

**PROJECT SPECIFICATIONS / MANUAL**

**Volume 5**

**Rye City School District**

**Rye High School/Middle School**

1 Parsons Street  
Rye, NY 10580

**SED Number: #66-18-00-01-0-005-031 & #66-18-00-01-0-005-032**

***Issued for Bid: 2021-01-19***

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**Rye City Schools**

**Rye High School/Middle School**

**1 Parsons Street Rye, NY 10580**

SED Number: # 6618-0001-0005-032

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## SECTION 000115

### LIST OF DRAWING SHEETS

#### 1.1 LIST OF DRAWINGS

- A. Drawings: Drawings consist of the Contract Drawings and other drawings listed on the Table of Contents page of the separately bound drawing set titled Drawings Issued for Bid, dated January 19, 2021.
- B. List of Drawings: Drawings consist of the following Contract Drawings and other drawings of type indicated:

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END OF SECTION 000115

## **SECTION 020800 – ASBESTOS ABATEMENT**

AT: RYE CITY SCHOOL DISTRICT  
RYE HIGH SCHOOL/MIDDLE SCHOOL  
SED# 66180001-0005-032

OWNER: RYE CITY SCHOOL DISTRICT  
555 THEODORE FREMD AVENUE, SUITE B-101  
RYE, NEW YORK 10580

CONSULTANT: QUALITY ENVIRONMENTAL SOLUTIONS  
& TECHNOLOGIES, INC.  
1376 ROUTE 9  
WAPPINGERS FALLS, NEW YORK 12590



**SPECIFICATION DATED: January 19, 2021**

Design conforms to all applicable provisions of the NYS Uniform Fire Prevention and Building Code, NYS Energy Conservation Construction Code and Education Department Building Standards.

## SECTION 020800 – ASBESTOS ABATEMENT PROCEDURES

### PART I – GENERAL

#### 1.01 DESCRIPTION

- A. All work under this contract shall be performed in strict accordance with the specifications and all applicable laws for asbestos removal projects. The Abatement Contractor shall furnish all labor, materials, supervision, services, insurance and equipment necessary for the complete and total removal of Asbestos-containing Materials (ACM) as described herein, in attachments to the specification, Job Specific Variance(s) and/or as directed by Rye CSD (here-in-after the "Owner") and/or the Owners Representative(s) to support ***Rye CSD: 2019 Capital Bond Project Phase II*** ☐ ***Rye High School/Middle School***.
- B. Abatement Contractor shall provide for personnel air monitoring to satisfy OSHA regulation 29 CFR Parts 1926.1101(f). All work performed shall be in strict accordance with applicable provisions and regulations promulgated under New York State Department of Labor, Industrial Code 56 (ICR-56).
- C. The Abatement Contractor shall satisfy the requirements for asbestos projects issued by the New York State Department of Labor concerning licensing and certification; notification; equipment; removal and disposal procedures; engineering controls; work area preparation; decontamination and clean-up procedures; and personnel air monitoring.
- D. The Abatement Contractor shall be responsible for submittal of asbestos project notification(s) and applicable fees to EPA and NYSDOL concerning this project. Project notification(s) shall be made for the cumulative total of ACM to be removed as required by ICR-56-3.4. Work practices for each individual work area established shall be consistent with the quantity of ACM contained within that work area as defined in ICR-56-2.
- E. The scope of work under this contract shall include the following:
  - 1. All asbestos-containing materials (ACM) shall be removed in accordance with these specifications. The Abatement Contractor is responsible for field verification of estimated quantities, locations and other site conditions that may affect work.
  - 2. All fixed objects remaining within the work area(s) shall be protected as required by Title 12 NYCRR Section 56-7.10(b) and as described in these specifications.
  - 3. The containerization, labeling and disposal of all asbestos waste in accordance with applicable city, state and federal regulations and these specifications.
  - 4. The Abatement Contractor will be responsible for repairing all building components damaged during abatement including, but not limited to, ceiling tiles, ceiling finishes, wall finishes and/or floor finishes, etc.
  - 5. The Abatement Contractor shall be responsible for any and all demolition required to access materials identified in scope of work and on associated drawings.

6. Concealed conditions that are exposed and may require additional work shall be brought to the attention of the Owner(s) immediately. The Abatement Contractor shall not abate these areas without a written notice to proceed. If the Abatement Contractor removes additional asbestos prior to the order to proceed the additional work will not be acknowledged.
7. Permissible working hours shall be Monday through Friday 7:00 A.M. to 4:00 P.M. and/or as defined by the Owner(s) and/or Owner's Representative(s). Holidays shall be considered weekends and not included for working days. Upon written approval from the Owner, the Abatement Contractor may work past these hours. The Abatement Contractor will incur any and all costs associated for work performed beyond the defined schedule including, but not limited to: abatement activities, project/air monitoring, custodial/staffing labor, overtime, mobilizations, etc.
8. Buildings will be turned over to the Abatement Contractor as is. At that time, all electrical services and HVAC systems in the proposed work areas will be shut down. Electricity and water supply will be maintained in the building for use by the Abatement Contractor. The Abatement Contractor is responsible for securing all power in the work area(s) and establishing all temporary GFCI hookups necessary to complete his work.
9. The Abatement Contractor shall remove all identified Asbestos-containing Materials (ACM) to building substrate(s); in areas indicted. Subsequent to final air clearances, the substrate(s) shall be washed with a neutralizing agent to prepare the substrate to accept new floor covering and eliminate residual odors.
10. The Abatement Contractor must coordinate location of waste containers with the Facility and the Owner. Deliveries and storage of equipment must be coordinated with the Facility and the Owner.
11. All "Large" and "Small" asbestos abatement projects, as defined by 12 NYCRR56 shall not be performed while the building is occupied. The term "building" means a wing or major section of a building that can be completely isolated from the rest of the building with sealed non-combustible construction. The isolated portion of the building must contain exists that do not pass through the occupied portion(s) and ventilation systems must be physically separated and sealed at the isolation barriers.

## **1.02 PRE-CONTRACT SUBMITTALS**

Within three (3) days after bids are opened, the three (3) apparent low bidders shall be required to submit the following documentation:

A. Resume's: Shall include the following:

1. Provide a list of projects of similar nature performed within the past two (2) years and include the dollar value of all projects. Provide project references to include owner, consultant, and air monitoring firms' name, contact person, address, and phone number, include location of project and date of completion.
2. Abatement Contractor license issued by New York State Department of Labor for asbestos work in accordance with ICR-56-3.

3. A list of owned equipment available to be used in the performance of the project.
4. The number of years engaged in asbestos removal.
5. An outline of the worker training courses and medical surveillance program conducted by the Abatement Contractor.
6. A standard operating procedures manual describing work practices and procedures, equipment, type of decontamination facilities, respirator program, special removal techniques, etc.
7. Documentation to the satisfaction of the Owner pertaining to the Abatement Contractor's financial resources available to perform the project. Such data shall include, but not be limited to, the firm's balance sheet for the last fiscal year.

**B. Citations/Violations/Legal Proceedings**

1. Submit a notarized statement describing any citations, violations, criminal charges, or legal proceedings undertaken or issued by any law enforcement, regulatory agency, or consultant concerning performance on previous asbestos abatement contracts. Briefly describe the circumstances citing the project and involved persons and agencies as well as the outcome of any actions.
2. Answer the question: "Has your firm or its agents been issued a Stop Work order on any project within the last two years?" If "Yes" provide details as discussed above.
3. Answer the question: "Are you now, or have you been in the past, a party to any litigation or arbitrations arising out of your performance on Asbestos Abatement Contracts?" If "Yes" provide details as discussed in 1. above.
4. Describe any liquidated damages assessed within the last two years.

**C. Preliminary Schedule**

1. Provide a detailed schedule including work dates, work shift times, estimate of manpower to be utilized and the start and completion date for completion of each major work area.

**1.03 DOCUMENTATION**

- A.** The Abatement Contractor shall be required to submit the following and receive the Consultant's approval prior to commencing work on this project:
1. Provide documentation of worker training for each person assigned to the project. Documentation shall include copies of each workers valid New York State asbestos handler certificates (for those employees who may perform asbestos removal), documentation of current respirator fit test and current OSHA required training and medical examination.
  2. The attached "Asbestos Employee Medical Examination Statement" and "Asbestos Employee Training Statement" forms shall be completed, signed and submitted for each worker assigned to

the project. Records of all employee training and medical surveillance shall be maintained for at least forty (40) years. Copies of the records shall be submitted to the Consultant prior to commencement.

3. The Abatement Contractor shall submit proof of a current, valid license issued by the New York State Department of Labor pursuant to the authority vested in the Commissioner by section 906 of the Labor Laws, and that the employees performing asbestos related work on this project are certified by the State of New York as required in Part 56 of Title 12 of the Official Compilation of Codes, Rules and Regulations of the State of New York latest edition. Copies of all licenses shall be submitted prior to the commencement of the project.
4. The Abatement Contractor shall submit a written respiratory protection program meeting the requirements of 29 CFR 1910.134 to the Consultant.
5. The name, address, social security number and NYS DOL certificate number of the person(s) who will supervise the asbestos project.
6. The name and address of the deposit or waste disposal site or sites where the asbestos materials are to be deposited or disposed of. This site must be approved by the Owner. The manifesting procedure must also be specified.
7. The name, address and New York State Dept. of Environmental Conservation ID Number of any transporters that are to be used to transport waste.
8. A written Standard Operation Procedure (SOP) that is designed and implemented to maximize protection against human exposure to asbestos dust. The SOP shall take into consideration the workers, visitors, building employees, general public and environment. As a minimum the procedures must include the following:
  - a. Security for all work areas on an around-the-clock basis against unauthorized access.
  - b. Project organization chart including the phone numbers of at least two responsible persons who shall be authorized to dispatch men and equipment to the project in the event of an emergency; including weekends.
  - c. Description of protective clothing and NIOSH approved respirators to be used.
  - d. Description of all removal methods to be used, including HEPA air filtration and decontamination sequence with special emphasis on any procedure that may deviate from these specifications.
  - e. A list of manufacturers' certificates stating that all vacuums, negative air filtration equipment, respirators and air supply equipment meet OSHA and EPA requirements.
  - f. A list of all materials proposed to be furnished and used under this contract.
  - g. Emergency evacuation procedures in the event of fire, smoke or accidents such as injury from falling, heat exposure, electrical shock, etc.

- h. The name, address and ELAP number of the New York State Department of Health Certified Analytical Testing Laboratory the Contractor proposes to use for the OSHA monitoring.
- 9. A detailed plan, in triplicate, for the phasing of the project, division of work areas and location of decontamination facilities, waste containers and temporary office.
- 10. Work schedule, identifying firm dates and completion for actual areas. Bar chart or critical path chart indicating phases is required.
- B. The Abatement Contractor shall post their NYS DOL contractor's license and maintain a daily log documenting the dates and time of the following items within each personal decontamination unit:
  - 1. Meetings; purpose, attendants, discussion (brief)
  - 2. Sign-in and sign-out of all persons entering the work area including name, date, time, social security number, position or function and general description of daily activity.
  - 3. Testing of barriers and enclosure systems using smoke tubes prior to the beginning of abatement activities and at least once a day thereafter until satisfactory clearance air monitoring results have been achieved.
  - 4. Inspection of all plastic barriers, twice daily, by the asbestos supervisor.
  - 5. Loss of enclosure integrity; special or unusual events, barrier breaches, equipment failures, etc.
  - 6. Daily cleaning of enclosures.
  - 7. Personnel air monitoring test results for OSHA Compliance. Results shall be posted at the work site within 24 hours of testing and copies supplied to the Owner within five (5) days of testing. Abnormalities shall be supplied to the Owner immediately.
- C. Documentation with confirmation signature of Consultant's representative of the following shall be provided by the Abatement Contractor at the final closeout of the project.
  - 1. Testing of barriers and enclosure systems using smoke tubes shall be performed prior to the beginning of abatement activities and at least once a day thereafter until satisfactory clearance air monitoring results have been achieved.
  - 2. Inspection of all plastic barriers.
  - 3. Removal of all polyethylene barriers.
  - 4. Consultant's inspections prior to encapsulation.
  - 5. Removal of waste materials.
  - 6. Decontamination of equipment (list items).
  - 7. Consultant's final inspection/final air tests.



D. The Abatement Contractor shall provide records of all project information, to include the following which shall be submitted upon completion of the project and prior to approval of the Abatement Contractor's payment application:

1. The location and description of the abatement project.
2. The name, address and social security number of the person(s) who supervised the asbestos project.
3. Certified payroll documentation Pursuant to Article 8, Section 220 of the NYS Labor Law
4. Copies of EPA/NYS DOL Asbestos Certificates for all Workers and Supervisors employed on the Project.
5. Copies of Medical Approval and Respirator Fit-testing for all Asbestos Workers and Supervisors employed on the Project.
6. Copies of Abatement Contractors Daily Sign-In Sheets & Logs for persons entering and leaving the work area. – Title 12 NYCRR Part 56-7.3.
7. Copies of Abatement Contractor's personal air sampling laboratory results.
8. The amounts and type of asbestos materials that was removed, enclosed, encapsulated, or disturbed.
9. The name and address of the deposit or waste disposal site or sites where the asbestos waste materials were deposited or disposed of and all related manifests, receipts and other documentation associated with the disposal of asbestos waste.
10. The name and address of any transporters used to transport waste and all related manifests, receipts and other documentation associated with the transport of asbestos waste.
11. All other information that may be required by state, federal or local regulations.
12. Copy of the Supervisor's Daily Project Log of events as described in 1.03 B, above.

#### **1.04 NOTIFICATIONS AND PERMITS**

A. The Abatement Contractor shall be required to prepare and submit notifications to the following agencies at least ten (10) days and/or business days, as required prior to the commencement of the project:

1. Asbestos NESHAPS Contact  
U.S. Environmental Protection Agency  
NESHAPS Coordinator, Air Facilities Branch  
26 Federal Plaza  
New York, New York 10007  
(212) 264-7307

2. State of New York Department of Labor  
Division of Safety and Health  
Asbestos Control Bureau  
State Office Building Campus, Building 12, Room 454  
Albany, New York 12240
3. Owner(s): Rye CSD  
555 Theodore Fremd Avenue, Suite B-101  
Rye, NY 10580  
ATTN: Robert Gimigliano, Director of Facilities & Operations  
Ph. (914) 967-6100  
Fx. (914) 967-6957  
E-mail. [Gimigliano.Robert@ryeschools.org](mailto:Gimigliano.Robert@ryeschools.org)
4. Environmental Consultant(s): Quality Environmental Solutions & Technologies, Inc. (QuES&T)  
1376 Route 9  
Wappingers Falls, New York 12590  
ATTN: Anthony Perre  
Ph. (845) 298-6031  
Fx. (845) 298-6251  
E-mail. [aperre@qualityenv.com](mailto:aperre@qualityenv.com)

B. The notification shall include but not be limited to the following information:

1. Name and address of Owner.
2. Name, address, and asbestos handling license number of the Abatement Contractor.
3. Address and description of the building, including size, age, and prior use of the building or area; the amount, in square feet or linear feet of asbestos material to be removed; room designation numbers or other local information where asbestos material is found, including the type of asbestos material (friable or non-friable).
4. Scheduled starting and completion dates for removal.
5. Methods to be employed in abating asbestos containing materials.
6. Procedures and equipment, including ventilating/exhaust systems, that will be employed to comply with the Code of Federal Regulation (CFR) Title 40, Part 61 of the U.S. Environmental Protection Agency.
7. The name and address of the carting company and of the waste disposal site where the asbestos waste will be deposited.

**NOTE:** Notifications shall be submitted using standard forms as may be used by the respective agency.

For DOL (NYS) include "Asbestos Project Notification" form (DOSH-483) with proper fee, if required. For EPA include "Notification of Demolition and Renovation"; 40 CFR Part 61.

- C. The Abatement Contractor shall secure any permits required by the city, town, county, or state that may be required and the cost for obtaining the permit shall be included in his base bid.
- D. The Abatement Contractor shall erect warning signs around the work space at every point of potential entry into the work area in accordance with OSHA 1926.58k (2), (i). These signs shall bear the following information:

**DANGER**  
**CANCER AND LUNG DISEASE HAZARD**  
**AUTHORIZED PERSONNEL ONLY**  
**RESPIRATORS AND PROTECTIVE**  
**CLOTHING**  
**ARE REQUIRED IN THIS AREA**

- E. The Abatement Contractor shall post at entrances to the work place and immediate adjacent areas, notifications to building occupants which include the name and license number of the contractor, project location and size, amount and type of ACM, abatement procedures, dates of expected occurrence and name and address of the air monitor and laboratory in compliance with ICR 56-3.6.
- F. The Abatement Contractor shall post a list of emergency telephone numbers at the job site which shall include the Owner's Representative, police, emergency squad, local hospital, Environmental Protection Agency, N.Y. State Department of Labor, Occupational Safety and Health Administration and the local Department of Health.

#### **1.05 APPLICABLE STANDARDS**

Except to the extent that more explicit or more stringent requirements are written directly into the contract documents, applicable standards of the construction industry have the same force and effects (and are made a part of contract documents by reference) as if copied directly into contract documents, or as if published copies were bound herewith. Resolution of overlapping and conflicting requirements, which result from the application of several different industry standards to the same unit of work, shall be by adherence to the most stringent requirement.

- A. Applicable standards listed in these Specifications form a part of this Specification and include, but are not necessarily limited to, standards promulgated by the following agencies and organizations:

- 1. ANSI:

American National Standards Institute  
1430 Broadway  
New York, New York 10018

2. ASHRAE:  
American Society for Heating, Refrigerating  
and Air Conditioning Engineers  
1791 Tullie Circle NE  
Atlanta, Georgia 30329
3. ASTM:  
American Society for Testing and Materials  
1916 Race Street  
Philadelphia, Pennsylvania 19103
4. CFR  
Code of Federal Regulations Available  
from Government Printing Office  
Washington, District of Columbia 20402
5. CGA  
Compressed Gas Association  
1235 Jefferson Davis Highway  
Arlington, Virginia 22202
6. CS  
Commercial Standard of NBS  
(US Dept. of Commerce)  
Government Printing Office
7. EPA  
Environmental Protection Agency, Region II  
26 Federal Plaza  
New York, New York 10007  
Asbestos Coordinator - Room 802  
(212) 264-9538  
Part 61, Sub-Parts A & B  
National Emission Standard for Asbestos
8. FEDERAL SPECS  
Federal Specification (General Services Administration)  
7th and D Street, SW  
Washington, District of Columbia 20406
9. NBS  
National Bureau of Standards  
(US Department of Commerce)  
Gaithersburg, Maryland 20834
10. NEC  
National Electrical Code (by NFPA)
11. NFPA

National Fire Protection Association  
Batterymarch Park  
Quincy, Massachusetts 02269

12. NIOSH

National Institute for Occupational Safety and Health  
26 Federal Plaza  
New York, New York 10007

13. NYSDOH

New York State Department of Health  
Bureau of Toxic Substance Assessment  
Room 359 - 3rd Floor  
Tower Building Empire State Plaza  
Albany, New York 12237

14. NYSDEC

New York State Department of Environmental Conservation  
Room 136  
50 Wolf Road  
Albany, New York 12233-3245

15. NYSDOL

State of New York Department of Labor  
Division of Safety and Health  
Asbestos Control Program  
State Campus  
Building 12  
Albany, New York 12240

16. OSHA

Occupational Safety and Health Administration  
(US Department of Labor)  
New York Regional Office - room 3445  
1515 Broadway  
New York, New York 10036

17. UL

Underwriters Laboratories  
333 Pfingsten Road  
Northbrook, Illinois 60062

B. Federal Regulations: Those which govern asbestos abatement work or hauling and disposal of asbestos waste materials:

1. U.S. Department of Labor, Occupational Safety and Health Administration, (OSHA):

a. Asbestos Regulations

Title 29, Part 1910, of the Code of Federal Regulations.

- b. Respiratory Protection  
Title 29, Part 1910, Section 134 of the Code of Federal Regulations.
  - c. Construction Industry  
Title 29, Part 1926, of the Code of Federal Regulations.
  - d. Access to Employee Exposure & Medical Records  
Title 29, Part 1910, Section 20 of the Code of Federal Regulations.
  - e. Hazard Communication  
Title 29, Part 1910, Section 1200 of the Code of Federal Regulations.
  - f. Specifications for Accident Prevention Signs and Tags  
Title 29, Part 1910, section 145 of the Code of Federal Regulations.
2. U.S. Environmental Protection Agency (EPA):
- a. Asbestos Hazard Emergency Response Act (AHERA) Regulation Asbestos Containing Materials in Schools Final Rule & Notice Title 40, Part 763, Subpart E of the Code of Federal Regulations.
  - b. Worker Protection Rule  
40 CFR Part 763, Subpart G, CPTS 62044, FLR 2843-9  
Federal Register, Vol. 50, No. 134, 7/12/85, P28530-28540
  - c. Regulation for Asbestos  
Title 40, Part 61, Subpart A of the Code of Federal Regulations
  - d. National Emission Standard for Asbestos  
Title 40, Part 61, Subpart M (Revised Subpart B) of the Code of Federal Regulations
  - e. Resource Conservation and Recovery Act (RCRA) 1976, 1980  
Hazardous and Solid Waste Amendments (HSWA) 1984  
Subtitle D, Subtitle C
3. U.S. Department of Transportation (DOT):
- a. Hazardous Substances: Final Rule Regulation 49 CFR, Part 171 and 172.
- C. State Regulations: Those which govern asbestos abatement work or hauling and disposal of asbestos waste materials:
- 1. New York State Department of Environmental Conservation (DEC) Regulations regarding waste collection registration. Title 6, Part 364 of the New York State Official Compilation of Codes, Rules and Regulations - 6NYCRR 364.
  - 2. New York State Right-To-Know Law

3. New York State Department of Labor Asbestos Regulations Industrial Code Rule 56.
  4. New York State Department of Health, Title 10 Part 73 Asbestos Safety Program Requirements.
- D. Standards: Those which govern asbestos abatement work or hauling and disposal of asbestos waste materials:
1. American National Standards Institute (ANSI)
    - a. Fundamentals Governing the Design and Operation of Local Exhaust Systems  
Publication Z9.2-79
    - b. Practices for Respiratory Protection  
Publication Z88.2-80
- E. Guidance Documents: Those that discuss asbestos abatement work or hauling and disposal of asbestos waste materials are listed below only for the Abatement Contractor's information. These documents do not describe the work and are not a part of the work of this contract.
- EPA:
1. Guidance for Controlling Asbestos Containing Materials in Buildings (Purple Book)  
EPA560/5-85-024.
  2. Asbestos Waste Management Guidance EPA 530-SW-85-007.
- F. Patents and Royalties: The Abatement Contractor shall pay all royalties and/or license fees. The Abatement Contractor shall defend all suits and claims for infringement of any patent rights and save the Owner and Consultant harmless from loss including attorney fees on account thereof.

## 1.06 DEFINITIONS

As used in or in connection with these specifications the following are terms and definitions.

**Abatement** - Procedure to control release from asbestos material. This includes removal, encapsulation and enclosure.

**Aggressive sampling** - A method of sampling in which the person collecting the air sample creates activity by the use of mechanical equipment during the sampling period to stir up settled dust and simulate activity in that area of the building.

**AIHA** - The American Industrial Hygiene Association, 475 Wolf Ledges Parkway, Akron, Ohio 44311.

**Airlock** - A system for permitting entrance and exit while restricting air movement between a containment area and an uncontaminated area. It consists of two curtained doorways separated by a distance of at least three feet such that one passes through one doorway into the airlock,

allowing the doorway sheeting to overlap and close off the opening before proceeding through the second doorway, thereby preventing flow-through contamination.

**Air sampling** - The process of measuring the content of a known volume of air collected during a specific period of time.

**Amended water** - Water to which a surfactant has been added.

**Approved asbestos safety program** - A program approved by the Commissioner of Health providing training in the various disciplines that may be involved in an asbestos project.

**Area air sampling** - Any form of air sampling or monitoring where the sampling device is placed at some stationary location.

**Asbestos** - Any naturally occurring hydrated mineral silicate separable into commercially usable fibers, including chrysotile (serpentine), amosite (cumingtonite-gunerite), crocidolite (riebeckite), tremolite, anthophyllite and actinolite.

**Asbestos contract** - An oral or written agreement contained in one or more documents for the performance of work on an asbestos project and includes all labor, goods and service.

**Asbestos handler** - An individual who installs, removes, applies, encapsulates, or encloses asbestos or asbestos material, or who disturbs friable asbestos. Only individuals certified by NYS Department of Labor shall be acceptable for work under this specification.

**Asbestos handling certificate** - A certificate issued by the Commissioner of Labor of the State of New York, to a person who has satisfactorily completed an approved asbestos safety program.

**Asbestos project** - Work undertaken by a contractor which involves the installation, removal, encapsulation, application or enclosure of any ACM or the disturbance of friable ACM.

**Asbestos Safety Technician (AST)** - Individual designated to represent the Consultant, perform third party monitoring and perform compliance monitoring at the job site during the asbestos project.

**Asbestos waste material** - Asbestos material or asbestos contaminated objects requiring disposal.

**Authorized visitor** - The building owner, his or her representative or any representative of a regulatory or other agency having jurisdiction over the project.

**Background level monitoring** - A method used to determine ambient airborne concentrations inside and outside of a building or structure prior to starting an abatement project.

**Building owner** - The person in whom legal title to the premises is vested unless the premises are held in land trust, in which instance Building Owner means the person in whom beneficial title is vested.

**Clean room** - An uncontaminated area or room that is a part of the personal decontamination enclosure with provisions for storage of persons' street clothes and protective equipment.



**Cleanup** - The utilization of HEPA vacuuming to control and eliminate accumulations of asbestos material and asbestos waste material.

**Clearance air monitoring** - The employment of aggressive sampling techniques with a volume of air collected to determine the airborne concentration of residual fibers upon conclusion of an asbestos abatement project.

**Commissioner** - Commissioner of the New York State Department of Labor.

**Contractor** - A company, unincorporated association, firm, partnership or corporation and any owner or operator thereof, which engages in an asbestos project or employs persons engaged in an asbestos project.

**Curtained doorway** - A device that consists of at least three overlapping sheets of plastic over an existing or temporarily framed doorway. One sheet shall be secured at the top and left side, the second sheet at the top and right side, and the third sheet at the top and the left side. All sheets shall have weights attached to the bottom to insure that the sheets hang straight and maintain a seal over the doorway when not in use.

**Decontamination enclosure system** - A series of connected rooms, separated from the work area and from each other by air locks, for the decontamination of persons, materials, equipment, and authorized visitors.

**Encapsulant (sealant) or encapsulating agent** - A liquid material that can be applied to asbestos material and which prevents the release of asbestos from the material by creating a membrane over the surface.

**Enclosure** - The construction of airtight walls, ceilings and floors between the asbestos material and the facility environment, or around surfaces coated with asbestos materials, or any other appropriate procedure that prevents the release of asbestos materials.

**Equipment room** - A contaminated area or room that is part of the personal decontamination enclosure system with provisions for the storage of contaminated clothing and equipment.

**Fixed object** - A unit of equipment, furniture or other fixture in the work area which cannot be readily removed from the work area.

**Friable Asbestos Material** - That condition of crumbled, pulverized, powdered, crushed or exposed asbestos capable of being released into the air by hand pressure.

**Friable material containment** - The encapsulation or enclosure of any friable asbestos material.

**Glovebag technique** - A method for removing asbestos material from heating, ventilating, and air conditioning (HVAC) ducts, piping runs, valves, joints, elbows, and other nonplanar surfaces in a noncontained work area. The glovebag assembly is a manufactured device consisting of a glovebag constructed of at least six mil transparent plastic, two inward-projecting longsleeve gloves, which may contain an inward projecting waterwand sleeve, an internal tool pouch, and an attached, labeled receptacle or portion for asbestos waste.

The glovebag is constructed and installed in such a manner that it surrounds the object or area to be decontaminated and to contain all asbestos fibers released during the abatement process.

**HEPA filter** - A high efficiency particulate air filter capable of trapping and retaining 99.97 percent of particulate greater than 0.3 microns equivalent aerodynamic diameter.

**HEPA vacuum equipment** - Vacuuming equipment with a high efficiency particulate air filtration system.

**Holding area** - A chamber in the waste decontamination enclosure located between the washroom and an adjacent uncontaminated area.

**Homogeneous work area** - A site within the abatement work area that contains one type of asbestos material and where one type of abatement is used.

**Large asbestos project** - An asbestos project involving the installation, removal, disturbance, enclosure, or encapsulation of 160 square feet or more of asbestos or asbestos material or 260 linear feet or more of asbestos or asbestos material.

**Minor asbestos project** - An asbestos project involving the installation, removal, disturbance, enclosure, or encapsulation of 10 square feet or less of asbestos or asbestos material, or 25 linear feet or less of asbestos or asbestos material.

**Movable object** - A unit of equipment, furniture or fixture in the work area that can be readily removed from the work area.

**Negative air pressure equipment** - A local exhaust system equipped with HEPA filtration. The system shall be capable of creating and maintaining a negative pressure differential between the outside and the inside of the work area.

