alarms and location. Through the use of function keys, historical data can also be displayed.
- F. The FACP shall include a password (three (3) levels of protection with individual passwords, minimum) protected key pad for access to programming, special functions and all system features.
- G. Any event initiated by the FACP due to an alarm input shall be retained in nonvolatile EPROM memory. The FACP shall also have sufficient memory for 1200 individual alarm/trouble events.
- H. The FACP shall have the following user connection types:
 - 1. Ethernet connection for a computer, personal data device or printer. Connection shall allow for programming changes, history download, setting review/changes, etc.
 - 2. RS 232 port for connection of a serial printer.
- I. Battery and charger shall be as specified within this section.
- J. Design Equipment: Notifier FireWarden-100

2.4 VENTILATION FAN SHUTDOWN CONTROL

- A. Provide supervised normally closed relays and contactors for connection into the fan motor control circuits ahead of all automatic devices.
- B. Sequence fan shutdown for every air distribution system over 1000 cfm. Provide duct detectors in return of systems over 2,000 cfm and in return at each floor of systems over 15,000 cfm.
- C. Provide drill bypass feature, locate switch on Fire Alarm Control Panel and label "DRILL-FAN SHUTDOWN BYPASS". Buzzer shall sound continuously while in bypass mode.
- D. Provide fan reset feature, locate switch on Fire Alarm Control Panel and label "FAN RESET".

2.5 INITIATION DEVICES

- A. General:

1. Provide analog addressable smoke and thermal sensors as shown. All detectors, control modules, monitor modules and all other initiation devices shall communicate with twisted pair cable and have an individual address. Peripheral devices shall be of the same manufacturer as the FACP.
2. Spot type detectors shall utilize the same interchangeable bases.
3. If a device is removed or taken out of service a trouble signal shall be initiated.

B. Photo-Obscuration Type Smoke Detector:

1. The photo-obscuration detector shall operate on the photo electronic principle and provide an analog signal to the system indicating the amount of smoke. Detector shall be an analog addressable type.
2. The detector shall incorporate a built in type identification so the system can identify the type of detector. The sensor shall be continually monitored to measure any change in their sensitivity because of the environment (dirt, smoke, temperature, humidity, etc.). Unit shall not be affected by exterior light or EMF.
3. The detector shall be designed and arranged to prevent interference from exterior electromagnetic fields and light.
4. The detector shall provide advance indication of the analog value of the products of combustion to the FACP indicating that maintenance is required in order to insure normal operation. The detector sensitivity shall be adjustable per device (within UL limits) and be set at the FACP for continuous or variable based on time of day. There shall be a minimum of six (6) selectable sensitivity levels. The individual detector sensitivity setting shall be adjusted to meet the building/space characteristics and operation. The detector shall monitor the obscuration continuously and raise the obscuration level to compensate for a dirty sensor to maintain the set sensitivity.
5. Detectors shall be designed for twistlock mounting to a separate base assembly. Provide manufacturer's recommended back box suitable for surface mounting where required.
6. The detector base shall have terminals for making all connections; no soldering shall be required. It shall be possible to secure the detector to the base with a concealed socket headscrew to prevent unauthorized tampering.
7. Smoke detectors shall be UL 268 listed and FM approved.
8. All smoke detectors shall be field checked and set to meet the prevailing conditions of the premise and any Owner requests. All such work shall be performed by an authorized representative of the manufacturer trained in such procedures.
9. Photo-obscuration type smoke detection shall be used for smoke detection unless indicated otherwise indicated.

C. Heat Detector:

1. The heat detector shall be a thermal sensor and shall constantly monitor the space temperature and constantly report this to the system. The unit shall be analog addressable.
2. The sensor shall use dual solid state thermistors and shall monitor the ambient temperature from 32 degrees F, to 155 degrees F and provide a fast response to rapid increase in temperature. The sensor shall send data to the FACP representing the analog value of the ambient temperature. The FACP shall be suitable to monitor for set temperature (selectable by detector for 135 or 155 degrees F) and rate of rise (selectable by detector for 15 or 20 degrees F per minute). Individual detector thermal settings shall be adjusted for the building/space characteristics and operation but shall initially be set to 135 degrees F set temperature and 15 degrees F per minute rate of rise.
3. Detectors shall be designed for twistlock mounting to a separate base assembly. Provide back box suitable for surface mounting where required.
4. The detector base shall have terminals for making all connections; no soldering shall be required. It shall be possible to secure the detector in the base with a concealed socket headscrew to prevent unauthorized tampering.
5. Smoke detectors shall be UL 268 listed and FM approved.
6. All thermal sensors shall be field checked and set to meet the prevailing conditions of the premise. All such work shall be performed by an authorized representative of the manufacturer trained in such procedures.