**Non-asbestos material** - Any material containing one percent or less asbestos by weight.

**Occupied area** - Any frequented portion of the work site where abatement is not taking place.

**Outside air** - The air outside the building or structure.

**Personal air monitoring** - A method used to determine an individual's exposure to airborne contaminants. The sample is collected outside the respirator in the person's breathing zone.

**Plasticize** - To cover floors, walls, ceilings and other surfaces with 6 mil fire retardant plastic sheeting as herein specified.

**Project** - Any form of work performed in connection with the abatement of asbestos or alteration, renovation, modification or demolition of a building or structure that may disturb asbestos or asbestos material.

**Removal** - The stripping of any asbestos material.

**Repair** - Corrective action using required work practices to control fiber release from damaged areas.

**Respiratory protection** - Respiratory protection required of licensed asbestos workers and authorized visitors in accordance with the applicable laws.

**Satisfactory clearance air monitoring results** - For all post- abatement samples, airborne concentrations of total fibers that are less than 0.01 fibers per cubic centimeter or background levels, whichever are greater, using phase contrast microscopy (PCM).

**Shower room** - A room between the clean room and the equipment room in the personal decontamination enclosure with hot and cold running water controllable at the top and arranged for complete showering during decontamination.

**Small asbestos project** - An asbestos project involving the installation, removal, disturbances, enclosure, or encapsulation of more than 10 and less than 160 square feet of asbestos or asbestos material of more than 25 and less than 260 linear feet of asbestos or asbestos material.

**Staging area** - The area near the waste transfer airlock where containerized asbestos waste has been placed prior to removal from the work area.

**Surfactant** - A chemical wetting agent added to water to improve its penetration.

**Visible emissions** - An emissions of particulate material that can be seen without the aid of instruments.

**Washroom** - A room between the work area and the holding area in the waste decontamination enclosure system, where equipment and waste containers are wet cleaned and/or HEPA vacuumed.

**Waste decontamination enclosure system** - An area, consisting of a washroom and a holding area, designated for the controlled transfer of materials and equipment.

**Wet cleaning** - The process of eliminating asbestos contamination from surfaces, equipment or other objects by using cloths, mops, or other cleaning tools.

**Work area** - Designated rooms, spaces, or areas where asbestos abatement takes place.

**Work site** - Premises where asbestos abatement is taking place.

**Work Surface** - Substrate surface from which asbestos-containing material has been removed.

## **1.07 UTILITIES, SERVICE AND TEMPORARY FACILITIES**

- A. The Owner shall make available to the Abatement Contractor all reasonable amounts of water and electrical power at no charge.
- B. The Abatement Contractor shall provide, at his own expense, all electrical, water, and waste connections, extensions, and construction materials, supplies, etc. All connections must be

approved in advance by the Owner and all work relative to the utilities must be in accordance with the applicable building codes.

- C. The Abatement Contractor shall provide scaffolding, ladders and staging, etc. as necessary to accomplish the work of this contract. The type, erection and use of all scaffolding, ladders and staging, etc. shall comply with all applicable OSHA provisions.
- D. All connections to the Owner's water system shall include reduced pressure backflow protection or double check and double gate valves. Valves shall be temperature and pressure rated for operation of the temperatures and pressures encountered. After completion of use, connections and fittings shall be removed without damage or alteration to existing water piping and equipment. Leaking or dripping valves shall be piped to the nearest drain or located over an existing sink or grade where water will not damage existing finishes or equipment.
- E. The Abatement Contractor shall use only heavy duty abrasion resistant hoses with a pressure rating greater than the maximum pressure of the water distribution system to provide water to each work area and to each decontamination unit. Provide fittings as required to allow for connection to existing wall hydrants or spouts, as well as temporary water heating equipment, branch piping, showers, shut-off nozzles and equipment. All water must be shut off at the end of each shift.
- F. The Abatement Contractor shall provide service to decontamination unit electrical subpanel with minimum 60 amp, 2 pole circuit breaker or fused disconnect and ground-fault circuit interrupters (GFCI), reset button and pilot light, connected to the building's main distribution panel. Subpanel and disconnect shall be sized and equipped to accommodate all electrical equipment required for completion of the work. This electrical subpanel shall be used for hot water heater, PAPR battery recharging and air sampling pumps.
- G. The Abatement Contractor shall provide UL rated 40-gallon electric hot water heater to supply hot water for the decontamination unit shower. Activate from 30 amp circuit breaker on the electrical subpanel located within the decontamination unit. Provide with relief valve compatible with water heater operation; relief valve down to drip pan on floor with type L copper. Wiring of the hot water heater shall be in compliance with NEMA, NEC, and UL standards.
- H. The Abatement Contractor shall provide identification warning signs at power outlets, which are other than 110-120 volt power. Provide polarized outlets for plug-in type outlets, to prevent insertion of 110-120 plugs into higher voltage outlets. Dry transformers shall be provided where required to provide voltages necessary for work operations. All outlets or power supplies shall be protected by ground fault circuit interrupter (GFCI) at the power source.
- I. The Abatement Contractor shall use only grounded extension cords; use "hard-service" cords where exposed to abrasion and traffic. Use single lengths or use waterproof connectors to connect separate lengths of electric cords, if single lengths will not reach areas of work.
- J. The Abatement Contractor shall provide general service incandescent lamps of wattage indicated or required for adequate illumination; Protect lamps with guard cages or tempered glass enclosures; Provide exterior fixtures where fixtures are exposed to moisture.
- K. The Abatement Contractor shall provide temporary heat or air conditioning as necessary to maintain comfortable working temperatures inside and immediately outside the work areas.

Heating and A/C equipment shall have been tested and labeled by UL, FM or another recognized trade association related to the fuel being used. Fuel burning heaters shall not be used inside containment areas. The Contractor shall also provide a comfortable working environment for occupied areas that are impacted by the asbestos removal.

- L. The Abatement Contractor shall comply with recommendations of the NFPA standard in regard to the use and application of fire extinguishers. Locate fire extinguishers where they are most convenient and effective for their intended purpose, but provide not less than one extinguisher in each work area, equipment room, clean room and outside the work area.

## **1.08 REMOVAL OF FIXTURES**

- A. In locations where the Abatement Contractor is directed to dispose of fixtures he shall either decontaminate the fixtures and dispose of them as non-asbestos containing materials or he shall place them in an appropriate container and dispose of them as asbestos containing material.
- B. In locations where the Abatement Contractor is directed to remove and reinstall fixtures, the fixtures shall be removed, decontaminated, labeled, protected with plastic and stored by the contractor in a location as directed by the Owner.
- C. Upon completion of the asbestos removal and upon receiving satisfactory clearance air monitoring results, all items to be replaced shall be restored to their original location and reinstalled by the Abatement Contractor.

## **PART 2 – PRODUCTS**

### **2.01 MATERIALS AND EQUIPMENT**

#### **A. GENERAL REQUIREMENTS**

- 1. Materials shall be stored off the ground, away from wet or damp surfaces and under protective cover to prevent damage or contamination.
- 2. Damaged or deteriorating materials shall not be used and shall be removed from the premises.
- 3. Power tools used to drill, cut into, or otherwise disturb asbestos material shall be equipped with HEPA filtered local exhaust ventilation.
- 4. The Abatement Contractor shall make available to authorized visitors, ladders and/or scaffolds of sufficient dimension and quantity so that all work surfaces can be easily and safely reached for inspection. Scaffold joints and ends shall be sealed with tape to prevent incursion of asbestos. Scaffolds and ladders shall comply with all applicable codes.

#### **B. PLASTIC BARRIERS (POLYETHYLENE)**

- 1. In sizes and shapes to minimize the number of joints.
  - a. Six mil. (.006") fire-retardant for vertical protection (walls, entrances and openings).

- b. Six mil. (.006") fire-retardant for horizontal protection (fixed equipment) and heating grilles.
  - c. Six mil. (.006") reinforced fire-retardant for floors of decon units.
- 2. Provide two (2) layers over all roof, wall and ceiling openings. Floor penetrations shall be sealed with a rigid material prior to plasticizing to prevent tripping and fall hazards. All seams within a layer shall be separated by a minimum distance of six feet and sealed airtight. All seams between layers shall be staggered.
  - 3. Barrier Attachment - Commercially available duct tape (fabric or paper) and spray-on adhesive. Duct tape shall be capable of sealing joints of adjacent sheets of plastic, facilitating attachment of plastic sheets to finished or unfinished surfaces of dissimilar materials and adhering under both dry and wet conditions.

#### C. SIGNS

- 1. Danger signs shall be provided and shall conform to 29 CFR 1926.1101 and be 14" x 20". These signs shall bear the following information:

**DANGER  
ASBESTOS  
CANCER AND LUNG DISEASE HAZARD  
RESPIRATORS AND PROTECTIVE  
CLOTHING  
ARE REQUIRED IN THIS AREA**

#### D. DANGER LABELS AND TAPE

- 1. Labels shall be affixed to any asbestos contaminated material in accordance with the requirements of 29 CFR 1910.1200 (f) of OSHA's Hazard Communication Standard, and shall contain the following information:

**DANGER  
CONTAINS ASBESTOS FIBERS  
AVOID BREATHING DUST  
CANCER AND LUNG DISEASE HAZARD**

- 2. A label shall be affixed on each container of asbestos waste in accordance with the requirements of 49 CFR Parts 171 and 172, Hazardous Substances; Final Rule (U.S. Department of Transportation), and shall contain the following information:

**RQ HAZARDOUS SUBSTANCE  
SOLID, NOS, ORM-E, NA 9188  
(ASBESTOS)**

3. A label shall be affixed on each container of asbestos waste in accordance with the requirements of 40 CFR Part 61.150, NESHAP; Asbestos; Final Rule (USEPA) and shall contain the name of the waste generator and the location at which the waste was generated.

NOTE: All containers marked as above (1,2 and 3) shall be disposed of as asbestos waste.

4. Provide 3" red barrier tape printed with black lettered "DANGER ASBESTOS REMOVAL". Locate barrier tape across all corridors, entrances and access routes to asbestos work area.

**E. PROTECTIVE EQUIPMENT**

**1. Respiratory Requirements**

- a. Where fiber levels permit, and in compliance with regulatory requirements, Powered Air Purifying Respirators are the minimum allowable respiratory protection permitted to be utilized during removal operations.
- b. Where not in violation of NIOSH, OSHA, and any other regulatory requirements, the Abatement Contractor shall provide the following minimum respiratory protection to the maximum use concentrations indicated:

| <u>MSHA/NIOSH Approved<br/>Respiratory Protection</u>                         | <u>Maximum Use<br/>Concentration</u> |
|---|--------------------------------------|
| Half-Mask Air Purifying<br>with HEPA Filters                                  | 10x PEL                              |
| Full-Facepiece Air Purifying<br>HEPA Filters and Quantitative<br>Fit Test     | 10x PEL                              |
| Powered Air Purifying (PAPR),<br>Loose fitting Helmet or Hood,<br>HEPA Filter | 25x PEL                              |
| Powered Air Purifying (PAPR),<br>Full Facepiece, HEPA Filter                  | 50x PEL                              |
| Supplied Air, Continuous Flow<br>Loose fitting Helmet or Hood                 | 25x PEL                              |
| Supplied Air, Continuous Flow   | 50x PEL                              |

Full Facepiece, HEPA Filter

Full Facepiece-Supplied Air  
Pressure Demand, HEPA Filter 100x PEL

Full Facepiece-Supplied Air  
Pressure Demand, with Aux. SCBA,  
Pressure Demand or Continuous Flow >100x PEL

2. Disposable Clothing - "Tyvek" manufactured by Dupont or approved equal.
3. NIOSH approved safety goggles to protect eyes.
4. Polyethylene bags, 6 mil. (.006") thick (use double bags).

NOTE: Workers must wear disposable coveralls and respirator masks at all times while in the work area. Contaminated coveralls or equipment must be left in work area and not worn into other parts of the building.

#### F. TOOLS AND EQUIPMENT

1. Airless Sprayer - An airless sprayer, suitable for application of encapsulating material, shall be used.
2. Scaffolding - Scaffolding, as required to accomplish the specified work, shall meet all applicable safety regulations.
3. Transportation Equipment - Transportation equipment, as required, shall be suitable for loading, temporary storage, transport and unloading of contaminated waste without exposure to persons or property. Water tight, hard wall containers shall be provided to retain and dispose of any asbestos waste material with sharp-edged components that may tear plastic bags or sheeting. The containers shall be marked with danger labels.
4. Surfactant - Wetting Agents - "Asbestos-Wet" - Aquatrols Corp. of America or approved equal, and shall be non- carcinogenic.
5. Portable (negative air pressure) asbestos filtration system - by Micro-Trap, or approved equal.
6. Vacuum, HEPA type equal to "Nilfisk" #GA73, or "Pullman/Holt" #75 ASA.
7. Amended Water Sprayer - The water sprayer shall be an airless or other low-pressure sprayer for amended water application.
8. Other Tools and Equipment - The Abatement Contractor shall provide other suitable tools for the stripping, removal, encapsulation, and disposal activities including but not limited to: hand-held scrapers, nylon brushes, sponges, rounded edge shovels, brooms, and carts.



## **PART 3 – EXECUTION**

### **3.01 PRE-ABATEMENT WORK AREA PREPARATION**

- A. The work area shall be vacated by the occupants prior to work area preparation and not reoccupied until satisfactory clearance air monitoring results have been achieved.
- B. Caution signs shall be posted at all locations and approaches to a location where airborne concentrations of asbestos may exceed ambient background levels. Signs shall be posted that permit a person to read the sign and take the necessary protective measures to avoid exposure.
- C. Shut down and lock out electric power to all work areas. The Abatement Contractor shall provide temporary power and lighting and ensure safe installation of temporary power sources and equipment used where high humidity and/or water shall be sprayed in accordance with all applicable codes. All power to work areas shall be brought in from outside the area through a ground-fault interrupter at the source.
- D. Isolate the work area HVAC system.
- E. The personnel decontamination enclosure system shall be installed or constructed prior to preparatory work in the work area and in particular before the disturbance of asbestos material. The waste decontamination enclosure system shall be installed or constructed prior to commencement of abatement activities.
- F. Movable objects within the work area shall be pre-cleaned using HEPA filtered vacuum equipment and/or wet cleaning and such objects shall be removed from the work area to an uncontaminated location. If disposed of as asbestos waste material, cleaning is not required.
- G. Fixed objects and other items, which are to remain within the work area, shall be pre-cleaned using HEPA filtered vacuum equipment and/or wet cleaning. Such objects shall be enclosed with two layers of at least six mil plastic sheeting and sealed with tape.
- H. The work area shall be pre-cleaned using HEPA filtered vacuum equipment and/or wet cleaning. Methods that raise dust, such as dry sweeping or vacuuming with equipment not equipped with HEPA filters, shall be prohibited. Asbestos material shall not be disturbed during pre-cleaning.
- I. Isolation barriers that seal off all openings, including windows, corridors, doorways, ducts, and any other penetrations of the work area, shall be constructed using two layers of at least six mil fire-retardant plastic sheeting sealed with tape. Also, all seams in mechanical system components that pass through the work area shall be sealed. Doorways and corridors, which shall not be used for passage during work, shall also be sealed.
- J. Removal of mounted objects. After isolation barriers are in place, objects such as light fixtures, electrical track, alarm systems, ventilation equipment and other items not previously sealed, shall be double sealed with six mil fire-retardant plastic sheeting. Localized HEPA filtered vacuum equipment shall be used during fixture removal to reduce asbestos dispersal.
- K. Individual roof and floor drains shall be sealed water tight using two layers of 6-mil fire-retardant

plastic sheeting and tape prior to plasticizing. Openings in floor shall be fully covered with plywood sheeting secured to the floor in such a way as to minimize a tripping hazard prior to plasticizing.

- L. Emergency and fire exits from the work area shall be maintained or alternate exits shall be established according to all applicable codes.
- M. Adequate toilet facilities shall be supplied by the Abatement Contractor and shall be located either in the clean area of the personnel decontamination enclosure or shall be readily accessible to the personnel decontamination enclosure.

### **3.02 LARGE ASBESTOS PROJECT PERSONNEL DECONTAMINATION ENCLOSURE SYSTEM (ICR 56-7.5)**

- A. The personnel decontamination enclosure shall be constructed prior to preparatory work in the work area and, in particular, before the disturbance of asbestos material.
  - 1. Construction and use of personnel decontamination enclosure systems shall be in accordance with ICR-56 and any Applicable or Site Specific Variances utilized on this project. Such systems may consist of existing rooms outside of the work area, if the layout is appropriate, that can be enclosed is plastic sheeting and are accessible from the work area. When this situation does not exist, enclosure systems may be constructed out of metal, wood or plastic support.
  - 2. The personnel decontamination enclosure system shall consist of a clean room, a shower room, and an equipment room, in series, separated from each other and from the work area by three airlocks.
  - 3. There shall be one shower per six full shift abatement persons calculated on the basis of the largest shift.
  - 4. The personnel decontamination enclosure system shall be fully framed, sheathed for safety and constructed to prevent unauthorized entry.
  - 5. Personnel decontamination enclosure systems constructed at the work site shall utilize at least six mil fire-retardant opaque plastic sheeting. At least two layers of six mil fire-retardant reinforced plastic sheeting shall be used for the flooring of this area.
  - 6. All prefabricated decontamination units shall be completely decontaminated and sealed prior to separation and removal from the work area. Mobile decontamination units shall remain in place until satisfactory clearance results have been attained.
  - 7. The clean room shall be sized to accommodate all authorized persons. Benches, lockers and hooks shall be provided for street clothes. Shelves for storing respirators shall also be provided. Clean clothing, replacement filters for respirators, towels and other necessary items shall be provided. The clean room shall not be used for the storage of tools, equipment or materials. It shall not be used for office space. A lockable door shall be provided to permit access to the clean room from outside the work area or enclosure. It shall be used to secure the work area and decontamination enclosure during off-shift hours.

8. The shower room shall contain one or more showers. Each shower head shall be supplied with hot and cold water adjustable at the tap. The shower enclosure shall be constructed to ensure against leakage of any kind. Uncontaminated soap, shampoo and towels shall be available at all times. Shower water shall be drained, collected and filtered through a system with at least 5.0 micron particle size collection capability. A system containing a series of several filters with progressively smaller pore sizes shall be used to avoid rapid clogging of the filtration system by large particles. Filtered wastewater shall be discharged in accordance with applicable codes. Contaminated filters shall be disposed of as asbestos waste. The shower room shall be constructed in such way that travel through the decontamination unit shall be through the shower.
9. The equipment room shall be used for the storage of equipment and tools after decontamination using a HEPA filtered vacuum and/or wet cleaning. A one day supply of replacement filters, in sealed containers, for HEPA vacuums and negative pressure ventilation equipment, extra tools, containers of surfactant and other materials and equipment that may be required during the abatement project may also be stored here. A walk-off pan filled with water shall be located in the work area just outside the equipment room for persons to clean foot covering when leaving the work area. A drum lined with a labeled, at least six mil plastic bag is required for collection of clothing and shall be located in this room. Contaminated footwear and work clothes shall be stored in this area.

### **3.03 WASTE DECONTAMINATION ENCLOSURE SYSTEM (ICR 56-7.5)**

#### **A. General Requirements**

1. A waste decontamination enclosure system shall consist of the following:
  - a. A washroom/cleanup room shall be constructed with an airlock doorway to the work area and another airlock doorway to the holding area.
  - b. The holding area shall be constructed with an airlock doorway to the washroom/cleanup room and another lockable door to the outside.
2. Where there is only one egress from the work area, the holding area of the waste decontamination enclosure system may branch off from the equipment decontamination room, which doubles as a waste washroom, of the personnel decontamination enclosure.
3. The waste washroom shall be equipped with a drain installed to collect water and deliver it to the shower drain where it shall be filtered through a system with at least 5.0 micron particle size collection capability. A system containing a series of several filters with progressively smaller pore sizes shall be used to avoid rapid clogging of the filtration system by large particles. Filtered wastewater shall be discharged in accordance with applicable codes. Contaminated filters shall be disposed of as asbestos waste.
4. The waste washroom shall be constructed in such a way that travel through the rooms shall be through the waste washroom

### **3.04 WORK AREA ENTRY AND EXIT PROCEDURES**

- A. The following procedures shall be followed throughout the asbestos abatement project until

satisfactory clearance air monitoring results have been achieved:

1. All persons shall enter and exit the work area through the personnel decontamination enclosure system.
2. All persons who enter the work area or an enclosure shall sign the entry/exit log, located in the clean room, upon every entry and exit.
3. All persons, before entering the work area, or an enclosure shall read and be familiar with all posted regulations, personal protection requirements, including work area entry and exit procedures, and emergency procedures. The entry/exit log headings shall indicate, and the signatures shall be used to acknowledge, that these have been reviewed and understood by all persons prior to entry.
4. All persons shall proceed first to the clean room, remove all street clothing, store these items in clean sealable plastic bags or lockers and don coveralls, head covering, foot covering and gloves. All persons shall also don NIOSH approved respiratory protection. Clean respirators and protective clothing shall be utilized, by each person, for each separate entry into the work area. Respirators shall be inspected prior to each use and tested for proper seal using quantitative or qualitative fit checks.
5. Persons wearing designated personal protective equipment shall proceed from the clean room through the shower room to the equipment room, where necessary tools are collected and any additional clothing shall be donned, before entry into the work area.
6. Before leaving the work area, all persons shall remove gross contamination from the outside of respirators and protective clothing by brushing, wet cleaning, and/or HEPA vacuuming.
7. Persons shall proceed to the equipment room where all coveralls, head covering, foot covering and gloves shall be removed. Disposable clothing shall be deposited into labeled containers for disposal. Reusable contaminated clothing, footwear, head gear and gloves shall be stored in the equipment room when not being used in the work area.
8. Still wearing respirators, persons shall proceed to the shower area, clean the outside of the respirator and the exposed face area under running water prior to removal of the respirator, and then fully and vigorously shower and shampoo to remove residual asbestos contamination. Respirators shall be washed thoroughly with soap and water. Some types of respirators will require slight modification of these procedures. An airline respirator with HEPA filtered disconnect protection shall be disconnected in the equipment room and worn into the shower. A powered air-purifying respirator facepiece shall be disconnected from the filter/power pack assembly prior to entering the shower.
9. After showering and drying, all persons shall proceed to the clean room and don clean personal protective equipment if returning to the work area or street clothing if exiting the enclosure.

### **3.05 EQUIPMENT AND WASTE CONTAINER DECONTAMINATION & REMOVAL PROCEDURES**

- A. The following procedures shall be followed throughout the asbestos abatement project until satisfactory clearance air monitoring results have been achieved.
1. External surfaces of contaminated containers and equipment shall be cleaned by wet cleaning and/or HEPA vacuuming in the work area before moving such items into the waste decontamination enclosure system airlock by persons assigned to this duty. These work area persons shall not enter the airlock.
  2. These contaminated items shall be removed from the airlock by persons stationed in the washroom during waste removal operations. These washroom persons shall remove gross contamination from the exterior of their respirators and protective clothing by brushing, HEPA vacuuming and/or wet cleaning.
  3. Once in the waste decontamination enclosure system, external surfaces of contaminated containers and equipment shall be cleaned a second time by wet cleaning.
  4. The cleaned containers of asbestos material and equipment are to be dried of any excessive pooled or beaded liquid, placed in uncontaminated plastic bags or sheeting and sealed airtight.
  5. The clean recontainerized items shall be moved into the airlock that leads to the holding area. The washroom persons shall not enter this airlock or the work area until waste removal is finished for that period.
  6. Containers and equipment shall be moved from the airlock and into the holding area by persons dressed in clean personal protective equipment, who have entered from uncontaminated areas.
  7. The cleaned containers of asbestos material and equipment shall be placed in water tight carts with doors or tops that shall be closed and secured. These carts shall be held in the holding area pending removal. The carts shall be wet cleaned and/or HEPA vacuumed at least once each day.
  8. The exit from the decontamination enclosure system shall be secured to prevent unauthorized entry.
  9. Where the waste removal enclosure is part of the personnel decontamination enclosure, waste removal shall not occur during shift changes or when otherwise occupied. Precautions shall be taken to prevent short circuiting and cycling of air outward through the shower and clean room.
  10. Containers labeled with Asbestos hazard warnings shall not be used to dispose of non asbestos waste.

### **3.06 ENGINEERING CONTROLS**

A. Ventilation.

1. The Abatement Contractor shall employ HEPA equipped vacuums or negative air pressure equipment for ventilation as required.
2. All negative air pressure equipment ventilation units shall be equipped with HEPA filtration. The Contractor shall provide a manufacturer's test certificate for each unit documenting the capability

of trapping and retaining 99.97 percent of asbestos fibers greater than 0.3 microns equivalent aerodynamic diameter.

3. A power supply shall be available to satisfy the requirements of the total of all ventilating units.
4. On electric power failure, abatement shall stop immediately and shall not resume until power is restored and exhaust units are operating fully. On extended power failure, longer than one hour, the decontamination facilities, after the evacuation of all persons from the work area, shall be sealed airtight.
5. If extending the exhaust of the ventilation units 50 feet from the building would result in an exhaust location either in the road, blocking driveway access to the facility or within 50 feet of other buildings, a second unit will be run in series with the primary unit.

### **3.07 MAINTENANCE OF DECONTAMINATION ENCLOSURE SYSTEMS AND WORK AREA BARRIERS**

#### **A. GENERAL REQUIREMENTS**

1. The Consultant must review and approve installation before commencement of work. Upon completion of the construction of all plastic barriers and decontamination system enclosures and prior to beginning actual abatement activities.
2. All plastic barriers inside the work area, in the personnel decontamination enclosure system, in the waste decontamination enclosure system and at partitions constructed to isolate the work area from occupied areas, shall be inspected by the asbestos supervisor at least twice daily. The barriers shall be inspected before the start of and following the completion of the day's abatement activities. Inspections and observations shall be documented in the project log.
3. Damage and defects in the barriers and/or enclosure systems shall be repaired immediately upon discovery and prior to resumption of abatement activities.
4. At any time during the abatement activities, if visible emissions are observed outside of the work area or if damage occurs to the barriers, work shall be stopped, repairs made and visible residue immediately cleaned up using HEPA vacuuming methods prior to the resumption of abatement activities.
5. The Abatement Contractor shall HEPA vacuum and/or wet clean the waste decontamination enclosure system and the personnel decontamination enclosure system at the end of each day of abatement activities.

### **3.08 HANDLING AND REMOVAL PROCEDURES**

The Abatement Contractor may utilize existing provisions of ICR-56, Applicable Variances or a Site Specific Variance, approved by the Owner's Consultant, to permit the conduct of this work.

### **3.09 ABATEMENT PROCEDURES**

#### **A. AIR SAMPLING - By Owner**

1. Air sampling and analysis shall be conducted according to the requirements of Subpart 56-4 before the start, during and after the completion of the asbestos removal project.
  2. In addition to the requirements of Subpart 56-4, air monitoring shall be conducted in accordance with any approved job specific variance(s) or applicable variance utilized.
  3. Clearance samples may be analyzed using PCM to maintain compliance with ICR-56.
  4. If applicable, clearance samples will be analyzed using TEM to maintain compliance with ICR-56 and 40 CFR 763.90[i].
- B. The provisions of the Applicable Variances or a Job Specific Variance shall apply only in those areas where approval has been granted by the NYS DOL and the Contractor has obtained concurrence from the Owner's Consultant. All other applicable provisions of Industrial Code Rule 56-1 through 56-12 shall be complied.
- C. A copy of the NYS DOL Job Specific or Applicable Variance, if applicable, shall be conspicuously posted at the work area(s).
- D. The Abatement Contractor shall construct a decontamination unit at the work site. The Abatement Contractor shall, as a minimum, comply with the requirements of 29 CFR 1926.1101(j); Hygiene facilities and practices for employees.

### **3.10 ENCAPSULATION PROCEDURES**

The following procedures shall be followed to seal in non-visible residue, after obtaining satisfactory clearance air monitoring results, while conducting lockdown encapsulation on any surfaces which were the subject of removal or other remediation activities:

- A. Only encapsulants rated as acceptable or marginally acceptable on the basis of Battelle Columbus Laboratory test procedures and rating requirements developed under the 1978 USEPA contract shall be used for lockdown encapsulation.
- B. Sealants considered for use in encapsulation shall first be tested to ensure that the sealant is adequate for its intended use. A section of the work surface shall be evaluated following this initial test application of the sealant to quantitatively determine the sealant's effectiveness in terms of penetrating and locking down the asbestos fibers. The American Society of Testing and Materials (ASTM) Committee E06.21.06E on Encapsulation of Building Materials has developed a guidance document to assist in the selection of an encapsulant.
- C. The encapsulant solvent or vehicle shall not contain a volatile hydrocarbon.
- D. Encapsulants shall be applied using airless spray equipment.
  1. Spraying is to occur at the lowest pressure range possible to minimize fiber release from encapsulant impact at the surface. It shall be applied with a consistent horizontal or vertical motion.