D. Single Station Smoke Detector:

1. Detectors shall operate on the photoelectronic principle. Upon activation, the detector shall sound its integral alarm horn in accordance with ANSI S34.1 and operate its associated alarm circuit and illuminate the built-in alarm light. Integral alarm horn shall be rated 90 dB at 10 ft. Built-in alarm light shall be 177 candela, 60 flashes/minute strobe. Provide LED power-on/alarm indicator. Detectors shall operate on 120 volts AC. Provide an integral 9 VDC battery backup with low/missing battery alarm signal. Provide with 9 VDC long life battery. Provide backbox suitable for surface mounting where required. unit shall have single pole double throw dry contacts rated 1 amp resistive at 24 VDC. Contacts shall operate when the detector is in the alarm condition. Detector shall be U.L. listed and F.M. approved. Detector shall operate from 40°F to 120°F and up to 93% relative humidity. Provide tandem operation capability.
2. Interconnect all detectors inside a dwelling unit such that any detector in alarm will activate the notification appliances in all the other connected detectors.
3. Design Equipment: Gentex 7139CS C.

4. Make:
 - a. Simplex
 - b. Gentex
 - c. Approved equal.

E. Addressable Initiation Module:

1. The addressable initiation module shall be used to connect supervised conventional initiating device or zone of supervised conventional initiating devices (water flow switches, tamper switches, manual pull stations, (4) wire smoke detectors, conventional (4) wire duct detectors, fire pump alarms, dry chemical fire extinguisher control panels, etc.) to one of the system's addressable circuits.
2. The module shall provide address setting means using rotary decimal switches and also store an internal identifying code which the control panel shall use to identify the type of device.
3. The module shall contain an integral LED that flashes each time the unit is polled.

F. Manual Pull Stations:

1. Noncoded pull-down type, double action (push then pull down) manual addressable units with front keyed test/reset. Units shall be semi-flush where installed in construction with hollow or block walls. Where construction does not allow semi-flush mounting then unit shall be surface mounted utilizing the manufacturers back box. Each unit shall have a distinct address. Units shall be key reset.
2. Units installed outdoors or in potentially wet locations shall be rated for such conditions.
3. Bright red finish with white lettering "FIRE ALARM".

G. Duct-Type Smoke Detector:

1. Detector shall be a photoelectric type that shall be activated by the presence of combustion products.
2. The detector head shall be a plug-in unit. The unit shall contain no moving parts. One chamber shall be for fire detection and the second chamber shall function as a reference, to stabilize the detector for changes in environmental temperature, humidity and pressure. It shall be possible to electrically check detectors sensitivity, using a sensitivity test set, or equivalent, and readjust the detectors sensitivity as required.

3. The detector base shall have terminals for making all connections; no soldering shall be required. It shall be possible to secure the detector in the base with a concealed socket-head screw to prevent unauthorized tampering.
4. Smoke detectors shall be listed by Underwriter's Laboratories, Inc. and approved by Factory Mutual Insurance Company.
5. Provide complete with sampling tubes. Size sampling tubes for 80% of the width of the duct. Locate in ductwork for the indicated system and in accordance with the manufacturer's recommendations. Unit shall be rated for air velocities of 300 to 4000 fpm as a minimum.
6. Provide addressable control module and 120V power for smoke damper operation.
7. Provide a remote indicating light/key test switch for each duct detector and mount in a local utility room with a sign indicating the system and location of the duct detector (i.e. AHU-2, Second Floor East End).
8. Provide addressable base.

H. Carbon Monoxide (CO) Detector:

1. Detector shall sense the level of CO concentration within a space and provide analog addressable signal to the system and be UL 2075 listed. Unit shall have a minimum life span of 10 years without replacement/recalibration.
2. Provide with audible notification base unit for local unique notification. Alarm and notification initiation shall be from the control panel.
3. Detector shall connect to the system addressable circuiting.
4. Alarm level shall be adjusted at the control panel. Upon an alarm the local notification shall sound and a trouble alarm initiated.

I. Single Station Carbon Monoxide (CO) Detector:

1. Detector shall sense the level of CO concentration within a space, provide local notification and be UL 2034 listed. Unit shall have a minimum life span of 10 years without replacement/recalibration.
2. Provide with audible notification base unit for local unique notification. Audible shall be 85dB minimum output at 10 ft.
3. Unit shall be 120V with 9V battery backup.

J. Single Station Combination Smoke/Carbon Monoxide Detector:

1. Detector shall be photoelectronic type and have carbon monoxide (CO) sensing. Upon activation, the detector shall sound its integral alarm horn in accordance with ANSI S34.1 and operate its associated alarm circuit and illuminate the built-

in alarm light. Integral alarm horn shall be rated 85 dB at 10 ft. Built-in alarm light shall be 177 candela, 60 flashes/minute strobe. Provide LED power-on/alarm indicator.

2. Detectors shall operate on 120 volts AC. Provide an integral 9 VDC battery backup with low/missing battery alarm signal. Provide backbox suitable for surface mounting where required. Unit shall have single pole double throw dry contacts rated 1 amp resistive at 24 VDC. Contacts shall operate when the detector is in the alarm condition. Detector shall be U.L. listed and F.M. approved. Detector shall operate from 40°F to 120°F and up to 93% relative humidity. Provide tandem operation capability.
3. Interconnect all detectors inside a dwelling unit such that any detector in alarm will activate the notification appliances in all the other connected detectors.
4. Design Equipment: Gentex 7139CS C.

2.6 NOTIFICATION APPLIANCES

A. Horns:

1. 24 volts DC.
2. Basic grille type with powder coated red finish paint.
3. Horn shall be rated 94 dBA (anechoic chamber) at 10 feet. Output shall be selectable steady tone or coded. Provide dampening devices to reduce unit output by 5dBA for a minimum of 40% of the system horn units and install as needed to meet the Owner's needs.
4. Units shall be semi-flush where installed in construction with hollow or block walls. Where construction does not allow semi-flush mounting then unit shall be surface mounted utilizing the manufacturers back box.
5. Units installed outdoors or in potentially wet locations shall be rated for such conditions.
6. Provide directional projector where noted on the Drawings.
7. Provide backbox and grille for fully recessed installations; 4 in. deep box maximum.
8. Sleeping locations shall utilize 520 Hz horns.
9. Horn for carbon monoxide alarm notification shall meet the requirements above but have a white finish color, have the word "ALERT" imprinted on the device and have a temporal Code 4 alarm.

B. Strobe Unit:

1. 24 volts DC with built-in Xenon Flasher; two watts maximum. Pulse duration shall be 0.2 seconds with maximum duty cycle of 40%. Illumination intensity shall be field selectable for 15/30/75/110 candela or 135/177/185 candela as applicable for the location. Output setting shall be 15 candela in corridors, 75 candela in general areas, 177 candela in sleeping areas or as indicated. Flash rate minimum 1 Hz, maximum 2 Hz. Units within building shall flash in synchronization.
2. Protruding pyramid shaped lexan lens with reflector and the word "FIRE" imprinted on the lens.
3. Rated life shall be a minimum of 500 hours of continuous operation.
4. Units installed outdoors or in potentially wet locations shall be rated for such conditions.
5. Units shall be semi-flush where installed in construction with hollow or block walls. Where construction does not allow semi-flush mounting then unit shall be surface mounted utilizing the manufacturers back box. Wall or ceiling mounted as noted on the Drawings.
6. Provide surface backbox for surface installation; 4 in. deep maximum.
7. Strobe for carbon monoxide alarm notification shall meet the requirements above but have a white finish color and have the word "ALERT" imprinted on the device.

C. Combination Horn-Strobe Units:

1. Unit shall be a combination of the horn and strobe units specified above in a single manufactured unit.

2.7 ADDRESSABLE CONTROL MODULE

- A. The addressable control module shall have an individual system address, be supervised and control an output dry contact from indication from the FACP. This can be used to control or have an input to elevator controls, notification appliances, door holder circuits, fans systems, etc. as indicated. Modules shall be connected to the addressable loop(s).
- B. The unit shall control an output relay (dry contact form C). The module shall mount in a 4 in. square, 2-1/8 in. deep electrical box.
- C. The module shall contain an integral LED that shall flash each time the module is polled.
- D. The module shall provide address setting means using rotary decimal switches and also store an internal identifying code which the control panel shall use to identify the type of device. Each unit shall have a separate address and be connected to the system addressable signaling circuit.