- E. Encapsulation shall be utilized as a surface sealant once all asbestos containing materials have been removed in a work area. In no event shall encapsulant be applied to any surface that was the subject of removal or other remediation activities prior to obtaining satisfactory clearance air monitoring.

### **3.11 CLEANUP PROCEDURES**

- A. The following cleanup procedures shall be required.

1. Cleanup of accumulations of loose asbestos material shall be performed whenever enough loose asbestos materials have been removed to fill a single leak tight container of the type commensurate with the material properties. In no case shall cleanup be performed less than once prior to the close of each working day. Asbestos material shall be kept wet until cleaned up.
2. Accumulations of dust shall be cleaned off all surfaces on a daily basis using HEPA vacuum cleaning methods.
3. Decontamination enclosures shall be HEPA vacuumed at the end of each shift.
4. Accumulations of asbestos waste material shall be containerized utilizing HEPA vacuums or rubber or plastic dust pans, squeegees, or shovels. Metal shovels shall not be used to pick up or move waste.
5. Excessive water accumulation or flooding in the area shall require work to stop until the water is collected and disposed of properly.

- B. The following cleanup procedures shall be required after completion of all removal activities.

1. All accumulations of asbestos waste material shall be containerized utilizing HEPA vacuums or rubber or plastic dust pan, squeegees or shovels. Metal shovels shall not be used to pick up or move waste. HEPA vacuums shall be used to clean all surfaces after gross cleanup.
2. Cleaning. All surfaces in the work area shall be HEPA vacuumed. To pick up excess liquid and wet debris, a wet purpose shop vacuum may be used and shall be decontaminated prior to removal from the work area.
3. Windows, doors, HVAC system vents and all other openings shall remain sealed. Decontamination enclosure systems shall remain in place and be utilized.
4. All containerized waste shall be removed from the work area and the holding area.
5. All tools and equipment shall be decontaminated and removed from the work area.
6. A final visual inspection and clearance air monitoring, as per the schedule for air sampling and analysis, shall be conducted.
7. The isolation barriers and decontamination unit shall be removed only after satisfactory clearance air monitoring results have been achieved.

### **3.12 SAFETY MONITORING – CONSULTANT:**



The Consultant will designate an Asbestos Safety Technician (AST) to represent the Owner during the removal program. The AST must be on the job site at all times during abatement work. Absolutely no abatement or preparation work will occur without the presence of the AST.

The AST will conduct four (4) milestone inspections.

1. Pre-commencement inspection shall be conducted as follows:
  - a. Notification in writing to the Consultant shall be made by the Abatement Contractor to request a pre-commencement inspection at least 48 hours in advance of the desired date of inspection. This inspection shall be requested prior to beginning preparatory work in another work area.
  - b. The AST shall ensure that:
    - i. The job site is properly prepared and that all containment measures are in place;
    - ii. The designated supervisor shall present to the inspector a valid supervisor's license issued by the New York Department of Labor;
    - iii. All workers shall present to the inspector a valid handler's license issued by the New York Department of Labor;
    - iv. Measures for the disposal of removed asbestos material are in place and shall conform to the adopted standards;
    - v. The Abatement Contractor has a list of emergency telephone numbers at the job site which shall include the monitoring firm employed by the Owner and telephone numbers for fire, police, emergency squad, local hospital and health officer.
  - c. If all is in order, the AST shall issue a written notice to proceed in the field. If the job site is not in order, then any needed corrective action must be taken before any work is to commence. Conditional approvals shall not be granted.

Progress inspection shall be conducted as follows:

- a. Primary responsibility for ensuring that the abatement work progresses in accordance with these technical specifications and regulatory requirements rests with the Abatement Contractor. The AST shall continuously be present to observe the progress of work and perform required tests.
- b. If the AST observes irregularities at any time, he shall direct such corrective action as may be necessary. If the Abatement Contractor fails to take the corrective action required, or if the Abatement Contractor or any of their employees habitually and/or excessively violate the requirements of any regulation, then the AST shall inform the Owner who shall issue a Stop Work Order to the Abatement Contractor and have the work site secured until all violations are abated.

Clean-up inspections shall be conducted as follows:

- a. Notice for clean-up inspection shall be requested by the Abatement Contractor at least 24 hours

in advance of the desired date of inspection;

- b. The clean-up inspection shall be conducted prior to the removal of any isolation or critical barriers and before final air clearance monitoring;
  - c. The AST shall ensure that:
    - i. The work site has been properly cleaned and is free of visible asbestos containing material and debris.
    - ii. All removed asbestos has been properly placed in a locked secure container outside of the work area.
  - d. If all is in order, the AST shall issue a written notice of authorization to remove surface barriers from the work area. All isolation barriers shall remain in place until satisfactory clearance air sampling has been completed.
4. Clearance Visual Inspection shall be conducted after the removal of non-critical plastic sheeting. The AST shall insure that:
- a. The work area is free of all visible asbestos or suspect asbestos debris and residue.
  - b. All waste has been properly bagged and removed from the work area.
  - c. Should clearance visual inspection identify residual debris, as determined by the AST, the Abatement Contractor is responsible for recleaning the area at his own cost and shall bear all costs of reinspection until acceptable levels are achieved.
- B. The Abatement Contractor shall be required to receive written approval before proceeding after each milestone inspection.

### **3.13 PERSONNEL AIR MONITORING – CONTRACTOR (29 CFR 1926.1101)**

- A. Personnel air monitoring shall be provided to determine both short-term (STEL) and full shift during when abatement activities occur. Personnel sampling shall be performed in each work area in order to accurately determine the concentrations of airborne asbestos to which workers may be exposed.
- B. The Abatement Contractor shall have a qualified "Competent Person" (as specified in 29 CFR 1926 OSHA) to conduct personnel air monitoring.
- C. The laboratory performing the air sample analysis shall be certified by NYS DOH ELAP and approved by the consultant.
- D. Personnel air monitoring test results for OSHA Compliance. Results shall be posted at the work site within 24 hours of testing and copies supplied to the Owner within five (5) days of testing. Abnormalities shall be supplied to the Owner immediately.

### **3.14 CLEARANCE AIR MONITORING**

- A. Air samples will be collected in and around the work areas at the completion of abatement activities.
- B. Clearance samples may be analyzed using PCM to maintain compliance with ICR-56.
- C. If applicable, clearance samples will be analyzed using TEM to maintain compliance with ICR-56 and 40 CFR part 763 “Asbestos-Containing Materials in Schools; Final Rule and Notice” section 763.90.
- D. **\*\*\*RETESTING\*\*\***  
Should clearance air monitoring yield fiber concentrations above the “Clearance” criteria of either 0.01 fibers per CC and/or background levels (PCM) –OR- seventy (70) structures per square millimeter (TEM/AHERA), the Abatement Contractor is responsible for re-cleaning the area at his own cost and shall bear all costs associated with the retesting of the work area(s) including monitoring labor, sampling, analysis, etc. until such levels are achieved.

### **3.15 RESPIRATORY PROTECTION REQUIREMENT**

- A. Respiratory protection shall be worn by all individuals inside the work area from the initiation of the asbestos project until all areas have successfully passed clearance air monitoring in accordance with these specifications. The Abatement Contractor shall keep available at all times two PAPR's with new filters and charged batteries for use by authorized visitors.
- B. All respiratory protection shall be MSHA/NIOSH approved in accordance with the provisions of 30 CFR Part II. All respiratory protection shall be provided by the Abatement Contractor, and used by workers in conjunction with the written respiratory protection program.
- C. The Abatement Contractor shall provide respirators that meet the requirements of 29 CFR Parts 1910 and 1926.
  - 1. Full facepiece Type C supplied-air respirators operated in pressure demand mode equipped with an auxiliary self- contained breathing apparatus, operated in pressure demand or continuous flow, shall be worn during gross removal, demolition, renovation and/or other disturbance of ACM whenever airborne fiber concentrations inside the work area are greater than 10.0 f/cc.
  - 2. Full facepiece Type C supplied-air respirators operated in pressure demand mode with HEPA filter disconnect protection shall be work during gross removal, demolition, renovation and/or other disturbance of ACM with an amphibole content and/or whenever airborne fiber concentrations inside the work area are equal to or greater than 0.5 f/cc and less than or equal to 10.0 f/cc.
  - 3. Full facepiece powered air-purifying respirators (PAPR) equipped with HEPA filters shall be worn during the removal, encapsulation, enclosure, repair and/or other disturbance of friable ACM if airborne fiber concentrations inside the work area are less than 0.5 f/cc. A supply of charged replacement batteries, HEPA filters and flow test meter shall be available in the clean room for use with powered air-purifying respirators. HEPA filters shall be changed daily or as flow testing indicates change is necessary. Any Type C supplied-air respirator operated in continuous flow, with HEPA filter disconnect protection, may be substituted for a powered

air-purifying respirator.

4. Loose fitting helmets or hoods with powered air-purifying respirators (PAPR) equipped with HEPA filters may be worn during the removal, encapsulation, enclosure, repair and/or other disturbance of friable ACM if airborne fiber concentrations inside the work area are less than 0.25 f/cc. A supply of charged replacement batteries, HEPA filters and flow test meter shall be available in the clean room for use with powered air-purifying respirators. HEPA filters shall be changed daily or as flow testing indicates change is necessary. Any Type C supplied-air respirator operated in continuous flow may be substituted for a powered air- purifying respirator.
  5. Half-mask or full-face air-purifying respirators with HEPA filters shall be worn only during the preparation of the work area and final clean up procedures provided airborne fiber concentrations inside the work area are less than 0.1 f/cc.
  6. Use of single use dust respirators is prohibited for the above respiratory protection.
- D. Workers shall be provided with personally issued and individually marked respirators. Respirators shall not be marked with any equipment that will alter the fit of the respirator in any way. Only waterproof identification markers shall be used.
- E. The Abatement Contractor shall ensure that the workers are qualitatively or quantitatively fit tested by an Industrial Hygienist initially and every six months thereafter with the type of respirator he/she will be using.
- F. Whenever the respirator design permits, workers shall perform the positive and negative air pressure fit test each time a respirator is worn. Powered air-purifying respirators shall be tested for adequate flow as specified by the manufacturer.
- G. No facial hair, which interferes with the face-to-mask sealing surface, shall be permitted to be worn when wearing respiratory protection that requires a mask-to-face seal.
- H. Contact lenses shall not be worn in conjunction with respiratory protection.
- I. If a worker wears glasses, a spectacle kit to fit their respirator shall be provided by the Abatement Contractor at the Abatement Contractor's expense.
- J. Respiratory protection maintenance and decontamination procedures shall meet the following requirement:
1. Respiratory protection shall be inspected and decontaminated on a daily basis in accordance with OSHA 29 CFR 1910.134(b); and
  2. HEPA filters for negative pressure respirators shall be changed after each shower; and
  3. Respiratory protection shall be the last piece of worker protection equipment to be removed. Workers must wear respirators in the shower when going through decontamination procedures; and
  4. Airline respirators with HEPA filtered disconnect shall be disconnected in the equipment room

and worn into the shower. Powered air-purifying respirator facepieces shall be worn into the shower. Filtered/power pack assemblies shall be decontaminated in accordance with manufacturers' recommendations; and

5. Respirators shall be stored in a dry place and in such a manner that the facepiece and exhalation valves are not distorted; and
  6. Organic solvents shall not be used for washing of respirators.
- K. No visitors shall be allowed to enter the contaminated area if they do not have their medical certification and training certificate. Authorized visitors shall be provided with suitable PAPR respirators and instructions on the proper use of respirators whenever entering the work area.

### **3.16 DISPOSAL OF WASTE**

#### **A. APPLICABLE REGULATIONS**

1. All asbestos waste shall be stored, transported and disposed of as per, but not limited to, the following Regulations:
  - a. NYS Code Rule 56
  - b. U.S. Department of Transportation (DOT)  
Hazardous Substances  
Title 29, Part 171 and 172 of the code of Federal Regulations  
regarding waste collector registration
  - c. Regulations regarding waste collector registration Title 6, part 364 of the New York State Official Compilation of Codes, Rules and Regulations – 6 NYCRR 364
  - d. USEPA NESHAPS 40 CFR 61
  - e. USEPA ASBESTOS WASTE MANAGEMENT GUIDANCE EPA/530-SW-85-007

#### **B. TRANSPORTER OR HAULER - The Abatement Contractor shall bear full responsibility for proper characterization, transportation and disposal of all solid or liquid waste, generated during the project, in a legal manner. The Owner shall approve all transportation and disposal methods.**

1. The Abatement Contractor's Transporter (hauler) and disposal site shall be approved by the Owner. The Abatement Contractor shall remove within 48 hours all asbestos waste from the site after completing the clean up.
2. The Transporter must possess and present to the Owner's representative a valid New York State Department of Environmental Conservation Part 364 asbestos hauler's permit to verify license plate and permit numbers. The Owner's representative will verify the authenticity of the hauler's permit with the proper authority.
3. The Abatement Contractor shall give 24 hour notification prior to removing any waste from the site. All waste shall be removed from site only during normal working hours. No waste may be

taken from the site without authorization from the Owner's representative.

4. The Abatement Contractor shall have the Transporter give the date and time of arrival at the disposal site.
5. The Transporter with the Abatement Contractor and Owner's consultant shall inspect all material in the transport container prior to taking possession and signing the Waste Manifest. The Transporter shall not have any off site transfers or be combined with any other off-site asbestos material.
6. The Transporter must travel directly to the disposal site with no unauthorized stops.

#### C. WASTE STORAGE CONTAINER

1. During loading and on site storage, the asbestos waste container shall be labeled with EPA Danger signage:

**DANGER**  
**CONTAINS ASBESTOS FIBERS**  
**AVOID CREATING DUST**  
**CANCER AND LUNG DISEASE HAZARD**

2. The NYS DEC Hauler's Permit number shall be on both sides and back of the container.
3. The Container will not be permitted to leave the site without the proper signage.
4. A copy of the completed waste manifest shall be forwarded directly to the Owner's Consultant by the disposal facility.
5. Packaging of Non-friable Asbestos. Use of an open top container shall require written request, by the Contractor, and written approval by the Owners Representative, and be performed in compliance with all applicable regulations.
  - a) A chute, if used, shall be air/dust tight along its lateral perimeter and at the terminal connection to the dumpster at ground level (solid wall and top container). The upper end of the chute shall be furnished with a hinged lid, to be closed when the chute is not being used.
  - b) The container shall be lined with a minimum of two (2) layers of 6 mil. Fire-retardant polyethylene draped loosely over the sides so as to facilitate being wrapped over the top of the load and sealed prior to transport from the site.
  - c) Prior to transport from the work site the Dumpster will be disconnected from the chute and sealed air/dust tight utilizing six mil plastic and tape. The waste material will be transported as an asbestos containing material by appropriate legal methods.

6. Packaging Friable Asbestos.

- a) The container shall be a solid wall, hard top and lockable container.
- b) The container shall be locked upon arrival at the site to restrict access. Security shall be provided at the entrance to the container during the loading process and immediately locked upon completion.
- c) The interior walls, floor and ceiling shall be lined with two (2) layers of 6 mil. Fire-retardant polyethylene.
- d) The waste shall be loaded in such a manner as to protect the integrity of the individual waste packages.
- e) Prior to transport from the work site the interior of the Dumpster will sealed air/dust tight utilizing six mil plastic and tape. The waste material will be transported as an asbestos containing material by appropriate legal methods.

D. WASTE DISPOSAL MANIFEST

- 1. The Asbestos Waste Manifest shall be equivalent to the "Waste Shipment Record" included in 40 CFR 61. A copy of the Contractor's manifest shall be reviewed by the Owner's Consultant and shall be the only manifest used.
- 2. The Manifest shall be verified by the Owner's Consultant indicating that all the information and amounts are accurate and the proper signatures are in place.
- 3. The Manifest shall have the signatures of the Abatement Contractor and the Transporter prior to any waste being removed from the site.
- 4. The Manifest shall be signed by the Disposal Facility owner or operator to certify receipt of asbestos containing materials covered by the manifest.
- 5. A copy of the completed manifest shall be provided by the Abatement Contractor to the Owner's Consultant and remain on site for inspection.
- 6. Abatement Contractor shall maintain a waste disposal log which indicates load number, date and time left site, container size, type of waste, quantity of waste, name of hauler, NYS DES permit number, trailer and tractor license number, and date manifest was returned to Consultant.
- 7. The Disposal Facility owner or operator shall return a signed copy of the Waste Manifest directly to:

**Rye CSD  
555 Theodore Fremd Avenue, Suite B-101  
Rye, NY 10580  
ATTN: Robert Gimigliano**

8. Copies of the completed Waste Manifest are to be sent by the disposal facility to the Hauler and Abatement Contractor.
9. Submit signed dump tickets and manifests with final payment request.
10. Final payment request will not be honored without signed dump ticket or manifests accounting for all asbestos waste removed from the site.

#### E. VIOLATIONS OF SPECIFICATIONS

1. Violations of the safety, hygiene, environmental, procedures herein, any applicable federal, state or local requirements or failure to cooperate with the Owner's representative shall be grounds for dismissal and/or termination of this contract.

#### F. VIOLATIONS OF NO SMOKING POLICY

1. The Federal Pro Children Act of 1994 prohibits School District Officials from smoking in any buildings or on the grounds that is property of the School District. The District shall be considered smoke free. The School District strongly enforces its' No Smoking Policy. It is the Contractor's responsibility to inform all workers of this policy. Any worker(s) involved with this project that are found smoking or using tobacco products will be informed that they are in violation of the Federal and State Law and School Board Policy and will be removed from site.



### 3.17 LOCATION OF “ABATEMENT WORK”

*(Please see attached Drawings for approximate locations)*

#### 1) RYE HIGH SCHOOL/MIDDLE SCHOOL (INTERIOR ABATEMENTS)

- Abatement Contractor is responsible for complete & total removal & disposal of approximately 1,460 SF of non-friable asbestos-containing 9”x9” floor tile & associated mastic on non-ACM slab. Tiles to be removed are both exposed and beneath existing wood casework. Abatement Contractor is responsible for all demolition required to access material(s), as well as for providing all equipment necessary to access material(s). Subsequent to final air clearance, the substrate(s) shall be washed with a neutralizing agent to prepare the substrate to accept new floor covering(s) and eliminate residual odors. See attached ACM Location Drawings for removal locations. See below for breakdown and layering systems:
  - 2<sup>nd</sup> Floor East Hallway – Exposed, on Slab (1,000 SF)
  - Classroom 303 – Exposed, on Slab (200 SF)
  - 3<sup>rd</sup> Floor Hallway Outside of 303 & 304 – Exposed, on Slab (260 SF)
- Abatement Contractor is responsible for complete & total removal & disposal of approximately 3,060 SF of non-friable asbestos-containing 1’x1’ floor tile on non-ACM slab. Abatement Contractor is responsible for all demolition required to access material(s), as well as for providing all equipment necessary to access material(s). See attached ACM Location Drawings for removal locations. See below for breakdown and layering systems:
  - Classroom 301 & 302 – On Slab (300 SF)
  - 3<sup>rd</sup> Floor Hallway Outside of 301 & 302 – (960 SF)
- Abatement Contractor is responsible for complete & total removal & disposal of 1’x1’ ceiling tiles with approximately 1,548 SF of non-friable asbestos-containing glue dabs on non-ACM plaster ceilings. ACM to be removed is both exposed and concealed above non-ACM suspended ceiling tiles as described below. Abatement Contractor is responsible for all demolition required to access material(s), as well as for providing all equipment necessary to access material(s). See attached ACM Location Drawings for removal locations. See below for breakdown:
  - Classrooms 301, 302 & 304 – Above Non-ACM Suspended Ceilings (1,548 SF Approx. Total)
- Abatement Contractor is responsible for removal of three (3) door frames/casings connected to friable, asbestos-containing plaster within the High School Auditorium Lobby. Doors shall be removed and stored prior to commencement of abatement activities. Abatement Contractor shall remove at least an additional one (1) foot of plaster from each side of the removed door frame, and patch/reinstall masonry to allow for installation of new doors and frames as non-abatement work. Removals shall include all materials, including the lathe, studs and/or masonry substrate. Abatement contractor is responsible for all demolition required to access material(s), as well as for providing all equipment necessary to access material(s). See attached ACM location drawings for locations. See below for breakdown and approximate quantity of plaster to be removed:
  - Men’s Toilet 103 Door (25 SF)
  - Two (2) Entrance Doors (25 SF Each, 50 SF Approximate Total)
- Abatement Contractor is responsible for complete & total removal and disposal of approximately 50 SF of friable, plaster on metal lathe and/or non-ACM masonry within Men’s Bathroom 103, and for the subsequent abatement of approximately 50 SF of non-friable asbestos-containing waterproofing tar on masonry behind the removed plaster. Abatement contractor is responsible for all demolition required to access material(s), as well

as for providing all equipment necessary to access material(s). See attached ACM location drawings for approximate location. Refer to drawing A2-511 for removal details.

- Abatement Contractor is responsible for complete & total removal and disposal of the following in Men's Bathroom 103, Girl's Toilet 241B, Boy's Toilet 181, and Girl's Toilet 183:
  - Radiator/Heater, and approximately 12 SF of friable insulation/insulation board assumed to exist behind the removed unit.
  - Mirrors and approximately 12 SF of non-friable glue/mastic on plaster and/or masonry.
  - Approximately 40 LF of friable pipe insulation/fittings assumed to exist in concealed locations such as, but not limited to above plaster/sheetrock ceilings, behind plaster/sheetrock walls, within CMU wet walls, chases, soffits, plenums, etc.

The Abatement Contractor is responsible for all demolition required to access material(s), as well as for providing all equipment necessary to access material(s). All debris generated shall be disposed of as ACM. See attached ACM location drawings for removal locations.

## **2) RYE HIGH SCHOOL/MIDDLE SCHOOL (ROOF & EXTERIOR ABATEMENTS)**

- Abatement Contractor is responsible for complete & total removal and disposal of approximately 570 SF of non-friable, asbestos containing roof flashing tar, as indicated on attached ACM Location Drawings. ACM flashing tar exists on flashings to roof perimeter, adjacent building facades, and all installed equipment, on non-ACM masonry and metal, and on non-ACM concrete roof deck. All removals shall be to their respective substrate(s) and shall be at least eighteen (18) inches from the edge of the roof or equipment. All layers above ACM tar shall be removed and disposed of as ACM. Abatement Contractor is responsible for all demolition required to access material(s), as well as for providing all equipment necessary to access material(s).
- Abatement Contractor is responsible for complete & total removal and disposal of approximately 50 LF of non-friable asbestos-containing caulk from two (2) windows outside of the 3<sup>rd</sup> floor stairwell, as described on attached ACM location drawings. Windows are to be accessed from the roof locations identified for asbestos abatement. Abatement contractor is responsible for all demolition required to access material(s) as well as for providing all labor and equipment necessary to access material(s).

### **END OF LOCATION OF WORK**

### **3.18 GENERAL**

- A. The Abatement Contractor will be responsible for repairing all building components damaged during abatement including, but not limited to: ceiling tiles, ceiling finishes, wall finishes, floor finishes, etc.
- B. The Abatement Contractor shall be responsible for all demolition required to access materials identified in scope of work and on associated drawings.
- C. Concealed conditions that are exposed and may require additional work shall be brought to the attention of the Owner immediately. The Abatement Contractor shall not abate these areas without a written notice to proceed. Additional asbestos abatement performed prior to the order to proceed will not be acknowledged.
- D. The Abatement Contractor shall remove asbestos-containing floor covering to the building substrate beneath; in areas indicted. Subsequent to final air clearance the substrate shall be washed with a neutralizing agent to prepare the substrate to accept new floor covering and eliminate residual odors.
- E. Power tools used to drill, cut into or otherwise disturb asbestos containing material shall be equipped with HEPA filtered local exhaust ventilation.
- F. The Abatement Contractor shall provide access to GFCI electrical power, required to perform the area air monitoring for this project, within and immediately adjacent to each work area.
- G. Unwrapped or unbagged ACM shall be immediately placed in an impermeable waste bag or wrapped in plastic sheeting.
- H. Coordinate all removal operations with the Owner.

**Asbestos Employee Medical Examination Statement  
Certificate of Worker Release  
Asbestos Employee Training Statement  
CERTIFICATE OF WORKERS'S ACKNOWLEDGEMENT**

PROJECT NAME: **Rye CSD: 2019 Capital Bond Project Phase II – Rye High School/Middle School**

CONTRACTOR'S NAME: \_\_\_\_\_

WORKING WITH ASBESTOS INVOLVES POTENTIAL EXPOSURE TO AIRBORNE ASBESTOS FIBERS. INHALING ASBESTOS FIBERS HAS BEEN LINKED WITH VARIOUS TYPES OF CANCER AND RESPIRATORY DISEASES. SMOKING CIGARETTES AND INHALATION OF ASBESTOS FIBERS INCREASES THE RISK THAT YOU WILL DEVELOP LUNG CANCER ABOVE THAT OF THE NON-SMOKING PUBLIC.

The Contract for this project requires your employer to 1) supply proper respiratory protection devices and training on their use 2) provide training on safe work practices and on use of the equipment used on the project 3) provide a medical examination meeting the requirements of 29 CFR 1926.1101. Your signature on this certificate, documents that your employer has fulfilled these contractual obligations and you understand the information presented to you.

**\*\*\*\*\*DO NOT SIGN THIS FORM UNLESS YOU FULLY UNDERSTAND THIS INFORMATION\*\*\*\*\***

RESPIRATORY PROTECTION: I have been trained in the proper use and limitations of the type of respiratory protection devices to be used on this project. I have reviewed the written respiratory protection program manual and a copy is available for my use. Respiratory protection equipment has been proved, by the Contractor, at no cost to me.

TRAINING COURSE: I have been trained in the risks and dangers associated with handling asbestos, breathing asbestos dust, proper work procedures, personal protection and engineering controls. I have satisfactorily completed and Asbestos Safety Training Program for New York State and have been issued a New York State Department of Health Certificate of Asbestos Safety Training.

MEDICAL EXAMINATION: I have satisfactorily completed a medical examination within the last 12 months that meets the OSHA requirement for an asbestos worker and included at least 1) medical history 2) pulmonary function 3) medical examination 4) approval to wear respiratory protection devises and may have included an evaluation of a chest x-ray.

Signature: \_\_\_\_\_ Date \_\_\_\_\_

Printed Name: \_\_\_\_\_ SS#: \_\_\_\_\_

Witness: \_\_\_\_\_ Date: \_\_\_\_\_

Rye CSD: 2019 Capital Bond Project Phase II – Rye High School/Middle School

ESTIMATE OF ACM QUANTITIES

\*\*\*\*\*

\*\*\*\*\*

EACH ABATEMENT CONTRACTOR SHALL READ AND ACKNOWLEDGE THE FOLLOWING NOTICE. A SIGNED AND DATED COPY OF THIS ACKNOWLEDGMENT SHALL BE SUBMITTED WITH THE ABATEMENT CONTRACTOR'S BID FOR THIS PROJECT. FAILURE TO DO SO MAY, AT THE SOLE DISCRETION OF THE OWNER, RESULT IN THE BID BEING CONSIDERED NON-RESPONSIVE AND RESULT IN DISQUALIFICATION OF THE ABATEMENT CONTRACTOR'S BID ON THIS PROJECT.

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**\*\*\* NOTICE \*\*\***

*The linear and square footages listed within this specification are approximates. Abatement Contractor is required to visit the work locations prior to bid submittal in order to take actual field measurements within each listed location. The Abatement Contractor shall base their bid on actual quantities determined, by them, at the site walkthrough. Estimates provided in these specifications are for informational purposes only and shall not be considered a basis for Change Orders on this project.*

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**Acknowledgment:** I have read and understand the above NOTICE regarding removal quantity estimates and understand that estimates provided in these specifications are for informational purposes only and shall not be considered a basis for Change Orders on this project. The Abatement Contractor's signatory represents to the Owner that he/she has the authority of the entity he/she represents to sign this agreement on its behalf.

Company Name: \_\_\_\_\_  
Type or Print

BY: \_\_\_\_\_  
Signature Title Date

Print Name: \_\_\_\_\_

## ASSOCIATED ASBESTOS REMOVAL LOCATION DRAWINGS

➤ **Rye CSD: 2019 Capital Bond Project Phase II □ Rye High School/Middle School**

- ***HSMS ASB-101 □ Rye High School/Middle School □ 1<sup>st</sup> Floor Asbestos Abatement***
- ***HSMS ASB-102 □ Rye High School/Middle School □ 2<sup>nd</sup> Floor Asbestos Abatement***
- ***HSMS ASB-103 □ Rye High School/Middle School □ 3<sup>rd</sup> Floor Asbestos Abatement***
- ***HSMS ASB-201 □ Rye High School/Middle School □ Roof Asbestos Abatement***

**END OF SPECIFICATION  
SECTION 020800**

## **SECTION 021000**

### **TREE PROTECTION AND TRIMMING**

#### **PART 1 – GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

##### **1.2 WORK INCLUDED**

- A. This section includes the protection and trimming of trees that are to remain but interfere with, or are affected by, execution of the Work, whether temporary or new construction.