2.8 REMOTE ANNUNCIATOR

- A. Wall mount within a flush box. Maximum depth of 4 in., stainless steel trim. Nominal dimensions of 4 in. x 12 in.
- B. Annunciation shall be by two line by 40 character LCD display to provide system information and alarm/trouble description.
- C. Unit power and control shall be from the FACP. Unit circuiting shall be supervised.
- D. Provide trouble signal with audible buzzer, silencing switch and system reset. All pushbuttons shall be inoperable without keyswitch activated. Pushbuttons for alarm acknowledge, silence and alarm reset shall be standard on the front with a description. Shall include a minimum of four auxiliary switches/pushbuttons to be programmed as coordinated with the owner (possible options are door holder release override, manual alarm initiation, elevator capture bypass, etc.).
- E. Tamper-resistant front panel screws.

2.9 MAGNETIC DOOR HOLDERS

- A. Rated 115 volts AC.
- B. Holders shall be wall or floor mounted adjacent to the doors as dictated by the building conditions. Floor mounted units shall only be used where wall mounted are not possible.
- C. Door holders shall be aluminum construction, have 25 pound holding force and shall have all necessary mounting hardware. Provide door plate for each and extender chain (chromed and 1 in. links) where needed.
- D. At each door holder location (or pair of door holders where two doors occupy the same opening), provide a flush mounted keyswitch to disable or enable the door holders. (Keyswitches not indicated on drawings). The keyswitch shall be maintained contact, with key removable in the vertical position. Keyswitch shall be tamper resistant, factory prewired brushed stainless steel finish. Provide all wiring to connect to local door holders. Make: DynaLock 2800 Series to meet the conditions or equivalent.

2.10 MUNICIPAL TIE EQUIPMENT - LEASED TELEPHONE LINE SYSTEM

- A. Provide complete system consisting of sending and receiving equipment.
- B. Transmission shall be provided over telephone lines arranged by the Owner.
- C. Sending reversing relay and associated equipment shall be contained within the Fire Alarm Central Processing Unit enclosure.
- D. Sending equipment shall transmit telephone line trouble as well as fire alarm condition signal.

2.11 AUTOMATIC DIALER

- A. Provide automatic tie to telephone line upon activation of the fire alarm system and transmission of prerecorded message. Provide two telephone lines from the building service individually routed to the FACP and terminated.
- B. Ten minute digitally stored message capacity.
- C. Provide automatic line seizure.
- D. Provide automatic telephone dialing to a prearranged telephone line. System shall have standard pre-recorded message stored in the memory. Record and store custom message as indicated by the Owner or call station.

2.12 DIGITAL COMMUNICATOR

- A. The digital fire communicator shall be installed in the FACP or mounted in a separate enclosure. The communicator shall be powered by 24 VDC from the FACP and shall report four (4) conditions - (2) alarm, (1) trouble and (1) supervisory. The unit shall have a built in auxiliary relay output which is programmable for alarm or trouble conditions, and shall be capable of sending a distinctive AC power failure report.
- B. Install all wiring in accordance with manufacturer's recommendations. All wiring shall be completely tested as directed by the manufacturer, and a written test report submitted to them for approval. Their approval shall be obtained before connecting any devices. The system manufacturer, by their approval of the test report, shall assume all responsibility for all installed wiring.
- C. The communicator shall have the following features: visual and audible trouble indications; supervised or unsupervised input channels, dual phone line interface with line seizure; local and remote programming and automatic 24-hour test.
- D. The communicator shall be UL 864 listed and meet the requirements of NFPA 72 Chapter 4 for supervising station fire alarm systems.

2.13 CENTRAL STATION MONITORING

- A. Make all arrangements for, and pay all costs for a UL listed central station monitoring service to monitor the fire alarm system through the digital communicator for a period of one (1) year.

2.14 BATTERY AND CHARGER

- A. Standby power shall be provided through 24 volt DC battery and automatic charger.
- B. Provide sealed lead-calcium batteries suitable for a minimum of 24 hours of battery standby. When the system is operating on the battery supply, a trouble condition shall be generated. When utility power is restored, the system shall revert back to 120 VAC supply without any operator action.
- C. Provide cell reversal protection.

- D. Battery life expectancy shall be ten (10) years minimum.
- E. Charger shall be self-regulating, solid state, type, automatic with capability to fully charge the discharged battery within 48 hours.
- F. Locate charger within the FACP enclosure. Locate batteries in FACP enclosure.