##### **1.3 RELATED SECTIONS**

- Section 31 11 00: Clearing and Grubbing.
- Section 31 23 00: Earthwork.
- Section 31 23 16: Trenching, Backfilling and Compaction.
- Section 31 25 00: Sediment and Erosion Control.
- Section 32 91 13: Soil Preparation and Soil Mixes.
- Section 32 92 00: Lawns.

##### **1.4 QUALITY ASSURANCE**

- A. Tree Pruning Standards: Comply with the National Arborist Association's "Pruning Standards for Shade Trees" except where more stringent requirements are indicated.

#### **PART 2 - PRODUCTS**

##### **2.1 MATERIALS**

- A. Drainage Fill: Selected crushed stone, or crushed or uncrushed gravel, washed, ASTM D448, size 24, with 90 to 100 percent passing a 2½ inch (63-mm) sieve and not more than 10 percent passing a ¾ inch (19-mm) sieve.
- B. Topsoil: As per Specification Section 32 91 13: Soil Preparation and Soil Mixes.
- C. Filter Fabric: Manufacturer's standard, non-woven, pervious, geotextile fabric of polypropylene, nylon, or polyester fibers.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Temporary Protection: Provide temporary fencing, barricades, or other suitable guards located outside the drip line (outer perimeter of branches) to protect remaining trees and other plants from damage.
- B. Protect tree root systems from damage due to noxious materials caused by run-off or spillage while mixing, placing, or storing construction materials. Protect root systems from flooding, eroding, or excessive wetting caused by dewatering operations.
- C. Do not store construction materials, debris, or excavated material within the drip line of remaining trees. Do not permit vehicles or foot traffic within the drip line, and prevent soil compaction over root systems.
- D. Do not allow fires.

### 3.2 EXCAVATION

- A. Install shoring or other protecting support systems to minimize sloping or benching of excavations.
- B. Do not excavate within tree drip line, unless otherwise indicated.
- C. Where excavation for new construction is required within tree drip lines, hand excavate to minimize damage to root systems. Use narrow-tine spading forks and comb soil to expose roots.
  - 1. Relocate roots in backfill areas wherever possible. If encountering large, main lateral roots, expose beyond excavation limits as required to bend and relocate without breaking. If encountered immediately adjacent to location of new construction and relocation is not practical, cut roots approximately 3 inches (75 mm) back from new construction.
  - 2. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition and temporarily support and protect roots from damage until they are permanently relocated and covered with earth.
- D. Where utilities trenches are required within tree drip lines, tunnel under or around the roots by drilling, auger boring, pipe jacking, or digging by hand.
  - 1. Root Pruning: Do not cut main lateral roots to tap roots; cut only smaller roots that interfere with installation of new work. Cut roots with sharp pruning instruments; do not break or chop.

### 3.3 REGRADING

- A. Grade Lowering: Where new finish grade is indicated below existing grade around



trees, slope grade beyond tree drip line. Maintain existing grades within tree drip lines.

1. Root Pruning: Prune tree roots exposed during grade lowering. Do not cut main lateral roots to tap roots; cut only smaller roots. Cut roots cleanly with sharp pruning instruments; do not break or chop.
- B. Minor Fill: Where existing grade is 6 inches (150 mm) or less below elevation of finish grade shown, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.
- C. Moderate Fill: Where existing grade is more than 6 inches (150 mm) but less than 12 inches (300 mm) below finish grade elevation, place a layer of drainage fill, filter fabric, and a final layer of topsoil on existing grade.
  1. Carefully place drainage fill against tree trunk approximately 2 inches (50 mm) above finish grade elevation and extend not less than 18 inches (450 mm) from tree trunk on all sides. For balance of area within drip line perimeter, place drainage fill to an elevation 6 inches (150 mm) below grade.
  2. Place filter fabric with overlapping edges of 6 inches (150 mm) minimum.
  3. Place fill layer of topsoil to finish grade. Do not compact drainage fill or topsoil. Hand grade to required finish elevations.

### 3.4 TREE PRUNING

- A. If required, prune remaining trees to compensate for root loss caused by damaging or cutting root system as directed by the Landscape Architect in accordance with accepted horticultural practices.
- B. Cut branches with sharp pruning instruments; do not break or chop.

### 3.5 TREE REPAIR AND REPLACEMENT

- A. Promptly repair trees damaged by construction operations to prevent progressive deterioration.
  1. Provide new trees of size and species selected by the Landscape Architect when trees over 6 inches (150 mm) in caliper, measured 12 inches (300 mm) above grade, are required to be replaced, due to abuse/damage/neglect of contractor.

### 3.6 DISPOSAL OF WASTE MATERIALS

- A. Burning on Owner's Property: Burning is not permitted on Owner's property.
- B. Disposal: Remove excess excavated material, displaced trees, and excess chips from Owner's property.

END OF SECTION 021000



## **SECTION 022113**

### **SITE SURVEY**

#### **PART 1 - GENERAL**

1.1 **RELATED DOCUMENTS:** Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

A. This Section includes the following:

1. Layout for all site work performed by a licensed surveyor.
2. Maintaining site control.
3. Preparing record drawings showing all new utilities and building additions.
4. Locate property and/or easement lines, building or other facilities that could affect construction.

#### **1.3 DEFINITIONS**

A. **Licensed Surveyor:** Registered in state where project is located and accepted by the Owner's Representative.

#### **1.4 SUBMITTALS**

A. Copies of the following will be made available to the Owner's Representative upon request throughout the project. Give the original to the Owner for his permanent files no later than two weeks after Contract completion.

1. Establish, maintain, and have available for review by the Owner's representative, throughout term of Contract, legible, comprehensive and complete survey notes, computations, sketches, drawings and similar records kept in a conventional format that is acceptable to the Owner's representative.
2. Record Plans or As Builts of all site improvements performed under this Contract. Using the same design system(s), the level accuracy of Record Plans or As Builts will be equal to that intended on design plans. All data on design plans will be verified or changed to reflect As Built conditions.
3. All calculations and field notes required to reestablish or modify the original control.

#### **1.5 QUALITY ASSURANCE**

A. All survey calculations of field work, where the accuracy could affect construction or the original design intent, shall be performed under the supervision of a Surveyor licensed in the state of the project. If requested by the Owner's representative, the Contractor shall have the portion of survey in question certified that the work was done under the supervision of a licensed Surveyor in the

applicable state.

- B. Perform survey work in accordance with recognized professional surveying practices, complying with local and state laws, rules and regulations. Ensure work performed by qualified personnel acceptable to Owner's representative.
- C. Maintain Project Survey field work in a condition such that it can be checked by the Owner's representative, and provide assistance in carrying out these checks. Checking by the Owner's representative does not relieve the responsibilities of this Contract.

## 1.6 PROJECT CONDITIONS

- A. No protected areas, site improvements, off-site areas or any areas to remain will be permanently marked or damaged without written consent of the Owner's representative.
- B. All stake-out placed for installation of or performance of site improvements will be maintained in a manner to allow the Owner's representative to perform construction observation.

## PART 2 - PRODUCTS

### 2.1 EQUIPMENT

- A. Surveying instruments and equipment used in performing the Project Survey shall be of the type(s) appropriate for the application at hand and shall be kept in acceptable calibration and good working order.

### 2.2 MATERIALS

- A. All temporary materials used in field shall be weather resistant and of standard quality.
- B. All permanent materials incorporated into the project shall be a type that prevents movement from freeze-thaw, minor contact or other expected occurrences and is found to be acceptable by the Owner's representative and local or state authority. When possible, use material specified on the Drawings.

## PART 3 - EXECUTION

### 3.1 FIELD

- A. All survey layout work shall be tied or referenced to the control survey data shown on the plans or supplied by the Engineer. The existing control shall be maintained in its original condition throughout the term of the Contract. If alteration of the original baseline condition is unavoidable, notify the Engineer of this situation and present a plan and procedure to the Engineer for review to remedy this alteration. Bring any error, apparent discrepancy in or absence of control survey data provided, to the Owner's representative's attention for resolution.

- B. At the direction of the Owner, establish, stake and reference all rights-of-way, easement limits, and building corners, and where required, stake under the direction of a licensed Land Surveyor. The licensed Land Surveyor shall, through the Contractor, present to the Engineer a certificate with the professional's seal in an acceptable format that such information has been accomplished under his or her direction.
- C. At all times maintain the project survey field work in a condition such that it can be reviewed by the Engineer, and render reasonable assistance to the Engineer in carrying out such checks. However, reviewing by the Engineer does not relieve the Contractor of his responsibilities under this Item.
- D. Assume sole responsibility for obtaining right of entry to properties, other than those properties on which the Owner has obtained easements with surface rights, for the purpose of conducting layout and survey work.

### 3.2 RECORD DRAWINGS/AS BUILT DRAWINGS

- A. Upon completion of the work under this Item, present a certificate to the Engineer attached to the As-built drawings, stating that all of the facilities shown on the Drawings or as may be added, deleted, or altered upon review of the Engineer, have been located in accordance with such Drawings or approved modifications thereof.

END OF SECTION 022113



**SECTION 023000**  
**SOIL TESTING SERVICES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

**A. Related Work Specified Elsewhere:**

Section 31 23 00: Earthwork.

Section 31 22 13: Rough Grading.

Section 31 23 16: Trenching, Backfilling and Compaction.

Section 32 10 00: Roadway and Miscellaneous Subbase.

Section 32 91 13: Soil Preparation and Soil Mixes.

**1.2 QUALITY ASSURANCE**

**A. Laboratory services are solely an assurance that contract provisions are met.**

**B. Forward copies of test results to Architect, Owner, Construction Manager, and Owner's Representatives within ten (10) days.**

**C. Testing Agency/Testing Laboratory Qualifications:**

1. Agencies shall have not less than five (5) years experience in testing services required on comparable construction projects.
2. Soil testing agency shall be an established geotechnical firm with a Geotechnical Engineer on staff that is licensed in the State of New York. The Contractor shall provide the firm with a copy of the contract drawings and specifications in order that the firm may be able to become thoroughly familiar with the project requirements prior to commencing site inspection and testing services.

**PART 2 - PRODUCTS (Not used)**

**PART 3 - EXECUTION**

**3.1 TESTING LABORATORY SERVICES**

- A. The Owner, at his own expense, shall obtain the testing services of a geotechnical engineering and testing firm that is regularly engaged in the testing of construction materials.**

**3.2 RESPONSIBILITIES AND DUTIES OF CONTRACTOR**

- A. To facilitate testing services, the Contractor shall:**

1. Furnish to the Testing Agency laboratory such samples of materials as may be necessary for testing purposes.
  2. Furnish such casual labor, equipment, and facilities as is necessary to obtain and handle samples at the project.
  3. Advise the Testing Agency sufficiently in advance of operations to allow for completion of tests and for the assignment of personnel.
  4. Provide safe access to items to be tested. This includes sheeting and ladders for deep excavations.
- B. If any portion of the work shows low test results or evidence of detrimental placing, the Construction Manager may require additional testing, compaction, or removal and replacement of soil materials at the Contractor's expense. In no case shall the inspector prescribe the method of repair of the defect.

### 3.3 QUALITY CONTROL

- A. Testing Agency shall perform the following tests and inspections:
1. Subgrades, Fill and Compaction:
    - a. Inspection of proofrolling operations including specifying undercuts as necessary. Undercuts shall be at Contractor's expense.
    - b. Inspection of subgrades upon which select fill, porous fill, subbases at concrete and asphaltic pavements or foundations are to be placed.  
Verification shall be made by the Testing Agency that all deleterious fill materials have been removed in accordance with the specifications.
    - c. Sieve analysis of proposed fill materials. Minimum one test for each 1,000 cubic yards of imported materials delivered to site.
    - d. Optimum moisture - maximum density curve for each soil used for backfill in accordance with ASTM D1557, Method A.
    - e. Tests in accordance with ASTM D-1577 of actual in-place density for each strata placed.

### 3.4 FREQUENCY OF TESTING

- A. The frequency of in-place density testing per lift of compacted material shall be in accordance with the following table. Minimums apply when areas to be tested are less than the designated unit.

|   | NO. OF TESTS | PER UNIT   | MINIMUM NO. OF TESTS PER LIFT   |
|---|--------------|------------|---------------------------------|
| Trenches (includes per LF of large diameter underground storage pipe) | 1            | 200 L.F.   | 2<br>For Each Type, Run or Size |
| Sidewalks   | 1            | 1,000 S.F. | 5                               |



|                                    |   |                  |                             |
|------------------------------------|---|------------------|-----------------------------|
| Parking Areas                      | 1 | 5,000 S.F.       | 8<br>For Each Separate Area |
| Roadways (Up to 30' Nominal Width) | 1 | 200 L.F.         | 5                           |
| Building Slabs                     | 1 | 1,000 S.F.       | 5                           |
| Footings and Piers                 | 1 | 100 L.F. or Pier | 2 for Footings, 1 Per Pier  |
| Detention Basin                    | 1 | 200 C.Y.         | 2                           |
| Embankment or Subgrade             | 1 | 2,000 L.F.       | 5                           |

- B. Frequency of testing may be increased at the discretion of the Owner, Engineer, Architect, or Construction Manager. Additional testing of re-compacted soils shall be at the expense of the Contractor.

END OF SECTION 023000



**SECTION 024119**  
**SELECTIVE DEMOLITION**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Demolition and removal of selected site elements.
  - 2. Salvage of existing items to be reused or recycled.
- B. Related Requirements:
  - 1. Section 011000 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
  - 2. Section 017300 "Execution" for cutting and patching procedures.

**1.3 DEFINITIONS**

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.
- E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

#### 1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
  - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

#### 1.5 PREINSTALLATION MEETINGS

- A. Pre-demolition Conference: Conduct conference at Project site.
  - 1. Inspect and discuss condition of construction to be selectively demolished.
  - 2. Review structural load limitations of existing structure.
  - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
  - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
  - 5. Review areas where existing construction is to remain and requires protection.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For refrigerant recovery technician.
- B. Engineering Survey: Submit engineering survey of condition of building.
- C. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for dust control and, for noise control. Indicate proposed locations and construction of barriers.
- D. Schedule of Selective Demolition Activities: Indicate the following:
  - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building manager's on-site operations are uninterrupted.
  - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
  - 3. Coordination for shutoff, capping, and continuation of utility services.
  - 4. Use of elevator and stairs.

5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
  - E. Pre-demolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Comply with Section 013233 "Photographic Documentation." Submit before Work begins.
  - F. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
  - G. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.
- 1.7 CLOSEOUT SUBMITTALS
- A. Inventory: Submit a list of items that have been removed and salvaged.
- 1.8 QUALITY ASSURANCE
- A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.
- 1.9 FIELD CONDITIONS
- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
  - B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
  - C. Hazardous Materials: Present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is on file for review and use by the Owner. Examine report to become aware of locations where hazardous materials are present.
1. Hazardous material remediation is specified elsewhere in the Contract Documents, which is not part of the Architectural Contract Documents services, but by Owner.

2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
  3. Owner will provide material safety data sheets for suspected hazardous materials that are known to be present in buildings and structures to be selectively demolished because of building operations or processes performed there.
  4. No work is to proceed until ALL Contractors have reviewed and signed acknowledging the report.
- D. Historic Areas: Demolition and hauling equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, including temporary protection, by 12 inches (300 mm) or more.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
1. Maintain fire-protection facilities in service during selective demolition operations.

#### 1.10 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding.
- B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

#### 1.11 COORDINATION

- A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

- B. Standards: Comply with ASSE A10.6 and NFPA 241.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Engage a professional engineer, licensed in the State of New York, to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
  - 1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
- D. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.
- E. Verify that hazardous materials have been remediated before proceeding with building demolition operations.
- F. Survey of Existing Conditions: Record existing conditions by use of measured drawings and preconstruction photographs or video.
  - 1. Comply with requirements specified in Section 013233 "Photographic Documentation."
  - 2. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
  - 3. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

### 3.2 PREPARATION

- A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

### 3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
  - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
  - 2. Arrange to shut off utilities with utility companies.
  - 3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
  - 4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
    - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
    - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    - f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    - g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.



### 3.4 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
  - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
  - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
  - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
  - 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
  - 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."
- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
  - 1. Strengthen or add new supports when required during progress of selective demolition.
- C. Remove temporary barricades and protections where hazards no longer exist.

### 3.5 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
  - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
  - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
  - 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
  5. Maintain fire watch during and for at least 36 hours after flame-cutting operations.
  6. Maintain adequate ventilation when using cutting torches.
  7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
  8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
  9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
  10. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal."
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Removed and Salvaged Items:
1. Clean salvaged items.
  2. Pack or crate items after cleaning. Identify contents of containers.
  3. Store items in a secure area until delivery to Owner.
  4. Transport items to Owner's storage area designated by Owner.
  5. Protect items from damage during transport and storage.
- D. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse.
  2. Pack or crate items after cleaning and repairing. Identify contents of containers.
  3. Protect items from damage during transport and storage.
  4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective

demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

### 3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch (19 mm) at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.
- B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.
- C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.
- E. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.

### 3.7 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and recycle or dispose of them according to Section 017419 "Construction Waste Management and Disposal."
  - 1. Do not allow demolished materials to accumulate on-site.
  - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
  - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
  - 4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.

### 3.8 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

**SECTION 028300 – LEAD-BASED PAINT WORK PRACTICES**

AT: RYE CITY SCHOOL DISTRICT  
RYE HIGH SCHOOL/MIDDLE SCHOOL  
SED# 66180001-0005-032

OWNER: RYE CITY SCHOOL DISTRICT  
555 THEODORE FREMD AVENUE, SUITE B-101  
RYE, NEW YORK 10580

CONSULTANT: QUALITY ENVIRONMENTAL SOLUTIONS  
& TECHNOLOGIES, INC.  
1376 ROUTE 9  
WAPPINGERS FALLS, NEW YORK 12590



**SPECIFICATION DATED: January 19, 2021**

## SECTION 028300 – LEAD SAFE WORK PRACTICES

### PART 1 - GENERAL

#### 1.1 DESCRIPTION/SCOPE OF WORK

- A. The work covered by these specifications shall consist of furnishing all labor, materials, tools, and equipment necessary to control and mitigate potential lead-based paint (LBP) hazards during demolition/renovation activities pertaining to the *Rye CSD □2019 Capital Bond Project Phase II*.

The following is a detailed listing of identified Lead-based Paint(s) and/or Lead-containing Material(s), above the EPA action level of 1.0 mg/sq. cm.:

#### **RYE HIGH SCHOOL/MIDDLE SCHOOL - INTERIORS**

- Middle School Office – Beige CMU Walls
- High School Faculty Room 250 – Blue Plaster Wall
- Auditorium Men’s Bathroom 103 – Glazed White Ceramic Wall Tiles
- Third Floor Room 304 Door to Stairwell – White Metal Door Casing
- Third Floor Staircase to Room 304 – Black Metal Stair Stringers
- First Floor Music Hallway (Outside of Proposed Elevator) – White Brick Walls
- First Floor Room 107 – Gray Brick/Stone Walls

Additionally, it should be noted that several components tested did in fact contain minimal lead-levels below the EPA threshold level of 1.0 mg/sq. cm for classification as Lead-Based Paint (LBP) and are considered lead-containing coatings by the OSHA Regulation, “Lead Exposure in Construction” (29 CFR 1926.62). OSHA does not recognize a minimum limit for lead concentration in paint for the purpose of disturbance. Monitoring of workers performing demolition/cleaning/disturbance of painted surfaces shall be completed to document personnel occupational exposure. Items containing any amount of lead concentration are considered lead-containing coatings per 29 CFR 1926.62, OSHA Lead Exposure in Construction.

#### **RYE HIGH SCHOOL/MIDDLE SCHOOL – EXTERIORS**

- NO Lead-Paints identified above the EPA / HUD thresholds

However, it should be noted that several components tested did in fact contain minimal lead-levels below the EPA threshold level of 1.0 mg/sq. cm for classification as Lead-Based Paint (LBP) and are considered lead-containing coatings by the OSHA Regulation, “Lead Exposure in Construction” (29 CFR 1926.62). OSHA does not recognize a minimum limit for lead concentration in paint for the purpose of disturbance. Monitoring of workers performing demolition/cleaning/disturbance of painted surfaces shall be completed to document personnel occupational exposure. Items containing any amount of lead concentration are considered lead-containing coatings per 29 CFR 1926.62, OSHA Lead Exposure in Construction.

The work of this Contractor shall include the following, and shall be as required by specific work-related tasks and disturbance(s) of above-referenced Lead-based Paint(s) and/or Lead-containing Material(s), above the EPA action level of 1.0 mg/sq. cm:

- 1) Personnel air monitoring and analysis.
  - 2) Waste characterization and classification.
  - 3) Transportation/disposal off-site of LBP wastes/debris and lead-contaminated waste/debris generated from LBP disturbance(s).
- A. Manual demolition, scraping and manual sanding of lead-based paint surfaces and power tool cleaning with dust collection systems shall be performed in conjunction with engineering and work practice controls meeting the requirements of 29 CFR 1926.62(e)(1).
  - B. Components with lead-based paint shall be removed intact to the extent practicable. A 6-mil polyethylene drop cloth shall be placed on either side of the component, prior to its removal, to catch any paint chips that may become dislodged. The component shall be wrapped in a layer of 6-mil polyethylene for movement to the disposal container. Follow proper disposal requirements. The area around the component removal shall be wet wiped and HEPA vacuumed, including the tent enclosure. The polyethylene sheeting shall be carefully folded in on itself and placed in a 6-mil disposal bag. Containment debris shall be properly disposed of as lead-based waste.
  - C. Chemical stripping should be used for LBP removal on surfaces that will be subjected to welding, cutting or torch burning. No chemical strippers containing methylene chloride shall be used by the Contractor on this project. Abrasive blasting, heat stripping, uncontained hydroblasting, welding, cutting or torch burning shall not be performed on surfaces where LBP is present. Abrasive blasting, heat stripping, uncontained hydroblasting, welding, cutting or torch burning shall only be performed on bare metal substrate.
  - D. The Contractor's use of a subcontractor shall not relieve the Contractor of full responsibility for the work to be performed.
  - E. If available, the Contractor may submit exposure assessment data obtained within the last twelve (12) months from previous jobs conducted under similar conditions, control methods, work practices and environmental conditions to be used in this contract. Other objective data may be used to demonstrate that work activities in this contract will not result in occupational exposures to airborne lead that exceeds the PEL. The assessment shall include comparable lead concentrations in coating materials, work practices, engineering controls and rates of work.
  - F. Until the exposure assessment is performed, the Contractor must provide to his workers the following: Respiratory protection with a minimum protection factor of 10, personal protective clothing, lead-free change areas, hand washing/shower facilities, biological monitoring and training per 29 CFR 1926.62.
  - G. This Specification shall be used as a Guideline for the use of Contractors who complete the demolition/renovation activities pertaining to the ***Rye CSD □2019 Capital Bond Project Phase II*** as detailed within Section 1.2 of this specification. The intent of this Specification is to remain in conformance with 29 CFR 1926.62 and to maintain an airborne concentration of lead-dust below the action level. This Specification is written in order to outline the worst-case scenario in regard to lead safe work practices. However, the work procedures section is written in a manner, which outlines the requirements that should be necessary, at a minimum, to maintain an airborne concentration of lead dust below the action level.

- H. The Contractor shall ensure that any HVAC equipment intakes within and around the work areas are protected by shutting down the units and/or installing HEPA filters over the intake. The Contractor shall coordinate rebalancing of the HVAC equipment prior to installing the HEPA filters. The Contractor shall alter the size and extent of the isolation barriers as necessary due to weather conditions, functional space use and density of building occupants in the vicinity, as required.

## **1.2 REGULATIONS & REFERENCE STANDARDS**

### **A. General Requirements**

All work of this section shall be conducted in strict accordance with all applicable Federal, State and Local regulations.

Matters of interpretations of the standards and regulations shall be submitted to the appropriate agency for resolution before starting work. Where these requirements vary the most stringent shall apply.

### **B. Specific Requirements**

1. American National Standards Institute (ANSI)
  - a. ANSI Z9.2-79 – Fundamentals Governing the Design and Operation of Local Exhaust Systems.
  - b. Z88.2-80 – Practice for Respiratory Protection.
2. Title X - U.S. Department of Housing and Urban Development “Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing.”
3. Code of Federal Regulations (CFR)
  - a. 29 CFR Part 1910.120 – Hazardous Waste Operations and Emergency Response.
  - b. 29 CFR Part 1910.134 – Respiratory Protection.
  - c. 29 CFR Part 1910.146 – Confined Space Entry Program.
  - d. 29 CFR Part 1910.1025 – Lead.
  - e. 29 CFR Part 1910.1200 – Hazard Communication.
  - f. 29 CFR Part 1926.55 – Gases, Vapors, Fumes, Dusts and Mists.
  - g. 29 CFR Part 1926.57 – Ventilation.
  - h. 29 CFR Part 1926.62 – Lead (Construction Industry Standard).
  - i. 40 CFR Part 260 – Hazardous Waste Management Systems: General.
  - j. 40 CFR Part 261 – Identification and Listing of Hazardous Waste.
  - k. 40 CFR Part 262 – Generators of Hazardous Wastes.



- l. 40 CFR Part 263 – Transporters of Hazardous Waste.
  - m. 40 CFR Part 264 – Owners and Operators of Hazardous Waste Treatment, Storage & Disposal Facilities.
  - n. 40 CFR Part 265 – Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage & Disposal Facilities.
  - o. 40 CFR Part 268 – Land Disposal Restrictions.
  - p. 40 CFR Part 745 – Lead; Requirements for Lead-Based Paint Activities in Child Occupied Facilities
  - q. 40 CFR Part 745.90 – EPA’s Renovation, Repair & Painting Rule.
  - r. 49 CFR Parts 170-178 – Department of Transportation Regulations.
4. New York Codes of Rules and Regulations (NYCRR)
    - a. 6 NYCRR Part 360 – Solid Waste Regulations.
    - b. 6 NYCRR Part 364 – Waste Transporter Permits.
    - c. 6 NYCRR Part 370-373 – Hazardous Waste Regulations.
    - d. 8 NYCRR Part 155 – Uniform Safety Standards for School Construction & Maintenance Projects.
  5. Steel Structures Painting Council (SSPC)
    - a. SSPC-Guide 6 – Guide for Containing Debris Generated During Paint Removal Operations.  
  
SSPC-Guide 7 – Guide for the Disposal of Lead-Contaminated Surface Preparation Debris.  
  
Preparation Debris.
  6. Underwriters Laboratories. Inc. (UL)
    - a. UL 586 – High Efficiency, Particulate Air Filter Units.

### **1.3 DEFINITIONS**

- A. **Abatement**  
For the purposes of this Specification, the term abatement shall refer to any procedure that impacts lead-based paint on any surface. Procedures can include paint removal; whole removal of the surface (i.e. window replacement); demolition of painted surfaces; and clean-up of paint debris.
- B. **Action Level**  
Employee exposure without regard to use of respirators, to an airborne concentration of lead of thirty (30) micrograms per cubic meter of air averaged over an 8-hour period. As used in this section, micrograms per cubic meter of air” refers to the action level. (Note: For longer exposure period lower action level is triggered).

- C. **Area Monitoring**  
Sampling of lead concentrations within the lead control area (work area) and inside the physical boundaries which is representative of the airborne lead concentrations that may reach the breathing zone of personnel potentially exposed to lead.
- D. **Physical Boundary**  
Area physically roped or partitioned off around a work area to limit unauthorized entry of personnel. As used in this section, “inside boundary” shall mean the same as “outside lead control area.”
- E. **Change Rooms and Shower Facilities**  
Rooms within the designated physical boundary around the work area equipped with separate storage facilities for clean protective work clothing and equipment and for street clothes which prevent cross-contamination.
- F. **Decontamination Room**  
Room for removal of contaminated personal protective equipment (PPE).
- G. **Eight-Hour Time Weighted Average (TWA)**  
Airborne concentration of lead averaged over an 8-hour workday to which an employee is exposed.
- H. **High Efficiency Particulate Air (HEPA) Filter Equipment**  
HEPA filtered vacuuming equipment with a UL 586 filter system capable of collecting and retaining lead-contaminated paint dust. A high efficiency particulate filter means 99.97 percent efficient against 0.3 micron size particles.
- I. **Lead Control Area**  
A work area within which engineering controls are implemented to prevent the spread of lead dust, paint chips or debris from lead-containing paint removal operations. The lead control area is isolated by physical boundaries to prevent entry of unauthorized personnel.
- J. **Lead Permissible Exposure Limit (PEL)**  
Fifty (50) micrograms per cubic meter of air as an 8-hour time weighted average as determined by 29 CFR Part 1926.62. If an employee is exposed for more than 8 hours in a work day, the PEL shall be determined by the following formula:  
  
$$\text{PEL (micrograms/cubic meter of air)} = 400/\text{No. hrs worked per day}$$
- K. **Personal Monitoring**  
Sampling of lead concentrations within the breathing zone of an employee to determine the 8-hour time weighted average concentration in accordance with 29 CFR Part 1926.62. Samples shall be representative of the employees work tasks. Breathing zone shall be considered an area within a hemisphere, forward of the shoulders with a radius of 6 to 9 inches and the center at the nose or mouth.
- L. **Wipe Sampling**  
Clearance testing procedures, which determine the amount of existing lead-based paint surface dust by atomic absorption spectroscopy analysis, or inductively coupled plasma emission spectrometry expressed in micrograms of lead.

## 1.4 QUALITY ASSURANCE

### A. Qualifications

1. Contractor: Certification that the Contractor has prior experience on LBP activity projects similar in nature and extent to ensure the capability to perform the required work procedures in a satisfactory manner.
2. Competent Person: Certification that the Contractor's full-time onsite Competent Person meets the competent person requirements of 29 CFR Part 1926.62 and is experienced in administration and supervision of LBP activity projects, including work practices, protective measures for building and personnel, disposal procedures, etc. This person shall have completed a Contractor Supervisor LBP abatement course by an EPA Training Center or an equivalent certification course and have had a minimum of 2 years on-the-job experience.
3. Testing Laboratory: The name, address, and telephone number of the independent testing laboratory selected to perform sampling and analysis for personal and area air samples and wipe samples, and TCLP analysis of LBP wastes and debris. Documentation that the laboratory performing the analysis is an EPA National Lead Laboratory Accreditation Program (NLLAP) accredited laboratory and that it is listed proficient in the NIOSH/EPA Environmental Lead Proficiency Analytical Testing Program (ELPAT), and a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) certified laboratory. Certification shall include accreditation for heavy metal analysis, list of experience relevant to analysis of lead in air, and a Quality Assurance and Quality Control Program. Currently, the American Association for Laboratory Accreditation (ASLA) and the American Industrial Hygiene Association (AIHA) are the EPA recognized laboratory accreditors. Documentation shall include the date of accreditation or reaccreditation.
4. Blood Lead Testing Laboratory: The name, address and telephone number of the blood lead testing laboratory; the laboratory's listing by OSHA and the U.S. Public Health Service Center for Disease Control (CDC); and documentation that the laboratory certified in the state where the work site is located.

### B. Respiratory Protection Devices

Manufacturer's certification of NIOSH for respiratory protection devices utilized on the site.

### C. Cartridges, Filters, and Vacuum Systems

Manufacturer's certification of NIOSH approval of respirator cartridges (organic vapor, acid gas, mist, dust, high efficiency particulate); High Efficiency Particulate Air (HEPA) filtration capabilities for all cartridges, filters, and HEPA vacuum systems.

### D. Medical Examination and Records

Certification that employees who are involved in LBP abatement work have received medical examinations and will receive continued medical surveillance, including biological monitoring, as required by 29 CFR Part 1926.62, 29 CFR Part 910.1200, 29 CFR Part 1910.120 and by the state and local regulations pertaining to such work. Records shall be retained, at Contractor expense, in accordance with 29 CFR Part 1910.20.

1. Provide medical surveillance to workers until exposure monitoring reveals that workers are not exposed on any day of the job to airborne lead at or above the Action Level of 30 ug/dL of blood. This consists of a blood test measuring the level of lead and zinc protoporphyrin by a licensed physician. Further testing and

medical exams may be necessary depending on the results of initial blood tests and/or the initial exposure assessment.

E. Training

Training certification shall be provided prior to the start of work involving LBP abatement, for all of the Contractors' workers, supervisors and Competent Person. Training shall meet the requirements of 29 CFR Part 1926.62, 29 CFR Part 1926.59, 29 CFR Part 1910.1200, 29 CFR Part 1910.120 and 49 CFR 172, and that required by EPA or the state LBP course for the work to be performed. Training shall be provided prior to the time of job assignment and, at least, annually. The project specific training shall at a minimum, include the following.

1. Specific nature of the operation, which could result in exposure to lead.
2. Purpose, proper selection, fitting, use and limitations of respirators.
3. Purpose and description of the medical surveillance program and the medical removal protection program, including information concerning the adverse health effects associated with excessive exposure to lead (with particular attention to the adverse reproductive effects on both males and females and hazards to the fetus and additional precautions for employees who are pregnant.)
4. Relevant engineering controls and good work practices.
5. The contents of any compliance plan in effect.
6. Instructions to employees that chelating agents should not routinely be used to remove lead from their bodies and should not be used at all except under the direction of a licensed physician.
7. The employee's right of access to records under 29 CFR Part 1910.20.

F. Respiratory Protection Program

1. Furnish each employee required to wear a negative pressure respirator or other appropriate type with a respirator fit test at the time of initial fitting and at least every 12 months thereafter as required by 29 CFR Part 1910.134 and 29 CFR Part 1926.62.
2. Establish and implement a respiratory protection program as required by ANSI Z88.2, 29 CFR Part 1910.134 and 29 CFR Part 1926.62.
3. All workers are required to don an appropriate level of protection commensurate with the airborne concentrations of lead in which they are working. The level of protection will be determined by the Contractor, based on objective air monitoring data.

G. Licenses and Permits

Copies of licenses and permits as required by applicable Federal, state and local regulations shall be obtained before the start of the LBP project.

## 1.5 SUBMITTALS

A. The submittals shall be submitted in accordance with Specification Section 01300, Submittals.

B. Certifications

Prior to the start of work, submit required certifications, plans, programs, permits and licenses identified in Paragraph 1.5 of this specification section.

- C. **Equipment List**  
Prior to the start of work submit list of equipment items to be used in the work, including brand names, model, capacity, performance characteristics, quantities and other pertinent information.
- D. **Lead-Based Paint (LBP) Management Plan**  
The contractor shall prepare a detailed LBP Management Plan that identifies the work procedures, health and safety measures to be used in LBP work procedures; and that addresses spill prevention, containment and emergency response procedures. The plan shall address the methods to be undertaken to abate the lead to include the following key elements:
1. LBP containment methods to control employee exposure to lead at or below the permissible exposure limit and to ensure that airborne lead concentrations of 30 micrograms per cubic meter of air are not exceeded outside of the lead control area.
  2. Training requirements as required by Federal, state and local regulations.
  3. Unique problems associated with the LBP project.
  4. Sketch of location, size and details of LBP control areas, decontamination rooms/areas, change rooms and shower facilities.
  5. Eating, drinking, smoking, and rest room procedures.
  6. Sequencing of LBP related work.
  7. Personnel protective equipment and respiratory protection program, including controls.
  8. Engineering controls, containment structures and safety measures.
  9. Worker exposure assessment procedures.
  10. Work Practice controls.
  11. Housekeeping.
  12. Hygiene facilities and practice.
  13. Medical surveillance, including medical removal procedures.
  14. Sampling, testing and analytical methods to include personnel air sampling requirements of 29 CFR Part 1926.62, wipe sampling of the surface where the LBP was removed and, when required, toxicity characteristic leaching procedure (TCLP) testing of the waste material in accordance with 40 CFR 261 and 6 NYCRR Part 371, and area air sampling required by the specifications. Procedures must include frequency, locations, sampling and analytical methods to be used.
- E. **Compliance Program**  
Contractor's Compliance Program prepared in accordance with 29 CFR Part 1926.62 (e) (2).
- F. **Waste Transporter and Disposal Facility Permits, and Disposal Documents.**

1. Name, address, and telephone number of 6 NYCRR Part 364 transporter who will be transporting the LBP wastes and debris and a copy of the transporter's 6 NYCRR Part 364 permit.
  2. Name, address, and telephone number of disposal facility accepting the LBP wastes and debris and a copy of the permit from the disposal facility documenting the facility is permitted to accept the wastes being delivered.
  3. Copy of completed waste characterization (waste profile) forms for obtaining approval to dispose of the LBP wastes and liquid wastes at the disposal facility.
  4. Copy of the approved waste characterization (waste profile) forms from the disposal facility indicating they are permitted to accept the wastes and will accept the wastes being delivered.
  5. Example of completed transportation and disposal documents (i.e., bill of lading or hazardous waste manifest and land disposal restriction notification forms, as applicable) prior to shipment of wastes.
  6. Copy of the completed and signed transportation and disposal documents at time of shipment for the disposal of LBP wastes and debris, liquid wastes and any other wastes generated, and copy signed by the disposal facility.
  7. Copy of certificate of destruction for incinerated wastes, certificate of treatment and/or certificate of disposal, as applicable and associated tracking documents from the final disposal facility for disposal of the LBP wastes and debris.
- G. Health and Safety Plan and Confined Space Entry Program  
Contractor's written site-specific Health and Safety Plan prepared in accordance with 29 CFR Part 1910.120 and Contractor's confined space entry program prepared in accordance with 29 CFR Part 1910.146. These documents are requested for information only and as documentation that they exist.
- H. Sampling and Laboratory Analysis Reports  
Submit field sampling logs for all personal and area air samples, wipe samples and waste samples taken, and submit copy of laboratory analysis reports and chain of custody records for all sample analysis.
- I. Competent person certification per Section 3.5.B.

## **1.6 POSTED WARNINGS & NOTICES**

The following regulations, warnings and notices shall be posted at the work site in accordance with 29 CFR Part 1926.62.

- A. Regulations  
A copy of applicable Federal, state, and local regulations shall be maintained at the work site.
- B. Warning Signs  
Warning signs shall be provided at approaches to LBP control areas. Signs shall be located at a distance from the LBP control areas that will allow personnel to read the sign and take the necessary protective actions required before entering the LBP control area. The signs shall comply with the requirements of 29 CFR Part 1926.62.
- C. Worker Information

Right-to-know notices shall be placed in clearly visible areas of the work site in compliance with Federal, State and Local regulations.

- D. **Air Monitoring Results**  
Daily air monitoring results shall be prepared in order to be easily understood by the workers and shall be placed in a clearly visible area of the work site.
- E. **Emergency Telephone Numbers**  
A list of telephone numbers shall be posted at the site. The list shall include numbers of the local hospital, emergency squad, police and fire departments, Government and Contractor representatives who can be reached 24 hours per day and professional consultants directly involved in the project.

## **1.7 EQUIPMENT & MATERIALS**

Sufficient quantities of health and safety materials required by 29 CFR Part 1926.62, and other materials and equipment needed to complete the project, shall be available and kept on the site.

- A. **Respirators**  
Air-purifying respirators shall be approved by NIOSH for use with dust, fumes and mists having permissible exposure limits less than 0.05 milligrams per cubic meter (i.e., have high-efficiency particulate air (HEPA) filters) and for other hazardous airborne contaminants that may be encountered, as determined by the Competent Person. The Contractor shall furnish, at no cost to personnel/employee, respirators to provide protection from airborne concentrations of lead. Respirators shall comply with the requirements of 29 CFR Part 1926.62 and shall be used in accordance with 29 CFR Part 1926.62, 29 CFR Part 1926.103 and 29 CFR Part 1910.134.
- B. **Respirator Cartridges**  
A sufficient supply of respirator cartridges shall be maintained at the work site to provide new cartridges to employees and authorized visitors, throughout the duration of the project. Cartridges shall be replaced according to the manufacturer's recommendations, when breathing becomes difficult, or if the cartridge becomes wet.
- C. **Protective Clothing**
  - 1. The Contractor shall furnish, at no cost to personnel/employee, equipment/ clothing for protection from airborne and waterborne LBP debris. An adequate supply of these items shall be available for worker and authorized visitor use. Workers and visitors shall not take protective clothing and equipment off the work site at any time. Protective clothing includes:
    - a. **Coveralls (Whole Body Protective Coverings):** Full-body coveralls and head covers shall be worn by workers in the work area as necessary. Sleeves shall be secured at the wrist and pants legs at the ankle with tape. Permeable clothing shall be provided in heat-stress conditions. Where non-disposable coveralls are provided, these coveralls shall be cleaned after each wearing. Cleaning of coveralls and other non-disposable clothing shall be in accordance with the provisions for cleaning in 29 CFR Part 1926.62.
    - b. **Boots:** Work boots with nonskid soles or impermeable work boot covers shall be worn by workers. Where required by OSHA, safety boots (steel toe or steel toe and shank) shall be worn. Paint the uppers of boots red with waterproof enamel. Do not allow boots to be removed from the work area for any reason after being contaminated with LBP debris. Dispose of boots as LBP contaminated waste at the end of the work.

- c. Gloves: Inner gloves, appropriate for items and hazards encountered and disposable outer work gloves shall be provided to each worker and shall be worn while the worker is in the work area. Glove material shall be appropriate for the specific chemical exposure. Gloves shall not be removed from the work area and shall be disposed of as LBP contaminated waste at the end of the work.
- d. Hard Hats: Head protection (hard hats) shall be provided as required by OSHA for workers and authorized visitors. Protective plastic-strap suspension hats shall be used. Hard hats shall be worn at all times that work is in progress. Hats shall remain in the work area until the project is completed. Hats shall be thoroughly cleaned, decontaminated and bagged before being removed from the work area at the end of the project.
- e. Eye Protection: Fog-proof goggles for personnel engaged in LBP operations shall be worn when the use of a full-face piece respirator is not required.

D. Negative Air Pressure System

When a LBP control area requires the use of an airtight containment barrier, a negative air pressure system shall be used and pressure differential recordings taken. LBP shall not be removed from the LBP control area until the proper engineer controls and HEPA filtration systems are in place.

1. HEPA Filter Requirements

The negative air pressure system shall be equipped with approved HEPA filters per UL 586. Negative air pressure equipment shall be equipped with new HEPA filters and shall be sufficient to maintain a minimum pressure differential of minus 5 Pa (0.02 inch) of water column relative to adjacent, unsealed areas. Negative air pressure system minimum requirements are listed below.

- a. The unit shall be capable of delivering its rated volume of air with a clean first stage filter, an intermediate filter and a primary HEPA filter in place.
- b. The HEPA filter shall be certified as being capable of removing particles as small as 0.3 micrometers at a minimum efficiency of 99.97 percent.
- c. The unit shall be capable of continuing to deliver no less than 70 percent of rated capacity when the HEPA filter is 70 percent full or measures 620 Pa (2.5 inches of water) static pressure differential on a magnehelic gauge.
- d. The unit shall be equipped with a manometer-type negative pressure differential monitor with minor scale division of 0.02 inch of water and accuracy within plus or minus 1.0 percent. The manometer shall be calibrated daily as recommended by the manufacturer. Record manually manometer readings of the pressure differential between the LBP control area and adjacent unsealed areas at the beginning of each workday and every 2 working hours thereafter.
- e. The unit shall be equipped with a means for the operator to easily interpret the readings in terms of the volumetric flow rate of air per minute moving through the machine at any given moment.
- f. The unit shall be equipped with an electronic mechanism that automatically shuts the machine off in the event of a filter breach or absence of a filter.
- g. The unit shall be equipped with an audible horn that sounds an alarm when the machine has shut itself off.



- h. The unit shall be equipped with an automatic safety mechanism that prevents a worker from improperly inserting the main HEPA filter.
  - i. The unit shall be ducted through the containment barrier wall to the outside of the work area. The unit shall not be exhausted into any work area.
- 2. **Number of Units Required**  
The air within the containment barrier shall be changed at least once every 15 minutes by a continuously operating negative air pressure system, until the LBP control area barrier is removed. Filters shall be replaced as necessary to maintain the efficiency of the system. A back-up unit shall be maintained onsite.
- 3. **Auxiliary Generator**  
An auxiliary generator shall be provided with a capacity adequate to power a minimum of 50 percent of the negative air machines at any time during the work. When power fails, the generator controls shall automatically start the generator and switch the negative air machine to generator power. The generator shall not present a carbon monoxide hazard to workers.
- 4. **Discontinuing Negative Air Pressure System**  
The negative air pressure system shall not be shut down during LBP work unless authorized by the Owner's Consultant. At the completion of the LBP work procedures and disposal project, units shall be run until full cleanup has been completed and wipe clearance samples have been collected, analyzed and have passed final clearance testing requirements. Dismantling of the negative air pressure systems shall conform to the written decontamination procedures. Prefilters shall be removed and properly disposed. The intake to the machines shall be sealed with polyethylene to prevent environmental contamination.

E. **Expendable Supplies**

- 1. **Polyethylene Sheet and Bags - General**  
Polyethylene sheet and bags shall be minimum 6-mil thick. Bags shall have pre-printed labels, and 5-inch (minimum) long plastic ties, pointed and looped to secure the filled bags. Polyethylene sheets shall be in roll sizes to minimize seams.
- 2. **Polyethylene Sheet - Flame Resistant**  
Where a potential for fire exists, flame-resistant polyethylene sheets shall be provided. Polyethylene film shall conform to the requirements of NFPA 701.
- 3. **Polyethylene Sheet - Reinforced**  
Reinforced polyethylene sheet shall be provided where high skin strength is required such as where it constitutes the only barrier between the LBP control area and the outdoor environment. The sheet stock shall consist of translucent, nylon-reinforced or woven-polyethylene thread laminated between two layers of polyethylene film. Film shall meet flame resistant standards of NFPA 701.
- 4. **Tape and Adhesive Spray**  
Tape and adhesive shall be capable of sealing joints between polyethylene sheets and for attachment of polyethylene sheets to adjacent surfaces. After dry application, tape or adhesive shall retain adhesion when exposed to wet conditions, including amended water. Tape shall be minimum 2 inches wide, industrial strength.

5. Containers  
DOT approved impermeable containers shall be used to receive and retain LBP waste and debris, and lead contaminated material until disposal. Containers shall be labeled in accordance with EPA, DOT and OSHA standards.
  6. Chemicals  
Chemicals, including caustics and paint strippers, shall be properly labeled and stored in leak-tight containers.
- F. Vacuum Systems  
HEPA filtered vacuum systems shall be used during LBP operations which generate dust. The systems shall be suitably sized for the project, and filters shall be capable of removing particles as small as 0.3 micrometers at a minimum efficiency of 99.97 percent.
  - G. Heat Blower Guns  
Heat blower guns shall be flameless, electrical, paint-softener type with controls to limit temperature to 590 degrees C (1,100 degrees F). Heat blower shall be DI (non-grounded) 120 Vac, and shall be equipped with cone, fan, glass protector and spoon reflector nozzles.
  - H. Chemical Paint Strippers  
Chemical paint strippers shall contain no methylene chloride.
  - I. Chemical Paint Stripper Neutralizer  
Neutralizers for paint strippers shall be compatible with the substrate and suitable for use with the chemical stripper that has been applied to the surface.

## **1.8 STORAGE OF MATERIALS**

Materials shall be stored in a place and manner, which protects them from damage and contamination. During periods of cold weather, plastic materials shall be protected from the cold. Regularly inspect materials to identify damaged or deteriorating items. Damaged or deteriorated items shall not be used and shall be removed from the site as soon as they are discovered. Stored materials shall not present a hazard or an inconvenience to workers, visitors and/or other employees.

## **PART 2 – PRODUCTS**

**(NOT APPLICABLE)**

## **PART 3 – EXECUTION**

### **3.1 WORK PROCEDURES**

LBP work procedures and related work shall be performed in accordance with the U.S. Department of Housing and Urban Development “Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing” and the accepted Contractor’s LBP Management Plan. Procedures and equipment required to limit occupational and environmental exposures to lead during LBP removal shall be in accordance with 29 CFR Part 1926.62 and as specified herein. LBP waste and debris, lead contaminated debris and personal protective clothing and equipment shall be disposed of in compliance with Federal, state, and local regulations.

A. Personnel Protection Procedures

Personnel shall wear and use protective clothing and equipment as specified and required by 29 CFR Part 1926.62 and 29 CFR Part 1910.120. Eating, smoking, drinking, chewing tobacco and chewing gum, and applying makeup shall not be permitted in the LBP control area. Personnel of trades not engaged in the LBP work procedures and disposal of LBP shall not be exposed at any time to airborne concentrations of lead equal to or in excess of 30 micrograms per cubic meter of air. Electrical service shall be disconnected when wet removal is performed, and temporary electrical service protected by a ground fault circuit interrupter shall be provided.

B. Safety and Health Procedures

The Competent Person shall be present on the work site throughout the LBP project to supervise, monitor and document the project's health and safety provisions. A daily log shall be maintained showing the results of sampling tests throughout the project area. LBP work being conducted within a LBP Control area where an airtight barrier is required shall be stopped if measured airborne lead concentrations, collected during LBP work procedures, exceed the pre- LBP work procedures airborne concentration levels.

C. Safety and Health Responsibilities

The Competent Person shall:

1. Verify that training meets applicable requirements.
2. Review and approve LBP Management Plan for conformance to the applicable referenced standards.
3. Inspect LBP removal work for conformance with the accepted LBP Management Plan.
4. Ensure that worker exposure air monitoring activities are in accordance with 29 CFR Part 1926.62.
5. Ensure work is performed in strict accordance with specifications.
6. Ensure hazardous exposure to personnel and to the environment are adequately controlled.
7. The Contractor's Competent Person shall be responsible for directing personal air monitoring.
8. The Owner's Consultant shall be responsible for directing area and final air/wipe testing.

D. Medical Surveillance Procedures

Medical surveillance shall be implemented in accordance with the accepted Contractor's LBP Management Plan, and shall comply with the requirements of 29 CFR Part 1926.62, including the provisions for biological monitoring, medical removal, protection and a physician's written opinion, signed by the physician performing the employee examination. The Contractor shall provide a copy of the written opinion for Contractor's employees prior to each employee's commencement of work.

E. Engineering Controls and Containment Structures

Engineering and work practice controls are the primary means of maintaining exposures to lead below the PEL. Paint removal and surface preparation activities must keep dust levels at a minimum. Torch cutting of surfaces with LBP will require appropriate personal protective equipment and exposure controls. Power tools must be equipped with vacuum shrouds including a high efficiency particulate air filtered vacuum system attached.

1. LBP Control Area

The LBP control area is where LBP work procedures occur and as such shall be considered contaminated. The LBP control area shall be isolated to prevent LBP containing dust or debris from passing into adjacent open areas. The control area shall be decontaminated at the completion of the LBP work procedure and disposal work.

2. Boundary Requirements.

Physical boundaries shall be provided around exterior LBP control areas by roping off the area indicated in the LBP Management Plan.

3. Control Barriers

The LBP control area shall be designated and separated from other outside areas with control barriers. The polyethylene sheeting shall have all openings masked and sealed. The LBP control area shall be erected according to the Contractors LBP Management Plan. Polyethylene sheeting shall be mechanically supported, independent of duct tape or spray adhesive.

4. Masking and Sealing

a. Exterior LBP control area requirements: Where the construction of a contained LBP control area is impractical or not required based on the method of lead work procedures, a roped-off perimeter shall be installed 20 feet from and around the area where the LBP handling procedures are performed and other requirements for LBP control areas shall be maintained. Personal monitoring of airborne concentrations shall be conducted in adjacent areas during the work shift, in accordance with 29 CFR Part 1926.62. Area air monitoring inside and outside of the roped-off perimeter shall be conducted as specified. Airborne concentrations shall not exceed specified levels.

5. Personnel Decontamination Unit

Personnel decontamination units shall be provided when required for the LBP procedures. Materials fabricated or delivered to the site before the shop drawings have been returned to the Contractor will be subject to rejection by the Owner's Consultant. Specifications and drawings of portable prefab units, such as a trailer unit, if utilized, must be submitted for review and approval before start of construction. Submittal shall include, but not be limited to, a floor plan layout showing dimensions, materials, sizes, thickness, plumbing, and electrical outlets. Access between contaminated and uncontaminated areas shall be through an airlock. Access between any two rooms or room and trailer within the decontamination unit shall be through a plastic sheeting curtained doorway. A separate equipment decontamination unit shall be provided. Each work area shall have an emergency exit. The personnel decontamination unit's clean room shall be the only means of entrance and exit, except for emergencies, from the LBP control area. Materials shall exit the LBP control area through the equipment decontamination area.

6. Clean Room

The clean room shall have only one exit to non-contaminated areas of the site. An airtight seal shall be constructed of polyethylene between the clean room and uncontaminated areas. Surfaces of the clean room shall be protected with sheet polyethylene. A temporary unit with a separate equipment decontamination locker room and a clean locker room shall be provided for personnel who are required to wear whole body protective clothing. One locker shall be provided in each locker room for each LBP worker, and each Contractor's representative. Lead-free personal clothing and shoes shall be kept in the clean locker. Hand wash station/showers shall be located between the equipment decontamination locker room and the clean locker room, and employees shall wash or shower before changing into personal clothes. An adequate supply of clean disposable towels shall be provided. LBP contaminated work clothing shall be cleaned. Clean rooms shall be physically attached to the LBP control area for areas inside the building but may be directly adjacent to the LBP control area outside of the building. Joint use of this space for other functions, such as offices, equipment storage, etc., is prohibited.

7. Hand Wash Station/Shower Room

An operational shower and hand washing station shall be provided between the work area and the clean changing room. Workers shall wash and/or shower before entering the clean changing room. Shower room shall be separated from other rooms by air-tight walls fabricated from polyethylene sheeting. Water shall be hot and cold or warm. Shower heads/ controls, soap dish, continuing supply of soap, and clean towels shall be provided. The shower shall be maintained in a sanitary condition. Waste water shall be pumped to drain and through waste water filters that meet state and/or local requirements. These filters shall be located inside the shower unit and filters shall be changed regularly. Spent filters shall be discarded as LBP contaminated waste.

8. Equipment Decontamination

The Equipment Decontamination Unit shall be used for removal of equipment and materials from the LBP control area, and shall include a wash room, holding room, and an enclosed walkway. The unit shall be constructed from wood framing material and polyethylene sheeting. Workers shall not enter or exit the LBP control area through the Equipment Decontamination Unit. A washdown station, consisting of an enclosed shower unit, shall be located in the work area outside the Wash Room. The washdown station shall be used to clean equipment, bags and containers. Bagged or containerized LBP wastes shall be passed from the work area and cleaned in the Wash Room. The Wash Room shall be separated from the work area by a polyethylene sheet flap. Wastewater shall be filtered and filters shall be changed as required for the shower unit and the Wash Room. Filters shall be disposed of as LBP contaminated wastes. The Holding Room shall be used as a drop location for bagged LBP passed from the Wash Room. This room shall be constructed so that bagged materials cannot be passed from the Wash Room through the Holding Room to the enclosed walkway. The walkway shall provide access to the Holding Room from outside the work area. The enclosed walkway shall be separated from the exterior by a single flap of polyethylene sheeting. The Contractor's equipment used for LBP work procedures shall be decontaminated prior to its removal outside of the lead control area. The decontamination water shall be containerized, the containers labeled, the liquid sampled and analyzed in the laboratory for lead, and properly disposed of off-site according to applicable Federal, State and Local regulations. See Paragraph 3.5.C.2.

9. Maintenance of Decontamination Units  
Barriers and polyethylene sheeting shall be effectively sealed and taped. Containment barriers shall be visually inspected at the beginning of each work period. Damaged barriers and defects shall be immediately repaired upon discovery. Smoke testing methods shall be used to test effectiveness of barriers when directed by the Owner's Consultant.
10. LBP Control Area Exiting Procedures  
Personnel exiting a LBP control area shall perform the following procedures and shall not leave the work place wearing any clothing or equipment worn during the work day:
  - a. HEPA vacuum all protective clothing before removing.
  - b. Remove protective clothing in the decontamination room and place this clothing in an approved impermeable disposal bag.
  - c. Wash or shower.
  - d. Change to clean clothes prior to leaving the physical boundary designated around the lead-contaminated work site.

F. Temporary Utilities

1. Temporary equipment as necessary to provide adequate power, light, heat, and water shall be installed, as needed, to accomplish the LBP operations properly and safely. The Contractor shall maintain the security and maintenance of the utility system in the LBP control areas. In the event of a failure of any utility system, the Owner will not be responsible for any loss of time or other expense incurred by the Contractor. In addition to any site-specific temporary utility requirements, the Contractor shall provide:
  - a. Back-flow protection on all water connections is required. Fittings installed by the Contractor shall be removed after completion of work with no damage or alteration to existing water piping and equipment.
  - b. When applicable, heavy-duty abrasion-resistant hoses to provide water to each work area and decontamination area.
  - c. A hot water heater, if necessary, to provide warm water to the decontamination showers.
  - d. Electrical service to work areas. Electrical service shall comply with National Electric Code, State and Local requirements and UL standards. Warning signs shall be posted at power outlets, which are other than 110-120 volt power. Only grounded extension cords shall be used. Incandescent lamps and light fixtures shall be of adequate wattage to provide good illumination in LBP control areas.
  - e. Temporary heating units, when needed, that have been tested and labeled by UL, FM, or another recognized trade association related to the fuel being consumed. Forced air or fan type units shall not be utilized inside a work area. Units shall have tip-over protection.
  - f. Sufficient quantity of single-occupant, self-contained chemical toilets, properly vented and fully enclosed.

### 3.2 LEAD-BASED PAINT WORK PRACTICES (Use methods as applicable)

#### A. Component Removal:

Components shall be removed intact to the extent practicable. A 6-mil polyethylene drop cloth shall be placed on either side of the component, prior to its removal, to catch any paint chips that may become dislodged. The component shall be wrapped in a layer of 6-mil polyethylene for movement to the disposal container. Follow proper disposal requirements. The area around the component removal shall be wet wiped and HEPA vacuumed, including the tent enclosure. The polyethylene sheeting shall be carefully folded in on itself and placed in a 6-mil disposal bag. Containment debris shall be properly disposed of as lead-based waste.