PART 3 - EXECUTION

3.1 INSTALLATION, EQUIPMENT

- A. All installations shall be accomplished in a professional manner by qualified personnel regularly engaged in and experienced in this type of Work. Fire alarm installation shall be directed by a person who possesses a state license for installation of fire alarm systems. All equipment and components shall be installed in accordance with the manufacturer's recommendations.
- B. System junction boxes and surface mounted device boxes shall be painted red.
- C. All notification circuits shall originate from the FACP. Signal expander units shall not be used.
- D. Provide all wiring to sprinkler flow switches, pressure switches, and alarm check valves, installed by others. Maintain supervisory circuitry to the switches. Use liquidtight conduit for the last 2 ft. - 0 in. of raceway at the switch.
- E. Provide all wiring to post indicator valves, OS&Y valves and dry pipe sprinkler system maintenance air pressure switches, provided by others. Wire into the supervisory alarm portion of the fire alarm system.
- F. Provide all wiring to the smoke dampers installed by others. Provide an addressable control module for each. Wire to the damper junction box with flexible conduit and wire; provide box or boxes as required. Install according to NEC. Smoke dampers shall close when its associated smoke duct detector is in alarm, upon direction from the FACP or if the associated fan unit is not operating.
- G. Provide all power supplies and wiring to smoke relief hatches and fire barriers provided by others. Smoke relief hatch or fire barrier shall operate only when its associated smoke detector is in alarm.
- H. Provide all wiring to duct smoke detectors. Duct smoke detectors shall be mounted on the ventilating ductwork by others. All mounting arrangements, holes cut into ductwork, sealing of openings along with ceiling and access doors for the duct type detectors shall be provided by others. Provide duct detectors along with sampling tubes with end caps. Sequence smoke damper operation thirty seconds after its associated fan has been shut down.
- I. Provide all wiring required for fan shutdown. Wire from the addressable control module for each fan to be shut down and provide wiring from the module to the fan control unit (starter, adjustable speed drive, etc.) Dry contact shall be wired ahead of all control

functions for starters. Provide intermediate relay for control circuits beyond the rating of the control module.

- J. Coordinate the municipal tie with the local Fire Department and comply with Fire Department requirements and regulations. Coordinate leased telephone line tie with Owner and Telephone Company.
- K. Install all door holders in accordance with installation detail on the drawings and coordinate with the General Construction trade. Connect door holders to nearest 120 volt corridor receptacle circuit.
- L. Provide 120 volt AC supervisory relays in the Fire Alarm Control Panel enclosure for each magnetic door holder power circuit to insure their associated circuit breakers are in the "ON" position. In the event a circuit breaker is in the "OFF" position, its associated supervisory relay shall transmit a trouble signal.
- M. All single-station smoke detectors shall be directly connected to the lighting circuit of the dwelling unit or sleeping room with no intervening wall switch. Cord-connected installation shall not be permitted.
- N. Provide all elevator capture control wiring. Installation shall be in accordance with manufacturer's recommendations.
- O. Elevator machine room and shaft heat detectors shall be mounted within two feet of the sprinkler head where applicable.
- P. Detection and initiating equipment shall be listed by NRTL and approved by FM.
- Q. All surface mounted devices shall be mounted on a special box furnished by fire alarm equipment manufacturer. Total assembly shall be secure, smooth contour and have no protrusions.
- R. Where detectors are installed on wood or masonry surfaces, attach brackets directly to the surface with tamperproof fasteners. Where detectors are installed on suspended ceilings, provide additional supports in the ceiling, such as channel support system, angle iron or additional runner bars. Fasten the additional supports rigidly to the ceiling runner bar system. Attach bracket to the supports with tamperproof fasteners. Install metal spacers between the bracket and supports so that the ceiling tiles will not be a part of the support system.
- S. Install wall mounted audio/visual signal devices at 80 in. AFF to center line. Where ceiling types are called for, verify ceiling type and mounting height in the field. Provide pendant-mounted devices as required for specified mounting height.
- T. An auxiliary fire alarm relay used to control an emergency control device that provides control functions described in this specification shall be located within 3 ft. of the emergency control device and all wiring shall be supervised.
- U. All smoke detectors shall be field checked and set to meet the prevailing conditions of the premise. All such Work shall be performed by an authorized representative of the manufacturer trained in such procedures.

- V. Provide circuiting from all indicated motor controls for indication if not operational and close any associated smoke dampers.
- W. Provide a weather proof combination horn/strobe unit to indicate fire protection system water flow located near the fire department connection at a location coordinated with the local fire marshal.