Clearance will be performed as follows:

1. Visual Clearance - Determine that all required work has been completed. Look for settled dust, paint chips or debris in work area. If located, cleanings will commence until visual inspection locates no evidence of dust.
2. The Owner's Consultant shall perform Dust and/or Soil Sampling, if required, and as outlined in the U.S. Department of Housing and Urban Development "Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing".

#### B. Chemical Stripping: Assumed Exposure (50 ug/m<sup>3</sup> - 500 ug/m<sup>3</sup>)

Chemical stripping, using an agent approved by the Owner's Consultant, followed by wet scraping is the preferred method of abatement for areas where torch cutting, welding and/or other hot-work will affect building components coated with lead-based paint or lead containing coatings. The specific stripping agent(s) proposed must be approved by the Owner. No chemical strippers containing methylene chloride shall be used by the Contractor on this project.

1. Horizontal surfaces directly below and at least 10' in a radial direction from the area where chemical stripping is to be performed shall be protected with 6-mil poly.
2. All LBP on specified surfaces shall be removed to the bare substrate. The job is not considered complete until the substrate is dry and free of paint, debris, and LBP residue.
3. LBP stripping agents shall be brushed or troweled on the designated surfaces, or otherwise applied in accordance with manufacturer's specifications. The minimum thickness of chemical stripping agent applied shall be 0.125 (1/8) inches or the manufacturer's recommendations.
4. Stripping agents shall not be applied to, nor be allowed to inadvertently penetrate, wood and/or other porous substrates.
5. The required dwell time for stripping will depend upon the ambient temperature, humidity, and thickness of LBP. If LBP is not completely removed following the initial application of stripper, a second application and wet scraping may be required.
6. Removed LBP shall not be deposited on the polyethylene containment surfaces, but shall be transferred directly into 6-mil polyethylene bags from the scraper. LBP shall be removed by wet scraping to the maximum extent feasible.

7. Any residue not removable by wet scraping shall be washed down to the bare metal substrate with a high-phosphate solution. LBP-contaminated wastewater shall be kept to a minimum using wet scrub brushes or sponges. These residues and disposable cleaning media shall also be directly transferred to the 6-mil polyethylene bags containing other LBP wastes. Free standing water shall be eliminated by use of a drying agent.
8. Clearance will be performed as follows:
  - a. Visual Clearance - Determine that all required work has been completed. Look for settled dust, paint chips or debris in work area. If located, cleanings will commence until visual inspection locates no evidence of dust.
  3. The Owner's Consultant shall perform Dust and/or Soil Sampling, if required, and as outlined in the U.S. Department of Housing and Urban Development "Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing".

C. Manual Demolition/Scraping/Cleaning: Assumed Exposure (50 ug/m<sup>3</sup> - 500 ug/m<sup>3</sup>)

Manual demolition, scraping, manual sanding and power tool cleaning with dust collection systems shall be performed in conjunction with engineering and work practice controls meeting the requirements of 29 CFR 1926.62(e)(1).

Seal openings of HVAC ductwork and other penetrations (doors, windows, etc.) within the Control Area with two layers of 6-mil polyethylene sheeting. For work on vertical surfaces, place a layer of 6-mil polyethylene sheeting below the area prior to manual demolition/scraping/ cleaning. The sheeting shall extend 5 ft. on either side of the work area, to catch any paint chips that may become dislodged.

Wet methods shall be used during manual scraping, manual sanding and power tool cleaning with dust collection systems. Local HEPA ventilation shall be utilized in conjunction with manual scraping, manual sanding and power tool cleaning with dust collection systems. In the case that local HEPA ventilation is not sufficient to control dust hazards, the Contractor shall be required to install engineering controls to meet requirements of Specification Section 1.8(D) "Negative Air Pressure System".

Removed LBP shall not be allowed to accumulate on surfaces within the Control Area, but shall be HEPA vacuumed or placed directly into 6-mil polyethylene bags. The Contractor shall maintain all surfaces as free as practicable of accumulated lead dust to prevent the dispersal of lead into the work place. LBP shall be removed by manual methods to the maximum extent feasible.

Debris shall be bagged in 6-mil polyethylene bags and secured in leak proof drums until TCLP testing is completed. Follow proper disposal requirements. The area around the surfaces subject to work shall be wet wiped and HEPA vacuumed, including the polyethylene sheeting. Upon clearance by the Owner's Consultant, the polyethylene sheeting shall be carefully folded in on itself and placed in a 6mil disposal bag. Containment debris shall be properly disposed of as lead-based waste.

Clearance will be performed as follows and as needed:

- a. Visual Clearance – determine that all required work has been completed. Look for settled dust, paint chips or debris in work area. If located, cleanings will commence until visual inspection locates no evidence of dust.



- b. The Owner's Consultant shall perform Dust and/or Soil Sampling, as required, and as outlined in the U.S. Department of Housing and Urban Development "Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing".

D. Alternative Lead Work Procedures

1. Any Work Procedure other than the outline procedures above, shall be submitted to the Owner's Consultant for approval prior to the start of the project. As there are many different components in differing areas of the building(s), it is impractical to address every potential lead work procedure. The intent of alternative lead work procedures shall be to maintain compliance with 29 CFR 1926.62 and maintain airborne concentrations of lead dust below the Action Level of 30 ug/dL of air.

### 3.3 MONITORING & CLEARANCE SAMPLING

During the entire LBP removal and disposal operations, the Owner's Consultant shall be on-site, as requested, directing the monitoring/sampling and inspecting the work to ensure that the health and safety requirements of this contract are satisfied.

A. Personnel Air Monitoring (Provided by the Contractor, as necessary)

1. Personnel air monitoring samples for airborne concentrations of lead shall be collected and analyzed in accordance with 29 CFR Part 1926.62. Results shall be reported in micrograms per cubic meter of air. The Competent Person shall use personal air monitoring results to determine the effectiveness of engineering controls, the adequacy of PPE and to determine if proper work practices are being employed. The Owner's Consultant shall be notified if any personal air monitoring result equals or exceeds 30 micrograms per cubic meter of air. The Contractor shall take steps to reduce the concentration of lead in the air.

B. Area Air Monitoring (Provided by the Owner's Consultant, as requested)

Airborne concentrations of lead shall be collected and analyzed in the laboratory. Results shall be reported in micrograms per cubic meter of air.

1. Pre-LBP work  
Pre-LBP work samples shall be collected in the following locations: 1) inside the lead control area, one upwind of the LBP work and two downwind of the LBP work procedure activities; and 2) outside the physical boundary (roped off) area, one upwind of the LBP work and two downwind of the LBP work activities. A total of six (6) samples. If work is performed inside the building, similar numbers of samples are to be positioned inside and outside the LBP containment area.
2. LBP Work  
The Competent Person shall collect area air samples on a daily basis during the duration of the LBP work. The samples shall be collected in the same location as the pre-work samples.
3. The area air samples shall be collected at 4 to 6 feet above grade, and using high volume air samplers.
4. The air samples shall be analyzed by NIOSH Method 7082 or method approved by Engineer.
5. Results

The Contractor shall have the results of the area air monitoring within 24 hours after completion of the sampling. Results shall be reported in micrograms per cubic meter of air.

6. Excessive Levels

Outdoor LBP work shall cease and the Owner's Consultant notified if measured airborne lead concentrations, collected during LBP activities, exceed the pre-work airborne concentration levels. The Contractor may be required to clean and re-sample the affected area, at no additional cost to the Owner, if directed by the Owner's Consultant. The Contractor shall correct the work practices and/or engineering controls and shall resume LBP work procedures at the direction of the Owner's Consultant.

C. Waste Sampling and Testing (Provided by the Contractor)

Sampling and testing of all waste, shall be in accordance with 40 CFR Part 261, 6 NYCRR Part 371 and SW-846, Chapter 9, Sampling Plan. See Paragraph 3.5.C of this specification section for waste sampling and analyses requirements.

D. Soil Sampling (Provided by the Owner, as requested)

1. If the Owner's Consultant or Owner's representative observes paint chips or LBP debris on the surface of the soil surrounding the work area during the LBP work procedures or at completion or if the Owner's Consultant or IH/ Owner's Representative suspects potential contamination to the soil based on observed procedures and conditions during the work, the contractor shall pay for composite soil samples of the surface soil where designated by the Owner's Consultant and at a frequency specified by the Owner's Consultant. Two Background surface soil samples will be collected where directed by the Owner's Consultant. The samples shall be analyzed by an independent laboratory for lead on a total basis (by EPA Method 6010) and TCLP basis (Extraction Method 1311, analysis by EPA Method 6010).
2. Standard Soils Clearance samples shall be collected by the Owner's Consultant and paid for by the Owner. The samples shall be analyzed by an independent laboratory for lead on a total basis (by EPA Method 6010) and TCLP basis (Extraction Method 1311, analysis by EPA Method 6010).
3. If the analyses exceed the TCLP limit, the soil shall be treated as LBP contaminated waste, excavated and disposed of as a hazardous waste by the Contractor.

Clearance Level (Subject to Change):

Soil: 400 microgram per gram

E. Dust/Wipe Sampling (Provided by the Owner, as necessary)

1. Dust/wipe samples shall be taken no sooner than 24 hours after abatement activities, including clean-up activities, have been completed.
2. Sampling for clearance criteria shall be performed as detailed in the HUD Guidance document. Appendices 13 and 14.
3. Failure to clear the work area and recleaning shall be the responsibility of the Contractor. The work area shall remain in place until satisfactory clearance has been achieved.

4. Analysis of Dust/Wipe samples for areas, which failed previous Dust/Wipe sampling, shall be reimbursed by the Contractor.

Clearance Levels:

|               |                                |
|---------------|--------------------------------|
| Floors:       | 10 micrograms per square foot  |
| Window Sills: | 100 micrograms per square foot |
| Window Wells: | 400 micrograms per square foot |

### **3.4 ADJACENT AREAS**

Damage to adjacent areas shall be repaired to the approval of the Owner.

### **3.5 CLEAN-UP & DISPOSAL**

#### **A. Cleanup**

1. **Daily**  
Surfaces in the LBP control area shall be maintained free of accumulations of paint chips, LBP debris, blasting debris and dust. Spread of dust and debris shall be restricted; waste shall not be distributed over the work area. Dry sweep or compressed air shall not be used for cleanup. At the end of each shift, the area shall be cleaned of visible lead paint contamination by vacuuming with a HEPA filtered vacuum cleaner and wet wiping the area. LBP work procedures work shall cease during the cleanup.
2. **At Completion of LBP work Procedure and a satisfactory visual inspection by the Engineer, a clean-up shall be performed by the Contractor. This clean-up includes removal of any contaminated material, equipment or debris including polyethylene sheeting from the work area. The polyethylene sheeting shall be sprayed or misted with water for dust control, construction debris removed and then the sheeting removed by folding it in upon itself.**
  - a. **Lead-contaminated debris shall be containerized in accordance with paragraph 3.5.C.1, LBP Wastes and Lead-Contaminated Wastes. Waste bags shall not be overloaded, shall be securely sealed and stored in the designated area until disposal.**
  - b. **Removal of surface polyethylene sheeting shall begin from top to bottom. Removal of floor polyethylene sheeting shall begin at the corners and folded in the middle to contain the dust. Polyethylene shall be disposed of as specified in Paragraph 3.5.C.1**
  - c. **Cleaning Equipment. The Contractor shall decontaminate the lead abatement equipment and equipment used in the work area. The wastewater from cleaning shall be contained, sampled and disposed of as specified in Paragraph 3.5.C.2.**

#### **B. Certification**

The Contractor shall certify in writing that the inside and outside the lead control area air monitoring samples are less than 30 micrograms per cubic meter of air, the respiratory protection for the employees was adequate, the work procedures were performed in accordance with 29 CFR Part 1926.62 and that there was no visible accumulations of lead-based paint and dust on the worksite. Do not remove warning signs at the lead control area or roped-off

boundary signs prior to the Owner's Consultant's receipt of the Contractor's certification. Re-clean areas showing dust, residual paint chips. LBP debris and blasting debris.

Waste Storage, Sampling/Analysis and Disposal (Provided by the Contractor)

1. LBP Wastes and Lead-Contaminated Water,  
LBP waste, and lead-contaminated waste and debris shall be stored sampled and analyzed and disposed of as follows.
  - a. The LBP waste and debris, lead contaminated personal protective equipment (PPE), clothing and waste polyethylene and lead-contaminated waste and debris shall be containerized in DOT approved containers (i.e.. 55 gallon drums, roll-off, etc.). If the waste is placed in roll-off(s), the roll off shall be lined with a minimum of 2 layers of 6-il polyethylene prior to placing any waste in it and covered with a liquid tight cover. Each container shall be labeled to identify the type of waste as defined in 49 CFR Part 172, 6 NYCRR Part 371 and 6 NYCRR Part 360 and with the date lead contaminated wastes were first put into the container.
  - b. A representative sample of the container(s) of LBP wastes and lead-contaminated wastes and debris generated by the LBP activities shall be taken in accordance with SW-. 846, Chapter 9, Sampling Plan and analyzed in the laboratory for TCLP lead by EPA Methods 1311 (extraction) and 6010 (analysis). If the wastes are placed in roll-off(s), four (4) composite samples per roll-off shall be taken for analysis. If the wastes are placed in 55 gallon drums, one composite sample for every ten (10) drums of wastes shall be taken for analysis. The laboratory analyses results shall dictate the proper method of disposal of the waste. A copy of the results shall be attached to the waste characterization (waste profile) form.
  - c. A waste characterization (waste profile) form shall be completed for the LBP waste and lead-contaminated waste and debris, and lead contaminated personal protective equipment and clothing (if containerized separately) and the forms submitted to Owner's Consultant for approval The Owner shall sign the forms. The Contractor shall process the forms and forward to the disposal facility for approval. The approved waste profile forms from the disposal facility shall be submitted to the Owner and Engineer prior to shipment of the wastes off-site.
  - d. The applicable waste transportation and disposal documents (i.e., hazardous waste manifest, bill of lading, non-hazardous waste manifest, land disposal restriction notification, etc.) shall be obtained and completed. An example of the completed waste transportation and disposal documents shall be submitted to Owner's Consultant for approval prior to shipment of the waste off-site.
  - e. Pick-up of hazardous wastes shall be made as needed to ensure that containers do not remain on the work site longer than 90 calendar days from the date affixed to each container. The Owner will assign an area for interim storage of waste-containing containers.
  - f. Lead contaminated personal protective equipment/ clothing, lead contaminated polyethylene, filters and debris, which cannot be sampled, shall be handled, stored, transported, and disposed of in the same manner as the LBP wastes and lead-contaminated wastes and debris, based on the sampling, laboratory analyses results and SW-846, Chapter 9, Sampling Plan calculations performed on the LBP wastes and lead-contaminated wastes and debris.

- g. The LBP and lead contaminated wastes/ debris shall be handled, stored, transported and disposed of in accordance with 40 CFR Parts 260 to 265, 6 NYCRR Part 370 to 373, 6 NYCRR Part 364 and 6 NYCRR Part 360, as applicable. Additionally, the disposal shall be based on the sampling, laboratory analysis results and SW-846, Chapter 9, Sampling Plan calculations. Land disposal restriction notification shall be as required by 40 CFR Part 268 and 6 NYCRR Part 376.

## 2. Wastewater and Decontamination Water

- a. Lead contaminated wastewater and decontamination water generated from the LBP work procedures shall be stored in DOT approved 55 gallon drums. Each drum shall be labeled to identify the type of waste as defined by 49 CFR Part 172, 6 NYCRR Part 371 and 6 NYCRR Part 360 and with the date lead contaminated liquid was first put into the drum.
- b. A representative sample from the drum(s) of liquid wastes shall be taken in accordance with SW-846, Chapter 9, Sampling Plan and analyzed in the laboratory for total lead and total cadmium by EPA Method 200.7/6010. One composite sample for every ten (10) drums of liquid wastes shall be taken for analysis. The laboratory analyses results shall dictate the proper method of disposal of the waste. A copy of the results shall be attached to the waste characterization (waste profile) form.
- c. A waste characterization (waste profile) form shall be completed for the liquid wastes and other wastes being generated and submitted to Owner's Consultant for approval. The Owner shall sign the form(s). The Contractor shall process the form(s) and forward the forms to the disposal facility for approval. The approved waste profile form(s) from the disposal facility shall be submitted to the Owner and Engineer prior to shipment of the wastes off-site.
- d. The applicable waste transportation and disposal documents (i.e., hazardous waste manifest, bill of lading, non-hazardous waste manifest, land disposal restriction notification, etc.) shall be obtained and completed. An example of the completed waste transportation and disposal documents shall be submitted to Owner's Consultant for approval prior to shipment of the waste off-site.
- e. The lead contaminated wastewater and decontamination water shall be handled, stored, transported and disposed of in accordance with 40 CFR Parts 260 to 265, 6 NYCRR Part 370 to 373, 6 NYCRR Part 364 and 6 NYCRR Part 360 as applicable.

## 3. Waste Pick-Up and Disposal

- a. Waste pick-up cannot be performed until all required submittals have been reviewed and approved by the Owner's Consultant. The Owner must be present at waste pick-up to sign the waste transportation documents and approve pick-up. No waste shall leave the site without approval and authorization by Owner.
- b. Coordinate scheduling of waste pick-up and transportation with Owner's Consultant. Notify Engineer at least 48 hours ahead of when the waste pick-up will take place.
- c. All wastes shall be properly disposed of off-site at an approved disposal facility. The wastes shall be transported by a transporter permitted to transport wastes per 6 NYCRR Part 364. The wastes shall be disposed of at a facility permitted to accept the waste being disposed of.

- d. Submit copy of completed and signed transportation and disposal documents to Owner and Engineer at time of shipment and submit copy of document signed by the disposal facility.
- e. Return or cause to be returned all waste manifests and bills of lading signed by the disposal facility within fifteen (15) days of removal from the project site.
- f. Submit certification of destruction for all incinerated wastes and certificates of final treatment and/or final disposal, as applicable, for all wastes disposed of off-site.
- g. All waste transportation and disposal must be conducted in accordance with all applicable State, Local and Federal regulations, all generator State regulations, all the State regulations where the wastes are transported through, and the disposal State regulations.

C. Payment for Disposal of Wastes

Payment for disposal of wastes will not be made until the following are received by the Owner:

- 1. A signed copy of the manifests
- 2. Bills of lading
- 3. Weight tickets, etc.
- 4. Certificate of final disposal, from the final treatment or disposal facility certifying the amount of lead containing wastes and debris delivered.

## **PART 4 – INSPECTION**

### **4.1 SUMMARY OF INSPECTION**

Limited lead-based paint inspections were completed throughout specific Renovation Areas as detailed on Geddis Architects architectural drawings to identify suspect lead-based paints and/or lead-containing hazards potentially affected by scheduled demolition/renovation activities included within the ***Rye CSD 2019 Capital Bond Project Phase II*** project, as detailed within Section 1.2 of this specification.

Anthony D. Perre, of **QuES&T**, performed visual assessment(s) and representative sampling on April 28, 2020. Existing documentation and/or information attained within inspection(s) and/or sampling activities conducted by EPA Lead Risk Assessor, Louis N. Johnson III, were reviewed and incorporated into this specification.

Paint testing was completed on-site utilizing a Niton XLp-300A XRF Spectrum Analyzer Serial #102273 in accordance with the EPA issued Performance Characteristics Sheet (PCS). A summary of results above the EPA action level of 1.0 mg/sq. cm., has been included to aid prospective bidders.

Surveys were completed in accordance with EPA, OSHA and HUD Guidelines for inspection of lead-based paint(s) and/or lead-containing material(s). Per these protocols, all suspect coated surfaces impacted by demolition/renovation activities were located and categorized by homogeneous painting histories and component types.

#### 4.2 SUMMARY OF RESULTS ABOVE THE EPA ACTION LEVEL OF 1.0 mg/cm<sup>2</sup>

The following is a detailed listing of identified Lead-based Paint(s) and/or Lead-containing Materials, above the EPA action level of 1.0 mg/sq. cm. The following listing should be utilized as a guide to specific work-related tasks and is not necessarily an Abatement Scope. Specified lead-safe work practices shall be performed in accordance with the stipulations defined within this specification as required by specific work-related tasks and in advance of disturbance(s) of the following Lead-based Paint(s) and/or Lead-containing Material(s), above the EPA action level of 1.0 mg/sq. cm:

##### **RYE HIGH SCHOOL/MIDDLE SCHOOL - INTERIORS**

- Middle School Office – Beige CMU Walls
- High School Faculty Room 250 – Blue Plaster Wall
- Auditorium Men’s Bathroom 103 – Glazed White Ceramic Wall Tiles
- Third Floor Room 304 Door to Stairwell – White Metal Door Casing
- Third Floor Staircase to Room 304 – Black Metal Stair Stringers
- First Floor Music Hallway (Outside of Proposed Elevator) – White Brick Walls
- First Floor Room 107 – Gray Brick/Stone Walls


Additionally, it should be noted that several components tested did in fact contain minimal lead-levels below the EPA threshold level of 1.0 mg/sq. cm for classification as Lead-Based Paint (LBP) and are considered lead-containing coatings by the OSHA Regulation, “Lead Exposure in Construction” (29 CFR 1926.62). OSHA does not recognize a minimum limit for lead concentration in paint for the purpose of disturbance. Monitoring of workers performing demolition/cleaning/disturbance of painted surfaces shall be completed to document personnel occupational exposure. Items containing any amount of lead concentration are considered lead-containing coatings per 29 CFR 1926.62, OSHA Lead Exposure in Construction.

##### **RYE HIGH SCHOOL/MIDDLE SCHOOL – EXTERIORS**

- NO Lead-Paints identified above the EPA / HUD thresholds

However, it should be noted that several components tested did in fact contain minimal lead-levels below the EPA threshold level of 1.0 mg/sq. cm for classification as Lead-Based Paint (LBP) and are considered lead-containing coatings by the OSHA Regulation, “Lead Exposure in Construction” (29 CFR 1926.62). OSHA does not recognize a minimum limit for lead concentration in paint for the purpose of disturbance. Monitoring of workers performing demolition/cleaning/disturbance of painted surfaces shall be completed to document personnel occupational exposure. Items containing any amount of lead concentration are considered lead-containing coatings per 29 CFR 1926.62, OSHA Lead Exposure in Construction.

Inspection findings reviewed & approved by:

Louis N. Johnson III   
EPA Lead Risk Assessor / Inspector  
Cert. #LBP-R-I151914-1 / #LBP-I-I151914-1

**END OF SECTION 028300**





## **SECTION 03 30 00**

### **CAST-IN-PLACE CONCRETE**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. General Notes, Sections, Plans, Typical Details, and other notes indicated on the structural drawings. In cases of conflict, information indicated on the structural drawings shall govern.

##### **1.2 SUMMARY**

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

##### **1.3 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
  - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Qualification Data: For Installer, manufacturer, and testing agency.
- E. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
  - 1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- F. Material Certificates: For each of the following, signed by manufacturers:
  - 1. Cementitious materials.

2. Admixtures.
  3. Form materials and form-release agents.
  4. Steel reinforcement and accessories.
  5. Fiber reinforcement.
  6. Waterstops.
  7. Curing compounds.
  8. Floor and slab treatments.
  9. Bonding agents.
  10. Adhesives.
  11. Vapor retarders.
  12. Semirigid joint filler.
  13. Joint-filler strips.
- G. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.
- H. Field quality-control test and inspection reports.
- I. Minutes of preinstallation conference.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
  2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

- E. ACI Publications: Comply with the following (latest editions) unless modified by requirements in the Contract Documents:
  - 1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5 and Section 7, "Lightweight Concrete.", and Section 8, "Mass Concrete".
  - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
  - 3. ACI 302.1R "Guide for Concrete Floor and Slab Construction"
- F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."
  - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
    - a. Contractor's superintendent.
    - b. Independent testing agency responsible for concrete design mixtures.
    - c. Ready-mix concrete manufacturer.
    - d. Concrete subcontractor.
  - 2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, concrete repair procedures, and concrete protection.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements and the approval of the architect and engineer, products that may be incorporated into the Work include, but are not limited to, products specified.

## 2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
  1. Plywood, metal, or other approved panel materials.
  2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
    - a. High-density overlay, Class 1 or better.
    - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
    - c. Structural 1, B-B or better; mill oiled and edge sealed.
    - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- E. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- F. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
  1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- G. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
  1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
  2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
  3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

## 2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, deformed, grade as indicated on the contract drawings.
- B. Epoxy-Coated Reinforcing Bars: ASTM A 615/A 615M, grade as indicated on the contract drawings, deformed bars, ASTM A 775/A 775M or ASTM A 934/A 934M, epoxy coated, with less than 2 percent damaged coating in each 12-inch bar length.
- C. Plain-Steel Wire: ASTM A 82, as drawn.
- D. Deformed-Steel Wire: ASTM A 496.
- E. Epoxy-Coated Wire: ASTM A 884/A 884M, Class A, Type 1 coated, as-drawn, plain-steel wire, with less than 2 percent damaged coating in each 12-inch wire length.
- F. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.
- G. Epoxy-Coated Welded Wire Reinforcement: ASTM A 884/A 884M, Class A coated, Type 1, plain steel.

## 2.4 REINFORCEMENT ACCESSORIES

- A. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
  - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
  - 2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

## 2.5 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
  - 1. Portland Cement: ASTM C 150 or ASTM C-1157, Type I/II, gray. Supplement with the following where indicated on the drawings:
    - a. Slag Cement used as a separate component in a concrete mixture: ASTM C-989 Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortar.

- b. Slag cement replacement levels shall not exceed 25% as a pound-for-pound replacement for portland cement in the concrete mixture.
  - c. Slag Cement when used as part of a blended cement: ASTM C-595 Specification for Blended Hydraulic Cements. Slag cement replacement levels shall not exceed 25% as a pound-for-pound replacement for portland cement in the concrete mixture.
  - d. Pozzolans (including fly ash): ASTM C-618, Class C. Pozzolan replacement levels shall not exceed 25% as a pound-for-pound replacement for portland cement in the concrete mixture.
  - e. Silica Fume: ASTM C-1240
- B. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
  - 1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
  - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Lightweight Aggregate: ASTM C 330, 1/2-inch nominal maximum aggregate size.
- D. Water: ASTM C 94/C 94M and potable.

## 2.6 MASS CONCRETE

- A. Materials in foundations with least dimension of 5 feet or more shall be considered mass concrete and placement shall conform to ACI 301 Section 8 "Mass Concrete".

## 2.7 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
  - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
  - 2. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
- C. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.

1. Available Products:

- a. Grace Construction Products, W. R. Grace & Co.; DCI.
- b. Master Builders, Inc.; Rheocrete CNI.
- c. Sika Corporation; Sika CNI.

2.8 FIBER REINFORCEMENT

- A. Carbon-Steel Fiber: ASTM A 820, deformed (minimum 25 lb/cu yd), "Novomesh 850" by SI Concrete Systems or approved equal. (to be used only where specifically indicated or approved by the architect and structural engineer).

2.9 WATERSTOPS

- A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch, or equal product approved by the architect and engineer.
  - 1. Available Products
    - a. Colloid Environmental Technologies Company (CETCO). WATERSTOP-RX

2.10 VAPOR RETARDERS

- A. Plastic Vapor Retarder: ASTM E 1745, Class A, minimum 20 mils thickness. Include manufacturer's recommended adhesive or pressure-sensitive tape.

2.11 CURING MATERIALS

- A. Clear, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A or ASTM C 309, Class A.
- B. All curing and sealing compounds at areas to receive flooring must be approved by the flooring installer for compatibility.

2.12 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 aromatic polyurea with a Type A shore durometer hardness range of 90 to 95 per ASTM D 2240.
- C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

- D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
  - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- E. Reglets: Fabricate reglets of not less than 0.0217-inch- thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- F. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

## 2.13 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301. Proportioning of concrete mix shall performed according to ACI 211.1
  - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
  - 1. Fly Ash: 25 percent. (where indicated on structural drawings)
  - 2. Slag Cement: 25 percent. (where indicated on structural drawings)
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
  - 1. Use water-reducing or high-range water-reducing admixture in concrete, as required, for placement and workability.
  - 2. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
  - 3. Use corrosion-inhibiting admixture in concrete mixtures where indicated on structural drawings.

## 2.14 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Proportion normal-weight concrete mixture as follows (or as indicated on the structural drawings):
  - 1. Minimum Compressive Strength: as indicated on the contract drawings.



2. Maximum Water-Cementitious Materials Ratio: as indicated on the contract drawings.
  3. Slump Limit: as indicated on the structural drawings.
  4. Air Content: as indicated on the structural drawings for all concrete exposed to freeze/thaw, no air entrainment for other concrete.
  - 5.
- B. Topping Slabs: Proportion structural lightweight concrete mixture as follows (or as indicated on the structural drawings):
1. Minimum Compressive Strength: as indicated on the contract drawings.
  2. Calculated Equilibrium Unit Weight: 115 lb/cu. ft., plus or minus 5 lb/cu. ft. as determined by ASTM C 567.
  3. Slump Limit: as indicated on the structural drawings.
  4. Air Content: Air content of trowel finished floors shall not exceed 3 percent.

## 2.15 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

## 2.16 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.
1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

## 2.17 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
1. Class A, 1/8 inch for smooth-formed finished surfaces.
  2. Class B, 1/4 inch for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete

surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.
  2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

## 2.18 EMBEDDED ITEMS

- A. Specify embedded items and anchorage devices for other work attached to or supported by cast-in-place concrete. Add specific requirements for installing embedded items, if any, that are part of the Work.
- B. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
  2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
  3. Install dovetail anchor slots in concrete structures as indicated.

## 2.19 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
  - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
  - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect and engineer.

## 2.20 SHORES AND RESHORES

- A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.

## 2.21 VAPOR RETARDERS

- A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.
  - 1. Lap joints 6 inches and seal with manufacturer's recommended tape.

## 2.22 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
  - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

- E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
- F. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.

## 2.23 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect and engineer.
  - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
  - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
  - 3. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of pile caps and grade beams or floor slabs.
  - 4. Space vertical joints in walls as indicated on structural drawings. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible. Provide approved waterstop in all joints.
  - 5. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
  - 6. Provide joint filler material and waterstop capable of bridging building expansion joints where such joints are indicated on the structural or architectural drawings.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, or as indicated on the structural drawings, as follows:
  - 1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
  - 2. Sawcut joints within 4 hours of placement using an early entry dry-cut saw.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
  - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.

2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 7 Section "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

## 2.24 WATERSTOPS

- A. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

## 2.25 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect and engineer.
- C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
  1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
  2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
  3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
  1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  2. Maintain reinforcement in position on chairs during concrete placement.
  3. Screed slab surfaces with a straightedge and strike off to correct elevations.
  4. Slope surfaces uniformly to drains where required.
  5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

- E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
  - 1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
  - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- F. Hot-Weather Placement: Comply with ACI 301 and as follows:
  - 1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
  - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.
- G. Conform to ACI 301 Section 8 – “Mass Concrete” for placement of concrete in excess of 5 feet in total thickness, including all mat slabs and thick pile caps shown on the structural drawings.

## 2.26 FINISHING FORMED SURFACES

- A. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
  - 1. Apply to concrete surfaces exposed to public view, and where indicated by the architectural drawings.
- B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

## 2.27 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. All floor finishes shall be reviewed and approved by the architect prior to placement of concrete.

- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
  - 1. Apply float finish to surfaces indicated on the architectural drawings.
- D. Steel trowel interior floor slabs scheduled to be exposed.
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to all exterior concrete slabs, paving, and steps, and where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom. Comply with flatness and levelness tolerances for trowel finished floor surfaces.
- F. Harden and seal floors as scheduled by the architect.

## 2.28 MISCELLANEOUS CONCRETE ITEMS

- A. Concrete encasement of steel columns: provide concrete encasement of steel columns using details indicated on the structural drawings.
- B. Pile cap anchorage: extend precast pile reinforcement strands into pile cap and provide anchors for strands capable of developing the tensile loads indicated on the structural drawings. Submit test data and product information for anchorage device to architect and engineer for approval.
- C. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- D. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- E. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.
- F. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

## 2.29 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- C. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- A. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
  - 1. After placing and finishing, use one or more of the following methods to preserve moisture in concrete:
    - a. Ponding, continuous fogging, or continuous sprinkling;
    - b. Application of mats or fabric kept continuously wet;
    - c. Continuous application of steam (under 150 °F);
    - d. Application of sheet materials conforming to ASTM C171
  - 2. Curing and Sealing Compound:
    - a. Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions.
    - b. Curing compound shall be applied immediately after slabs are finished. Recoat areas subjected to heavy rainfall within three hours after initial application.
    - c. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.
    - d. All curing and sealing compounds at areas to receive flooring must be approved by the flooring installer for compatibility.

## 2.30 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
  - 1. Defer joint filling until concrete has aged at least two month(s). Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.
- D. Provide joint filler capable of bridging building expansion joints where required on the structural or architectural drawings.

## 2.31 CONCRETE SURFACE REPAIRS



- A. Defective Concrete: Repair and patch defective areas when approved by Architect and engineer. Remove and replace concrete that cannot be repaired and patched to Architect and engineer's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one-part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
  - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
  - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
  - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect and engineer.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
  - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
  - 2. After concrete has cured at least 14 days, correct high areas by grinding.
  - 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
  - 4. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
  - 5. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact

patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

- E. Unless noted otherwise, provide a minimum floor slab flatness (Ff) of 25, and a minimum floor slab levelness (Fl) of 25 (levelness applies to slabs on grade only). Flatness and levelness (where applicable) shall be verified in the field using a profilograph within 72 hours of placement. Provide corrective action where floor levelness and/or flatness is not within specified tolerances.
- F. Perform structural repairs of concrete, subject to Architect and engineer's approval, using epoxy adhesive and patching mortar.

## 2.32 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- B. Inspections:
  - 1. Steel reinforcement placement.
  - 2. Headed bolts and studs.
  - 3. Verification of use of required design mixture.
  - 4. Concrete placement, including conveying and depositing.
  - 5. Curing procedures and maintenance of curing temperature.
  - 6. Verification of concrete strength before removal of shores and forms from beams and slabs.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
  - 1. Testing Frequency: Obtain at least one composite sample for each 50 cu. yd. or fraction thereof of each concrete mixture placed each half day.
    - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
  - 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
  - 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173/C 173M, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  - 4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.

5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
6. Compression Test Specimens: ASTM C 31/C 31M.
  - a. Cast and laboratory cure three sets of two standard 12" cylinder specimens for each composite sample.
7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
  - a. Test one set of two field-cured specimens at 7 days; one set of two specimens at 28 days; and one set of two specimens at 56 days (if required due to low strength at 28 days).
  - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated. If one specimen in a test shows evidence of improper sampling, molding, or testing, discard the specimen and consider the strength of the remaining cylinder to be the test result. If both specimens in a test show any defects, discard the entire test.
8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
9. Test results shall be reported in writing to Architect and engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect and engineer but will not be used as sole basis for approval or rejection of concrete.
11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect and engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect and engineer.
12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate does not comply with the Contract Documents.

END OF SECTION 033000



## **SECTION 03 54 00**

### **SELF LEVELING UNDERLAYMENT**

#### **PART 1 GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 General Requirements, apply to the work of this section.

##### **1.2 DESCRIPTION OF WORK**

- A. Furnish and install the concrete toppings on subfloors to meet finish flooring material leveling and moisture tolerance requirements.  
Moisture Control Primer  
Moisture Control Sealer.  
Crack and joint filler.  
Self leveling underlayment/topping

##### **1.3 SUBMITTALS**

- A. Manufacturer's Data: Submit manufacturer's specifications and installation instructions for all products including certifications and other data as may be required to show compliance with the Contract Documents.
- B. Manufacturer's Review: Submit written signed statement, that Contract Documents have been reviewed by qualified representatives of the materials manufacturer, and that materials and system to be used for underlayment are proper and adequate for the applications shown.

##### **1.4 QUALITY ASSURANCE**

- A. Underlayment work shall be performed by firm with at least five years experience on comparable Projects.
- B. The Owner reserves the right to retain an independent testing laboratory to inspect the work. Neither presence of the testing laboratory, nor any observations and testing performed by the laboratory shall relieve the Contractor of his responsibilities for the Work.

##### **1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials in manufacturer's unopened containers identified with brand, type, grade, date of manufacture, class, lot number, and other qualifying information.

- B. Store materials in original sealed containers, in dry enclosed storage area, within temperature range recommended by manufacturer.

## 1.7 JOB CONDITIONS

- A. Maintain manufacturer's current installation instructions at Project site.
- B. Maintain interior building area above 50°F. before, during, and after application of underlayment until cured.
- C. Provide and maintain adequate ventilation until topping cures completely.

## PART 2 PRODUCTS

### 2.1 PRIMER AND SEALER

- A. Two component epoxy based moisture control primer: Ardex P-MC
  - 1. Bond/Adhesion: 110 psi (0.8 Mpa) at 5 day old concrete (ASTM D-4541, Modified) 550 psi (3.8Mpa) at 28 days on moist concrete 580 psi (4.0 Mpa) at 28 days on dry concrete
  - 2. Permeance: (ASTM E-96) 0.27 perms (1.53E-08 grams/PA\*s\*m2),
  - 3. Two component epoxy based moisture control sealer: Ardex S-MC,
  - 4. Bond/Adhesion: (ASTM D-4541, Modified) 550 psi over primer
  - 5. Permeance: (ASTM E-96) 0.27 perms (1.53E-08 grams/PA\*s\*m2)

### 2.2 CRACK AND JOINT FILLER

- A. Moving Joints and Moving Cracks – honor all moving joints and moving cracks up through the underlayment. Flexible sealing compound Ardex Ardiseal Rapid
- B. Saw Cuts, Dormant Control Joints and Dormant Cracks – fill all dormant control joints and dormant cracks with Ardex Ardifix Low Viscosity Rigid Polyurethane Crack and Joint Repair

### 2.3 HYDRAULIC CEMENT UNDERLAYMENT

- A. Hydraulic Cement-based Self-Leveling Underlayment Ardex K 13
  - 1. Compressive Strength: 5,300 psi (371 kg/cm2) at 28 days, ASTM C109M.
  - 2. Flexural Strength: 1,000 psi (70 kg/cm2) at 28 days, ASTM C348
  - 3. VOC: 0
- B. Aggregates and additives for applications greater than 1" in thickness as recommended by underlayment manufacturer.
- C. Lightweight aggregates for application at new ramp as recommended by

underlayment manufacturer.

## PART 3 EXECUTION

### 3.1 CONDITION OF SURFACE

- A. Examine the substrates, adjoining construction and conditions under which the Work is to be installed. Do not proceed with the Work until unsatisfactory conditions have been corrected.
- B. Pre-Installation Meeting: Prior to installation of concrete underlayment and at the Architect's direction, meet at the Project site to review the material selections, installation procedures, and coordination of the Work with work of other sections. Meeting shall include the Architect, Trade Contractor, Subcontractor, manufacturer's representatives, inspection and testing services (if any), and any other subcontractor whose work requires coordination with this work.
- C. Surfaces to receive concrete underlayment shall be thoroughly dry and free of moisture.
- D. Subfloor surfaces shall not contain any grease, oil, or any other contaminants which could affect the complete bonding of the underlayment concrete to substrates.

### 3.2 INSTALLATION - GENERAL

- A. At the start of the installation and periodically as work progresses, provide the services of the manufacturer's technical representative at the job site as often as deemed necessary by the manufacturer to advise on all phases of this Work.
- B. Install the system in accordance with manufacturer's published instructions, except where more stringent requirements are specified.

### 3.3 SURFACE PREPARATION

- A. Fill non-moving cracks and joints as recommended by the concrete underlayment materials manufacturer.
- B. Concrete Underlayment Over Concrete Slab: Prime porous surfaces of 11% (minimum) absorption with Primer. Comply with underlayment concrete manufacturer's recommendations.

### 3.4 INSTALLATION

- A. Mix materials by methods and in proportions recommended by manufacturer.

- B. Maximum depth of concrete underlayment shall be 1 in. Add aggregates as recommended by manufacturer for underlayment depth.
- C. Install control joints following manufacturer's recommendations in locations indicated on the Drawings.
- D. Allow underlayment to cure properly. Block off traffic and protect floor underlayment from physical damage during curing.
- E. Test for dryness by taping 24 x 24 in. sections of plastic to concrete underlayment surface. After approximately 16 hours of curing, if no condensation occurs, the installation shall be considered dry and ready to receive finish flooring.

### 3.5 CLEAN-UP

- A. Upon completion of the concrete underlayment, clean all stains, remove all masking, protections, equipment, material, and debris from the work and storage area, and leave those areas in an undamaged condition acceptable to Architect.

END OF SECTION



## SECTION 04 01 00

### MASONRY MAINTENANCE

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

- A. All plant, labor, materials, equipment, testing and services necessary to complete the work shown on the drawings, schedules, and keynotes, as specified herein, and as may be required by conditions and authorities having jurisdiction, including, but not limited to, the following:
  - 1. Remove and restore exterior stone masonry where new cap flashings are being installed.
  - 2. Install sealant and backer rod at new flashings and existing window joints.
  - 3. Parge masonry walls with quick setting concrete grout to achieve smooth surfaces for the new flashings.
- B. Related Requirements
  - 1. Carpentry - Section 06 10 00
  - 2. EPDM Roofing - Section 07 53 23
  - 3. Sheet Metal Flashing & Specialties - Section 07 62 00
  - 4. Roof Accessories - Section 07 72 00

##### 1.3 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. A firm (Installer) with at least 5 continuous years experience performing work similar to that required for this project, employing personnel skilled in the work specified.
    - a. The Installer shall directly employ the personnel performing the work of this section.
    - b. The Installer shall have a full time supervisor in the work area when work is in progress. The Supervisor shall have a minimum of 5 years experience with work similar in nature and scope to this project, and speak fluent English.

- i) Submit the Supervisor's resume upon request.
- 2. The Installer shall provide a reference list of at least three previously completed projects of comparable size and similar design, within a fifty mile radius of this project, which may be observed by representatives of the Owner:
  - a. The reference list shall include at a minimum, the completion date, a description of the work performed, the Owner's name - contact person - phone number and address and the Architect's name - contact person and phone number.
  - b. Submit the reference list upon request.
- B. Material Quality: Obtain each type of material from a single source to ensure consistent quality, color, pattern, and texture.
- C. Pre-construction conference: Attend the pre-construction meeting and discuss the following:
  - 1. How and when masonry work will be performed.
  - 2. How the masonry work will be coordinated with other work.
  - 3. How roof & building surfaces will be protected, and how the building will be kept watertight as masonry work progresses.
  - 4. Weather to anticipate during construction.
  - 5. The availability of materials, personnel, equipment and facilities needed to proceed and complete the work on schedule.
  - 6. A schedule for Manufacturer and Architect inspections.

#### 1.4 SUBMITTALS

- A. Submit the following items far enough in advance to obtain approval prior to performing any other work on site:
  - 1. A pre-work site and building inspection report with photos, to document conditions before any other work starts on site.
  - 2. Manufacturer's technical literature for all materials.
  - 3. Test reports and certifications substantiating compliance with specification requirements if requested by the Architect.
  - 4. Samples to show sizes, grade and color, prior to mock-up erection, of each new exposed masonry material. Include the full range of colors and textures needed in the samples.
    - a. Stone: four samples each not less than 12 x 12 inches.
    - b. Mortar: four 6 inch long 1/2 inch wide strips set in metal or plastic channels.

- c. Anchors: four of each type of anchor.
- B. Simultaneously provide all technical submittals needed for this project, for all technical sections, collated by section. Incomplete submittals will not be reviewed.
  - 1. Submittals shall be prepared and made by the firm that will perform the actual work.
  - 2. Provide electronic submittals via an on-line submittal exchange program if one is established for this project; if an on-line program isn't established, provide the submittals on portable USB drives in pdf format, organized in folders by Section.
  - 3. Safety Data Sheets: Simultaneously provide all Safety Data Sheets needed for this project, for all specification sections - collated by section, in three ring binders. Provide two binders.
- C. Payment requisitions will not be processed until all submittals are received and approved.

#### 1.5 JOB MOCK UPS

- A. Prepare mock-ups of masonry work in actual job locations.
  - 1. For stone rebuilding - provide 4 foot long mockups.
  - 2. For sealant joints - provide 2 foot long mockups to show how the joints will be prepared, and 2 foot long mockups to show new backer rod and sealant.
- B. Construct each mock up with its associated roof and wall flashings, to show the following:
  - 1. The color, size and type of each masonry unit and mortar used to set it.
  - 2. Workmanship quality.
  - 3. The size and spacing of weep inserts.
  - 4. Flashings built into the masonry.
  - 5. Related materials and their installation techniques to fully establish a quality standard for the work.
- C. Mock-ups shall be constructed to establish the minimum acceptable standard of materials and workmanship, and to assure that completed work which matches the mock ups will be fully functional and serve the purpose for which it was designed.
- D. Approved mock-ups may be left in place and incorporated into the permanent installation. Rejected mock-ups shall be removed and replaced until an acceptable mock up is approved.
- E. Do not proceed with masonry work until mock-ups are installed, inspected and approved in writing.

## 1.6 DELIVERY, STORAGE AND HANDLING

- A. Carefully pack, handle, and ship masonry units and accessories in suitable packs or pallets or in heavy cartons.
- B. Deliver material to the site in the Manufacturer's original and unopened containers and packaging, bearing labels which identify the types and names of the products and Manufacturers. Unload and handle to prevent chipping and breakage.
- C. Protect masonry materials and aggregates during storage and construction from excess wetting by rain, snow or ground water, and from staining or intermixture with earth or other types of materials.
- D. Protect grout, mortar and cement products from deterioration by moisture and temperature. Store in a dry location or in waterproof containers. Protect liquid components from freezing.
- E. Do not overload the structure when storing materials on the roof.
- F. Protect roof surfaces where material and equipment is placed on them, and where construction traffic occurs, with 6 mil fire retardant polyethylene, covered with 1-1/2 inch thick foam insulation, overlaid with 2 by 10 wooden planks.

## 1.7 GUARANTEE

- A. Provide a written Contractor's Guarantee which guarantees that all work will remain free of material and workmanship defects and in a watertight condition for a five year period beginning upon Final Completion:
  - 1. Defects include but are not limited to the following: leakage, delamination, lifting, loosening, splitting, cracking, joint separation and movement.
  - 2. The Contractor shall make the repairs and modifications necessary to enable the work to perform as guaranteed at his own expense:
  - 3. Guarantee coverage shall include removing and replacing items installed as part of the original work, if removal is needed to make repairs.
- B. Provide one Guarantee that covers "all work performed" when a single contractor is awarded work specified in multiple Sections.
- C. The Guarantee shall take effect no more than 30 days before the satisfactory completion of all punch list work.
- D. The Contractor's Surety Company may add a rider to the Performance Bond which clarifies that Performance Bond Coverage expires two years after Final

Completion; i.e., Performance Bond Coverage does not run for the entire five year term of the Contractor's Guarantee.

## 1.8 JOB CONDITIONS

- A. Perform masonry work only when the air temperature is 40 degrees F and above and will remain so until the masonry has dried, but for not less than 72 hours after work ends.
- B. Erect temporary covers over pedestrian walkways and at building entrances and exits which will remain active as the work progresses.
- C. Prevent mortar from staining the face of surrounding masonry and other building surfaces; immediately remove any which falls or spills. Protect sills, ledges and projections from mortar droppings.
- D. Protect roof surfaces where material and equipment is placed on them, and where construction traffic occurs, with 6 mil fire retardant polyethylene, covered with 1-1/2 inch thick foam insulation, overlaid with 2 by 10 wooden planks.
- E. Coordinate masonry removal and restoration with the installation of new flashings.
- F. Prevent masonry work from rapid drying during hot weather. Use burlap to shield fresh masonry from direct sunlight, and mist fresh masonry with potable water so it cures slowly for at least 72 hours.
  - 1. Remove and replace any new masonry that develops shrinkage cracks, or isn't bonded well to adjoining masonry.

## PART 2 - PRODUCTS

### 2.1 MASONRY UNITS

- A. Stone: new or salvaged stone to match the type, color, surface texture and general sizes of existing adjacent stone.

### 2.2 MORTAR

- A. General Construction Mortar:
  - 1. Type S, custom colored, non-staining masonry cement containing Type I Portland cement meeting ASTM C150 and Type S hydrated lime meeting ASTM C207.
  - 2. Natural or manufactured sand aggregate selected to match the size, texture, gradation and color of the existing mortar aggregate, meeting ASTM C 144.

3. Clean potable water, free of oils, acids, alkalis and organic matter.

## 2.3 MISCELLANEOUS MATERIALS

- A. Anchors: Fabricated from Type 304 stainless steel to match existing.
- B. Sealant: High performance, solvent free, formulated and moisture curing silyl-terminated polyether sealant, ASTM C-920, Type S, Grade NS, Class 25, NovaLink construction sealant by ChemLink, color as selected.
- C. Backer Rod: Closed cell polyethylene foam, non-absorbent, compressible, chemically inert rod.
- D. Concrete Grout: Fast setting Portland cement based polymer modified repair mortar as manufactured by The Quikrete Companies, under the trade name Quick-Setting Cement, or equal.
- E. Weep Inserts: Full height head joint inserts formed of a polypropylene honey comb, three-eighths inch thick, Hohmann & Barnard, Inc. #QV Quadro-Vent.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Carefully perform work so the structural integrity of masonry adjoining the work is preserved. Simultaneously remove only limited sections of existing masonry; support and protect masonry remaining next to and above the removal areas.
- B. Completely remove and replace any existing masonry that moves, or if cracks form in the mortar joints between the masonry units, or within the masonry units.
- C. Cure all mortar by misting it with potable water to maintain it in a damp condition for not less than 72 hours. Shield fresh mortar from direct sunlight with wet burlap, and prevent fresh mortar from prematurely drying during the curing period. Remove and replace mortar joints that dry pre-maturely.
- D. Cut and remove existing masonry using hand and machine methods. Equip each cutting machine with a separate dedicated vacuum and manufacturer's blade guard vacuum attachment, and control the amount of dust produced so there are no visible plumes. Comply with OSHA crystalline silica standards for construction.
- E. Do not overcut brick head joints and allow the blade to nick the bricks; remove and replace bricks damaged during the cutting and repointing preparation process at no cost to the Owner.

### 3.2 MORTAR MIXES

A. Measurement and Mixing:

1. Measure general construction mortar materials when dry by volume using a pail or similar container. Do not measure with a shovel.
  - a. Mix mortar using 1 part mortar cement and 3 parts sand aggregate.
  - b. Thoroughly mix cement and aggregate in a clean mechanical batch mixer before adding water; then continue mixing and add only enough water to produce a workable mix.
  - c. Do not mix mortar by hand.
2. Mix factory blended pointing mortar in a clean mechanical batch mixer, adding only enough water to produce a workable mix.
  - a. Do not mix mortar by hand.
3. Use mortar within 45 minutes of final mixing; do not re-temper or use partially hardened material.

- B. Mix and install mortar with the same ingredients used to produce the approved mock-up. Do not adjust the color or proportions without written approval. Do not use admixtures of any kind in the mortar unless specifically approved.

### 3.3 STONE REMOVAL AND REPLACEMENT

- A. Simultaneously remove only limited sections of existing stone masonry; support and protect masonry remaining next to and above the removal areas.
- B. Carefully remove stones on a piece-by-piece basis to the extent indicated. Cut out full units, to permit replacement with full size units. Clean the edges of the remaining stones, to remove all mortar, dust, and loose debris in preparation for rebuilding.
- C. Install new cap flashings and wall flashing extensions, properly lapped under and connected to the existing wall flashings, as indicated on the drawings and specified elsewhere, before installing new stones.
- D. Install new stones to restore the original appearance of the wall. Butter vertical joints, and push the stones into a full bed of mortar. Tool the mortar joints to match the joints of surrounding stone.

### 3.4 SEALANT JOINTS

- A. Carefully remove existing sealant and back up material from within the joints to a minimum depth of 1-1/2 inches, and from the surface of adjoining masonry at the edges of the joints.
  1. Use hand tools and work to avoid damage to adjoining masonry.
  2. Replace adjoining masonry damaged during sealant removal work.

- B. Install new backer rod without puncturing or tearing it, to snugly fill the joint at a depth to yield a sealant joint twice as wide as it is deep.
  - 1. Do not twist backer rods, or install multiple pieces of undersized rod, when the correct size rod is not onsite.
- C. Mask the edges of all joints prior to installing sealant.
  - 1. Push sealant into the joint to completely fill it, tool the sealant to produce a slightly concave, neat recessed joint, and remove joint masking before excess sealant sets.

### 3.5 CLEANING, PROTECTION AND WATERTIGHTNESS

- A. Inspect the interior and exterior of the building and grounds, and submit a written report with photos to document any leaks or damage, prior to performing any other work on site.
- B. The Owner will conduct a similar inspection at the completion of the work, and the Contractor will be charged for all leaks and damage that weren't documented in the Contractor's report, or repaired to the Owners satisfaction at the Contractor's expense.
- C. Provide any equipment, material and labor necessary to protect the site, the building, its contents and occupants, pedestrians, and surrounding landscaped and paved areas from damage due to the construction work or from inclement weather during construction.
- D. Do not perform work during inclement weather. Protect incomplete work and the building from damage by inclement weather - which may occur unexpectedly. Make all work areas watertight at the end of each day's work.
- E. Clean up all litter, refuse, rubbish, scrap materials and debris at least twice a day; at noon and at the end of the work day, so the roof and site presents a neat, orderly and workmanlike appearance. Place the debris in a dumpster, and remove the dumpster from the site as soon as it is full or no longer being used.
- F. Carefully and thoroughly clean the entire roof to remove all residual debris when all work is complete. After cleaning the roof, thoroughly clean all drain sumps, drain lines, leader heads and leaders. Do not allow debris to enter the drainage system.

END OF SECTION 04 01 00



## **SECTION 042000**

### **MASONRY VENEER**

#### **PART 1 - GENERAL**

##### **1.1 GENERAL REQUIREMENTS**

- A. The General Conditions of the Contract and the General Requirements are hereby made part of this Section of the Specifications.

##### **1.2 SCOPE OF WORK**

- A. The work includes furnishing all labor, materials, equipment, and supervision to accomplish the following work in accordance with the Drawings and Specifications.
- B. Masonry Removal
  - 1. Remove granite veneer and architectural precast concrete pieces as shown and store stones for cleaning and reinstallation. Label each stone according to the approved field survey layout drawings with the appropriate designation that notes its location and stone number. as the stones are being removed and label the general area where each group of stone was removed.
    - a. Note that the first-floor granite, including columns, and the precast concrete arches and related support stones are to remain in place.
  - 2. Remove all existing cavity wall components, including veneer anchors, mortar droppings and pea gravel, insulation boards, and weather barrier.
  - 3. Remove bottom 2 ft of existing fiberglass-faced gypsum exterior wall sheathing at bottom of second floor. The Engineer will survey condition of exposed existing cold-formed framed backup wall.
- C. Clean granite and precast concrete of mortar, sealant, efflorescence and staining, dirt, dust, and other debris.
- D. Survey all granite veneer and architectural precast concrete scheduled for reinstallation. Notify Engineer of all stones which are broken, cracked, chipped, stained, or have other defects which might be visible in the finished work. Notify Engineer of any stones which have less than 3 in. of horizontal surface depth on the top or bottom surface. Replace stones as directed by the Engineer; for pricing assume 1% of granite veneer stones require replacement, and one precast window head requires replacement.

- E. Cut back of precast concrete window sills as shown on the Drawings to provide sufficient cavity space for insulation installation. Survey sills prior to cutting to confirm the location and depth of any reinforcement; do not cut until confirmed that sufficient cover exists to prevent early corrosion of reinforcement (1-1/2 in. minimum) – review with Engineer if insufficient cover.
- F. Provide an adjustable veneer anchor system for the granite masonry veneer at the building walls and stainless steel stone anchors for the precast concrete (minimum two anchors per top and bottom of stone). Stainless steel stone anchors must be designed to meet current code requirements and reuse existing stone kerf or dowel holes. Coordinate with the installation of metal through-wall flashing and wall waterproofing (Section 071000 – Waterproofing System and Section 076000 – Sheet Metal Flashing).
- G. Provide mineral wool insulation that fits snugly between the veneer anchor system back plates and the stone anchors.
- H. Provide aerogel insulation within cavity behind reinstalled stone sills.
- I. Reinstall granite veneer as shown on the Drawings, integrating any replacement stones. Begin at the ground level and place replacement and existing granite stones in random ashlar pattern to match existing layout. Cut stone at continuous lines of metal flashing.
- J. Reinstall precast concrete, integrating any replacement pieces and match existing layout. Coordinate with granite veneer installation.
- K. Clean finished masonry veneer upon completion of installation, including all mortar remnants.

### 1.3 COORDINATE WITH RELATED WORK

- A. Coordinate the work of this Section with the work of other trades under this Contract, including but not limited to:
  - 1. Section 071000 – Waterproofing Systems.
  - 2. Section 076000 – Sheet Metal Flashing.

### 1.4 SUBMITTALS

- A. Submit the following items in time to allow for review by the Engineer and resubmittals, if needed, without delaying the work. Do not order materials or start work before receiving the Engineer's written approval.
- B. Submit the following items from the manufacturer to the Engineer for approval:
  - 1. Samples and/or manufacturer's literature for all materials specified and proposed for use on this Project, each properly labeled.

2. Manufacturer's installation recommendations for all materials used on this Project.
3. Certifications by the producers of all materials that all materials supplied comply with all the requirements of these specifications and the appropriate standards.

C. Contractor Qualifications:

1. The Contractor performing the work under this section must have a minimum of ten years' experience in comparable work and must submit a list, with references, of three buildings on which they worked in the last five years, employing workers skilled in the restoration processes and operations indicated.
2. List building name and address, architect, general contractor, and appropriate subcontractors and foreman with phone numbers and contact person.