3.2 SYSTEM CIRCUITING

- A. All wiring shall conform to the NEC and to NFPA-72, National Fire Alarm Code.
- B. Install all wiring in accordance with manufacturer's recommendations taking into account loading, intended location, circuit length, spare capacity and voltage drop.
- C. All wiring shall be copper and installed in a dedicated/segregated EMT conduit system.
- D. Power circuits:
 - 1. Provide the required quantity of 20 ampere, 120 volt circuits to the system with a minimum of one (1) for the FACP.
 - 2. Circuit breakers serving fire alarm system equipment shall have a red handle lock to prevent from manual off operation. Directory shall be marked for the specific equipment served.
- E. Provide minimum #18 AWG twisted shielded pair for addressable signal line circuits. Notification appliance circuits shall be #14 AWG minimum.
- F. Addressable signal line circuits shall be NFPA 72 - 2010 Class A (redundant, single open operation).
- G. Notification appliance circuits shall be NFPA 72 - 2010 Class A (redundant, single open operation).
- H. Notification circuits shall be segregated as indicated on the drawings and by individual floors as a minimum.

3.3 PROGRAMMING

- A. Include in bid the cost to cover all system programming, including items particular to this project (such as custom zone descriptions, time delay settings, sensitivity settings, etc.) such that entire system is 100% complete and operating to the Owner's satisfaction. Coordinate all system programming with the Owner. Also, provide programming of the system a minimum of once during the warranty period to provide changes requested by the Owner.

3.4 SPARE EQUIPMENT

- A. Provide the following spare equipment to the Owner. Deliver the equipment to the Owner designated location on the project site in original packaging.

B. Equipment to include:

1. Smoke detectors: 5% of each type used with a minimum of five (5).
2. Heat detectors: 5% of each type used with a minimum of five (5).
3. Addressable control modules: 2% of each type used with a minimum of two (2).

3.5 TESTING AND INSTRUCTION

- A. The complete fire alarm system shall be fully tested after the installation is complete. Testing shall include all devices, FACP, annunciator panel, other panels, features and functions. Testing shall be witnessed by the owners representative and be in accordance with the NFPA and herein. Provide a testing report to the authority having jurisdiction and the Engineer as a submittal.
- B. Provide a minimum of four (4) hours of instruction to the operating personnel designated by the Owner's Representative with regard to use and operation of the system. Provide up to three programming modifications.
- C. Provide three (3) sets of keys to all panels, manual stations, etc., to the Owner's Representative.
- D. Provide a copy of the system programming to the Owner on a CD/DVD disk or flash drive.
- E. Provide to the Owner system Operation Manuals as specified, that shall include as a minimum:
 1. Bill of Material.
 2. Catalog descriptive literature for all equipment. This shall include a description of the unit, ratings, functions, capability, materials and compatibility with other components.
 3. Riser Wiring Diagram showing all equipment, devices, device addresses, connections, control connections, remote notification connection(s), wire quantities and sizes.
 4. Floor plan indicating equipment and device locations, addresses, power circuit information with power panel location, notification circuiting, initiation circuiting and control circuiting. Contact the Engineer for a copy of the project floor plans.
 5. Typical Terminal Wiring Diagram for each type of device.
 6. Terminal wiring Diagram for all Fire Alarm equipment.
 7. Calculations including:

- a. Battery sizing calculations indicating total number of power devices, load associated with each type device and recommended battery capacity (AH).
 - b. Voltage drop calculations with actual equipment loads used to derive battery back-up ampere-hour rating and individual circuit voltage drop (indicate the wire size to be used and the associated voltage drop with the allowed voltage drop) for each circuit.
8. Instruction report starting when instruction was given and who was in attendance, signed by Owner's Representative.
9. A written test report from an authorized representative of the equipment manufacturer that each device and overall system operation has been 100% tested and approved.
10. Certificate of Completion as described in NFPA-72.
11. A two (2) year warranty in accordance with the Basic Requirements of these Specifications shall be provided for this system.

3.6 CO DETECTOR SIGNAGE

- A. Coordinate with the Owner, install a permanent 8-1/2 in. and 11 in., two (2) color lamicaid sign at eye level in the vicinity of every CO alarm notification device indicating specific instructions to be followed, ex. "Do not enter room if an alarm is sounding".

END OF SECTION

APPENDIX A

FIRE ALARM SYSTEM OPERATION/SEQUENCE MATRIX

System Outputs

[illegible]