D. Precast Concrete Manufacturer's Qualifications

1. The precast concrete manufacturer performing the work under this Section must have a minimum of ten years of experience providing precast concrete for similar work and be able to provide upon request, three references from within five years of comparable work. References should list building name and address, designer, general contractor, appropriate subcontractors, and foreman with phone numbers and contact person.
2. The precast concrete manufacturer must meet qualification requirements listed in Para. 1.9.

E. Field Survey (For Removal Areas): Prior to the start of the removal work or any repair work, conduct a survey of the existing masonry. Coordinate survey with the Engineer so that they can be present at the beginning of the survey. As a minimum, record the following information:

1. Dimensions of all stones scheduled for removal, including joint dimensions and scaled elevation drawings. Show type and coursing of each individual stone. Include unique identification number on drawing for each stone. Mark numbers on back and top of stone with crayon or other removable marker. Dimensions required for granite and architectural precast concrete scheduled for removal.
2. Note any observed deterioration or damage, including cracks, spalls, chips, or similar deterioration.
3. Photographic Documentation: Provide photographs documenting location and condition of each stone scheduled for removal and of each damage area noted. Identification number marked on stones scheduled for removal must be visible in photograph.

4. Approval of field documentation is required before removal work may begin. Field documentation must be submitted prior to the Shop Drawings required in Para. 1.4.E.
- F. Removal Procedures: Provide a detailed description of the removal process, equipment being used, and any materials required to complete the work for approval. Include procedures and detail drawings for interior debris barricades and exterior debris chute nets, dust and fume control measures, temporary weather protection and temporary partitions.
- G. Field Survey for Spalls, Cracks, and Delaminated Stone Scheduled for Reinstallation: After cleaning, survey all masonry scheduled for reinstallation. Submit survey log corresponding to each stone's individual designation that notes any of the following and provide photographic documentation of the conditions. Include proposed repair procedure, including possible replacement.
  1. Depth of stone less than 3 in. on horizontal surface.
  2. Cracks.
  3. Chips.
  4. Broken stone.
  5. Stains that remain and will be visible in the finished work.
- H. Shop Drawings:
  1. Shop drawings of the reinstalled masonry showing reinstalled pieces, replacement pieces, anchorage, veneer layout and coursing, flashing locations, anchorage locations, and other coordination items. Coordinate these Drawings with relieving angle and metal flashing shop drawings.
  2. Shop drawings identifying Contractor's procedures and methods for removing, storing, and reinstalling granite in order to ensure the size, color, and texture of granite veneer stays consistent.
  3. Shop drawings showing anchorage for precast concrete pieces around windows and water table band course. Submit with anchor and stone calculations noted below.
  4. Shop Drawings for all replacement stone and architectural precast concrete pieces showing fabrication details, dimensions for individual replacement stones, anchorage attachment points, finishes, reinforcement and dimensioned elevations for each individual replacement stone. Contractor shall verify all dimensions and coordinate the drawings with field conditions.
- I. Mix design and procedure for all mortar mixtures.
- J. Mix design for architectural precast concrete
- K. Samples: All samples will be reviewed by the Engineer and Owner's Representative for matching qualities to the existing masonry wall.

1. Submit three 12 in. x 12 in. samples of new granite in range of colors, textures, and surface type to be used in the work.
  2. Submit three 12 in. x 12 in. samples of new precast concrete in range of colors, textures, and surface type to be used in the work.
  3. Mortar Samples: Prior to any mockups, provide samples of the cured mortar proposed to be used. Samples will be used to evaluate the color and texture of the mortar and will be compared to the original mortar in place on the building. The mortar samples may be made in rings cut from 3 in. dia. PVC pipe. Mockups cannot begin until samples are approved. Note that different mortar samples may be required for different building areas or materials.
- L. Test Results: Submit the test results for the proposed granite stone to be used on the Project following the ASTM testing procedures listed below. Test results shall be from a testing laboratory independent of the fabricator and acceptable to the Owner's Representative, to confirm that the proposed material meets all of the physical requirements set forth in this Specification.
1. Flexural Strength (wet and dry) – ASTM C880.
  2. Modulus of Rupture (wet and dry) – ASTM C99.
  3. Compressive Strength – ASTM C170.
  4. Absorption by Weight – ASTM C97.
  5. Density – ASTM C97.
- M. Test Results for Precast Concrete: Provide test results for cast stone manufacturer using proposed mix design. Tests shall include:
1. Compressive strength (ASTM C1194).
  2. Absorption (ASTM C1195).
  3. Freeze/thaw (ASTM C666) as modified in ASTM.
- N. Calculations: Anchorage of precast concrete to backup wall is delegated design. Submit calculations stamped by a registered professional engineer in the state of New York for precast concrete stone anchors and associated fasteners to support the lateral loads listed below and dead loads of granite veneer above.
1. Wind Loads:
    - a. Positive Load: 27 psf.
    - b. Negative Load: 35 psf.
- O. Cleaning Products and Procedures: For each masonry material and staining type, submit the following package of information:
1. Product literature and manufacturer recommendations for the masonry cleaning products and equipment.

2. Written cleaning procedure, including dilution, dwell time, rinsing procedure, and materials for the mockup. Procedures are to be submitted both prior to mockups and prior to full cleaning.
3. Written procedures for protecting building occupants, pedestrians, and the work and for containing and disposing of effluent.

## 1.5 REFERENCED STANDARDS

- A. The following documents are a part of this Specification except as modified in this Section, including the references contained in each document. Comply with all applicable Sections of the documents and the reference standards unless specifically modified herein.
- B. American Society of Testing Standards (ASTM):
  1. ASTM C615 – Standard Specification for Granite Dimension Stone.
  2. ASTM C270 – Standard Specification for Mortar for Unit Masonry.
  3. ASTM C1194 – Standard Test Method for Compressive Strength of Architectural Cast Stone.
  4. ASTM C1195 – Standard Test Method for Absorption of Architectural Cast Stone.
  5. ASTM C1364 – Standard Specification for Architectural Cast Stone.
  6. ASTM C 666 – Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
- C. American Concrete Institute (ACI):
  1. ACI SP-15-05 – Specifications for Structural Concrete with Selected ACI and ASTM References.
  2. ACI 530-02 – Building Code Requirements for Masonry Structures.
  3. ACI 533-02 – Design Responsibility for Architectural Precast-Concrete Projects.
  4. ACI 318-95 – Building Code Requirements for Reinforced Concrete.
- D. ACI 315 – Manual of Standard Practice Detailing Reinforced Concrete Structures.
- E. ACI 318 and design recommendations of PCI MNL 120, PCI Design Handbook – Precast and Prestressed Concrete.
- F. PCI MNL 117 – Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products for manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required.
- G. Concrete Reinforcing Steel Institute (CRSI): MSP-1-90 – Manual of Standard Practice.
- H. Brick Institute of America (BIA).

- I. National Precast Concrete Association (NPCA).
- J. Standards for Architectural Cast Stone: Standard for the Design of Architectural Cast Stone (TMS 404); Standard for the Fabrication of Architectural Cast Stone (TMS 504); Standard for the Installation of Architectural Cast Stone (TMS 604).

#### 1.6 EXAMINE EXISTING CONDITIONS

- A. Verify all site conditions and dimensions by measurements in the field. Verify existing construction in consideration of the special conditions associated with working in and repairing and modifying an existing building.
- B. Notify the Engineer immediately of any inconsistencies between field conditions and those shown in the Contract Drawings. The Engineer will determine what modifications or additional repairs are necessary.

#### 1.7 QUALIFICATIONS

- A. The work of this Section shall be performed by a contractor acceptable to the Owner prior to bid. The masonry contractor, the contractor's superintendent, and the foreman will have at least five years of experience with successfully completed work described in this Section.

#### 1.8 MOCKUPS

- A. Notify the Engineer at least 72 hrs before starting work on each mockup. Do not proceed with any part of the work before the Engineer approves the appropriate mockups. The mockups will be used to establish both technical and aesthetic standards for other replacement, reinstallation, and repair of units for the remainder of the Project. Reconstruct mockups as many times as necessary to obtain the Engineer's approval at no additional cost to the Owner. The approved mockups may be used as a guideline for the remainder of the work and installed work will be judged accordingly.
- B. Provide the following mockups:
  - 1. In situ mockup of granite veneer reinstallation including all related anchorage and cavity wall elements. Mockup to include a minimum of 15 sq ft of area and include flashing installation. Mockup to include finished mortar joints.
  - 2. Existing mortar removal from stone and precast concrete piece to be reinstalled; mockup to demonstrate proposed procedures and level of proposed mortar removal.
  - 3. Provide the following sample panels of proposed cleaning methods. Approved mockup will determine procedures for each area of soiling including approximate concentration and dwell time.

- a. Efflorescence Staining
  - b. General Construction Mortar Staining
4. Masonry work as specified in this section to complete the mockups specified in related sections.

#### 1.9 PRECONSTRUCTION CONFERENCE

- A. Attend a preconstruction conference to be held with representatives of the Owner, the Contractor, the Engineer, and all other trades to discuss the work covered under this Section. Review methods and procedures related to masonry installation, including inspection of waterproofing and flashing prior to installation, installation procedures, protection from damage, replacement materials, submittals, and schedules.

#### 1.10 QUALITY CONTROL/ASSURANCE

- A. An inspection of the existing cold formed metal framing by the Engineer is required after removal of the exterior sheathing. The Contractor shall provide access to these areas for the Engineer's inspection. Repairs to the cold-formed metal framing walls may be required because of this inspection. Repairs to the cold-formed metal framing wall are included as Unit Price items.
- B. The Engineer will perform tests and inspections and prepare test reports per the New York State Building Code. Building wall components that require inspection include but are not limited to mortar preparation and joint size, anchor installation, bearing width of existing granite, and backup wall construction.
- 1. Provide Testing Agency and Engineer of Record with access to places where masonry work is performed to complete tests and inspections.
  - 2. Inspections and tests by the Testing Agency and Engineer of Record do not relieve the Contractor of responsibility for supervision and quality control of the Work.
- C. The Contractor shall conduct a quality control program that includes, but is not limited to, the following:
- 1. Inspection of all materials to ensure that they conform to contract requirements and that all materials are new and undamaged.
  - 2. Establishment of procedures for executing the work.
  - 3. Inspection of work in progress to ensure that work is being done in accordance with established procedures and specific instructions, if given by the Engineer.
  - 4. Inspection of all work completed, including visually examining all masonry work, and correction of all defective work.



- D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- E. Precast Concrete Fabricator Qualifications: A firm that assumes responsibility for engineering architectural precast concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
  - 1. Participates in PCI's plant certification program and is designated a PCI-certified plant for Group A, Category A1 – Architectural Cladding and Load Bearing Units or participates in APA's "Plant Certification Program for Production of Architectural Precast Concrete Products" and is designated an APA-certified plant.

#### 1.11 DELIVERY, STORAGE, AND HANDLING

- A. Protect granite and precast concrete during removal, transit, storage and handling against damage. Stones and precast concrete pieces that are damaged, chipped, cracked, or stained as a result of contractor handling will not be permitted to be reinstalled and will be replaced at the contractor's expense.
- B. Store all materials in a location selected by the Owner. Store all materials neatly on pallets to prevent wetting or damage. Use fire-retardant canvas tarpaulins to cover all exterior stored materials, top to bottom. Polyethylene covers are not acceptable.
- C. Protect ALL materials from the weather. Promptly remove from the site all materials rejected by the Engineer or harmed by moisture anywhere, at any time, during transportation, storage, handling, and installation.
  - 1. Store cement, lime, and other water-actuated or moisture-sensitive materials in a dry interior location.
  - 2. Store all materials in original, unopened, labeled containers and packaging, and in compliance with the manufacturer's directions. Comply with all practices recommended by the manufacturers of all materials, including (but not limited to) manufacturer's minimum and maximum temperature, humidity, shelf life, and other requirements for storage.
- D. Do not stockpile materials or equipment to overload any building or site component.

#### 1.12 PROTECTION

- A. Protect the building, occupants, pedestrians, and building contents from all risks associated with this work including inclement weather. Replace damaged components at no charge to the Owner and to the satisfaction of the Owner using mechanics skilled in the appropriate trade and approved by the Owner.

- B. Do not damage existing building components, including flashing, roofing, and backup materials scheduled to remain when removing masonry. Provide adequate protection of the window glass and frames to prevent breakage, scratches, and any other damage during work associated with this Section.
- C. Do not allow mortar droppings to remain on face of masonry, windows (glass or aluminum surfaces) or other building components to prevent staining.
- D. Provide window, door and louver protection.
- E. Proceed with installation only when existing and forecasted weather conditions permit masonry and related materials to be installed according to manufacturer's written instructions and industry guidelines.
- F. Protect finished work from water entry into cavity and masonry saturation.
- G. Environmental Requirements:
  - 1. Make necessary provisions for the diversion and disposal of cleaning water and solutions. Take necessary precautions and protective measures to prevent injury to people and damage to property in areas adjacent to the site, including damage due to cleaning odors and VOCs and contamination resulting from runoff of cleaning solution or cleaning water.
- H. Do not wet or wash down masonry surfaces when the temperature is below 40°F or may drop below 40°F within 24 hrs.

#### 1.13 WARRANTY

- A. Guarantee all work under this Section in a document. State that if, within two years after the Date of Substantial Completion of the Work, any of the work of this Section is found to be defective or not in accordance with the Contract Documents, the contractor shall correct it promptly after receipt of a written notice from the Owner to do so, unless the Owner has previously given the contractor a written acceptance of such condition. Also, state that the contractor shall bear all costs incurred by the Owner, including reasonable attorney's fees, to enforce compliance with the obligations of this guarantee. The obligation of these Guarantees shall run directly to the Owner and may be enforced by the Owner against the contractor, shall survive the termination of the Contract, and shall not be limited by conditions other than this Contract.

## PART 2 - PRODUCTS

### 2.1 MASONRY VENEER MATERIALS

- A. Reuse existing undamaged granite stones.

- B. Where individual granite stones are cracked, damaged, or inadequately sized, provide replacement granite
1. Provide granite stones with finish, color, grade and pattern to match existing granite on building:
    - a. Thickness – Nominal 6 in. thick, minimum 4 in. thick at thinnest point.
    - b. Size – Height and width to be similar dimensions as existing stone.
    - c. Texture – Split-faced gray granite cut with square edges.
    - d. Color – Colors to match existing range in the gray scale.
  2. Provide granite stones exceeding the following minimum physical properties:
    - a. Flexural Strength, wet and dry (ASTM C880) – 1,500 psi minimum.
    - b. Modulus of Rupture, wet and dry (ASTM C99) – 1,500 psi minimum.
    - c. Compressive Strength (ASTM C170) – 19,000 psi minimum.
    - d. Absorption by Weight (ASTM C97) – 0.40% maximum.
    - e. Density (ASTM C97) – 160 pcf minimum.
  3. All granite shall be ASTM C615 Building Grade, free from cracks, seams, or spalls, which will affect its visual appearance or structural integrity. Inherent variations characteristic of the quarry from which it is obtained will be acceptable, except knots, which shall be limited to 1-1/2 in. maximum size.
- C. Adjustable Anchor System for Granite Veneer: Tie-HVR-195VB Anchor System by Hohmann & Barnard, Inc. Provide anchor system in Type 304 stainless steel, except for vertical J-hook.
1. Back plate: 12 ga stainless steel plate. Provide in lengths to accommodate insulation thickness and areas with no insulation. Provide back plates with two fastener holes vertically for installation into metal studs.
  2. Vertical J-Hook: Stainless steel, Type 316, 7/16 in. dia.
  3. Masonry Ties: Stainless steel flexible tie #345-VT by Hohmann & Barnard, Inc. Provide 12 ga heavyweight flexible head with hole diameter to accommodate 3/8 in. dia. J-hook wire and wall tie wire with 3/16 in. dia. of varying lengths to accommodate cavity width and nominal stone thickness.
- D. Anchor System for Below Base of Wall Flashing: Two-part adjustable masonry veneer anchor system consisting of a 12 ga plate attached to the back-up wall, 3/16 in. diameter wire tie in length to provide sufficient embedment into masonry veneer. Confirm existing cavity width. Provide all masonry anchor system materials in Type 304 stainless steel. Confirm existing cavity width and fastener pull-out strength in the back-up wall before ordering materials.

1. Basis of Design into Metal Studs: HB-213 by Hohmann & Barnard, Inc., or approved equal.
  2. Basis of Design into Concrete Foundation: HB-5213 with brass expansion anchor by Hohmann & Barnard, Inc., or approved equal.
- E. Fasteners:
1. Fasteners into metal studs and structural steel: Hex-head washer, self-drilling screw fastener, bi-metal fasteners with stainless steel head designed to withstand hydrogen embrittlement. Provide #12 screws into metal studs and minimum 1/4 in. into structural steel; adjust diameter as required for base material thickness. Provide screws in length as required to obtain minimum 1/4 in. of threads on the back of the base material.
  2. Fasteners into concrete: Stainless steel, hex head, 1/4 in. dia., in length to provide minimum 2 in. embedment depth into substrate.
    - a. KWIK-CON II+ by Hilti.
    - b. Tapcons by Buildex.
    - c. Tapper by Powers.
- F. Mortar: ASTM C270, Type S. Proportions by volume 1:1/2 : 4-1/2 (portland cement: hydrated lime: mason's sand). Do not use ground limestone or prepared masonry mortar mixes. Use the same brands of cement and lime, and the same source of sand throughout the Project, for each mix. Do not use any admixtures except those called for herein without written approval by the Owner's Representative. Mortar color must match the approved mockup specified above.
1. Water: Potable.
  2. Mason's Sand: ASTM C144, fineness modulus 2.0 to 2.5.
  3. Hydrated Lime: ASTM C207, Type "S."
  4. Portland Cement: ASTM C150, Type I (white, non-staining), low alkali (equivalent alkalis less than 0.6%).
  5. Mortar Pigment: ASTM C979, do not use mortar coloring material unless specifically requested by the Engineer to obtain color match. If requested, integral coloring material shall consist of inert, non-fading, finely ground, alkali-fast mineral oxides, made especially for cement/lime mortars. Limit coloring additive so as not to exceed 10% of the weight of Portland cement. Do not use carbon black as a coloring additive.
- G. Setting Shims: Plastic by Kor-o-lath of New England.
- H. Weep Holes: Rectangular Plastic Weep Holes #342S by Hohmann & Barnard, Inc. Provide with stainless steel screen.
- I. Architectural Precast Concrete:

1. Comply with ASTM C1364 – Standard Specification for Architectural Cast Stone, except as noted in these specifications, including freeze-thaw testing.
2. Comply with ACI Standard 301 – Specification for Concrete Construction, except as noted in these Specifications.
3. Before casting, submit mix design and all other components to the Architect for approval.
4. Reinforcing materials:
  - a. Reinforcing Bars: ASTM A615/A615M – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement, Grade 60, deformed, epoxy coated.
  - b. Steel Bar Mats: ASTM A184/A184M – Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement, fabricated from ASTM A615/A615M, Grade 60, deformed bars, epoxy coated, assembled with clips.
  - c. Plain-Steel Welded-Wire Reinforcement: ASTM A185 – Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete, fabricated from as-drawn steel wire into flat sheets, epoxy coated.
  - d. Deformed-Steel Welded Wire Reinforcement: ASTM A497/A497M – Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete, flat sheet, epoxy coated.
  - e. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 117. Metal devices shall be epoxy coated.
  - f. Locate steel precisely and uniformly, with minimum clearance of 1-1/2 in. from edges, from the top and slots (if any).
5. Portland Cement: ASTM C150, Standard Specification for Portland Cement, Type I or Type III, white, unless otherwise indicated, with alkali less than 0.6%.
6. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C33, Standard Specification for Concrete Aggregates, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.
  - a. Face-Mix Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining.
  - b. Face-Mix Fine Aggregates: Selected, natural, or manufactured sand of the same material as coarse aggregate.
  - c. Use face-mix aggregates of gradation and color to produce finish selected.

7. Coloring Admixture: ASTM C979/979M-10 – Standard Specification for Pigments for Integrally Colored Concrete, synthetic mineral-oxide pigments or colored water-reducing admixtures, temperature stable, color stable, nonfading, alkali resistant, and color required to match approved samples.
8. Fine aggregate: ASTM C33, not to exceed 40% by volume of the total aggregate.
9. Lightweight Aggregates: ASTM C330/C330M-14 – Standard Specification for Lightweight Aggregates for Structural Concrete.
10. Air-Entraining Admixture: ASTM C260/C260M-10a – Standard Specification for Air-Entraining Admixtures for Concrete, certified by manufacturer to be compatible with other required admixtures.
11. Water-Reducing Admixture: ASTM C494/C494M-13 – Standard Specification for Chemical Admixtures for Concrete, Type A.
12. Mix Design:
  - a. Prepare design mixes for each type of concrete required.
  - b. Design mixes may be prepared by a qualified independent testing agency or by qualified precast plant personnel at precast architectural concrete fabricator's option.
  - c. Limit water-soluble chloride ions to the maximum percentage by weight of cement permitted by ACI 318-11 (ACI 318M-11).
  - d. Normal-Weight Concrete Face and Back-Up Mixes: Proportion mixes by either laboratory trial batch or field test data methods according to ACI 211.1-91, with materials to be used on Project, to provide normal-weight concrete with the following properties:
    - (1) Compressive Strength (twenty-eight days): 5,000 psi.
    - (2) Maximum Water-Cementitious Materials Ratio: 0.45.
  - e. Water Absorption: ASTM C 1195.
    - (1) Cold Water: 6% maximum after twenty-eight days.
    - (2) Boiling Water: 10% maximum at twenty-eight days.
  - f. Freeze Resistance: ASTM C666, as modified in ASTM C1364, cumulative percent mass loss (CPML) less than 5% after 300 cycles.
  - g. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117. Air entrain to 3.5% to 4.5% complying with ASTM C260; total air content not to exceed 5%.
  - h. When included in design mixes, add other admixtures to concrete mixes according to manufacturer's written instructions. Water-reducing, retarding, or accelerating admixtures shall not be used without specific Architect approval; if approved for use, admixtures must comply with ASTM C494 and contain not more than 0.1% chloride ions.

- i. Prohibited Products: Do not use calcium chloride, or separators or curing compounds, that could interfere with the bond between concrete and mortar or coating.
- 13. Finish: Finished faces shall be free from voids, chips, stains, or other imperfections that detract from the appearance of the unit when viewed from a distance of 10 ft.
- 14. Wet cure for a minimum of 24 hrs after removal from form.
  - a. After wet curing, store the units in well vented areas at a temperature of not less than 50°F for not less than 48 hrs. Storage and transportation to be protected against damage or staining.
  - b. For patching and filling, comply with ACI 301, Chapter 9.
    - (1) Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free that will provide continuous and true precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.
    - (2) Mold-Release Agent: Commercially produced liquid-release agent that will not bond with, stain, or adversely affect precast concrete surfaced and will not impair subsequent surface or joint treatments of precast concrete.

J. Anchors for Setting Precast Concrete Elements:

- 1. Anchors: Sized as required per stone anchorage calculations. Minimum 1/8 in., ASTM A153, Type 304 stainless steel anchor, split-tail kerf anchor, plate with pins on both sides, or dowels to match existing anchor system and of grade suitable for application as required per the delegated design.
  - a. Precast Accessories: Provide clips, hangers, plastic or steel shims, and other accessories required to install architectural precast concrete units.
  - b. Fasteners: As required per the delegated design.
- 2. Sealant: Provide sealant in each stone anchor hole as described in Section 079000.

K. Insulation:

- 1. Mineral wool insulation, minimum R value of 4/in. of thickness, 2.5 in. thick, when tested in accordance with ASTM C518.
- 2. Aerogel insulation, 0.20 in. (5 mm) thick, minimum R-10.3/in., SpaceLoft by Aspen Aerogel or approved equal.

## 2.2 MASONRY CLEANING MATERIALS

- A. Water: Clean, potable, nonstaining, and free of oils, acids, alkalis, and organic matter.
- B. Water-Spray Apparatus: Pumps, backflow preventions, and misting unit capable of applying a constant spray rate set between 0.4 and 0.8 gal/sq ft/min.
- C. Pressure-Wash Unit: Unit capable of delivering water at a pressure between 100 psi and 400 psi; with a flow rate of 4 gal/min. Use 45° fan tip.
- D. Application Brushes: For acid-based cleaners, use soft natural fiber (Tampico) or masonry brushes only. For other cleaners, use natural fiber or nylon brushes only. Do not use metal wire brushes on masonry.
- E. Chemical Cleaners – General Cleaning:
  - 1. Efflorescence Staining:
    - a. HT-626 by Hydroclean.
    - b. 101G Granite, Terra Cotta, and Brick Cleaner by Diedrich Technologies.
    - c. SureKlean Light Duty Restoration Cleaner by Prosoco.
  - 2. General Mortar Cleaning:
    - a. Water with a stiff bristle brush.
    - b. HT-455 by Hydroclean.
    - c. SureKlean Vana Trol by Prosoco.
    - d. 101G Granite, Terra Cotta, and Brick Cleaner by Diedrich Technologies.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify all site conditions and dimensions by field measurements in consideration of the special conditions associated with alterations of existing construction and reconstruction. Notify the Engineer immediately of any inconsistency between field conditions found during demolition and those shown in the Contract Drawings. The Engineer will determine what modifications or additional repairs are necessary.
- B. Inspect all granite veneer (new and existing) and precast concrete pieces. All granite shall be ASTM C615 Building Grade, free from cracks, seams or spalls, which will affect its visual appearance or structural integrity. All precast concrete shall meet ASTM C1364, and should be free from cracks and spalls. All granite veneer shall have minimum thickness of 4 in; dispose of existing stone with



thickness less than 4 in. or dress stone so that thickness is greater than 4 in. Notify the Engineer immediately of substandard material found during demolition or prior to installation. The Engineer will determine what modifications or additional repairs are necessary.

- C. Inspect existing waterproofing and flashing to remain in place as shown in the Drawings, particularly at below- and at-grade areas. Repair holes, tears and other deficiencies in the waterproofing and flashing as determined by the Engineer.

### 3.2 GENERAL MASONRY WORKMANSHIP

- A. Masonry workmanship shall comply with all applicable recommendations of the Brick Institute of America, the Indiana Limestone Institute of America and Specifications for Masonry Structures ACI 530, except as modified below. Do not proceed with masonry installation until all associated flashings are installed. Report any damage to flashing work within the work area to the Engineer and provide for repairs by appropriately skilled mechanics.
- B. Masonry construction should match the existing masonry construction, including profiles and colors. Any unspecified variances from the existing construction will be cause for rejection.
- C. Conduct all masonry work in a neat and workmanlike manner, to prevent staining any surface with mortar or other spills. Keep all exposed surfaces of the masonry free from mortar at all times. Avoid dropping mortar on completed masonry work or other elements of the building. If mortar drops or spills, spot-clean immediately using a clean sponge and clean water, before mortar can set.
- D. Hot Weather:
  - 1. Above 80°F: Protect the masonry and mortar from direct sunlight and exposure to wind to avoid rapid evaporation of water in the mortar before, during, and after masonry construction.
  - 2. Above 90°F: Do not use mortar when masonry surface temperature is above 90°F. Protect the masonry and mortar from direct sunlight and exposure to wind to avoid rapid evaporation of water in the mortar before, during, and after masonry construction.
- E. Cold Weather (below 40°F): Do not work in average daily temperatures below 40°F without providing cold weather protection as described in ACI 530 and outlined in the table below. Continue to operate heaters overnight with appropriate supervision. Do not use heaters that produce oily deposits on the masonry. If any oily deposits occur, consult with the Engineer to determine how best to remove oily deposits, and remove at the Contractor's expense.

| Temp. | WORK IN PROGRESS | COMPLETED WORK |
|-------|------------------|----------------|
|-------|------------------|----------------|

|              | <b>Brick</b>                            | <b>Mortar</b>   | <b>Assemblage</b>  | <b>Assemblage</b>  |
|--------------|---|---|--|--|
| Above 40°F   | No Requirements                         | No Requirements   | No Requirements  | No Requirements  |
| 40°F to 25°F | Remove visible ice.                     | Heat during mixing to between 40°F and 120°F. Maintain above freezing while in use. | No Requirements.   | Protect masonry with a weather-resistive cover for 24 hrs after construction. Completely cover masonry when temp. is less than 32°F. |
| 25°F to 20°F | Remove visible ice.                     | Heat during mixing to between 40°F and 120°F. Maintain above freezing while in use. | Use heat sources on both sides of wall. Install wind breaks when velocity is over 15 mph.    | Completely cover with insulated blanket for 24 hrs after construction.   |
| Below 20°F   | Heat to above 20°F; remove visible ice. | Heat during mixing to between 40°F and 120°F. Maintain above freezing while in use. | Provide an enclosure and use heat sources to maintain temp. above 32°F within the enclosure. | Provide an enclosure and use heat sources to maintain temp. above 32°F within the enclosure.   |

- F. Mix mortar using sufficient quantity of water to ensure good workability in accordance with BIA recommendations. For each batch, measure cement and lime by volume or equivalent weight. Measure material with an approved device. Measure sand by weight or in calibrated containers, with allowance made for moisture content, bulking, and consolidation. Do not use shovel measurements. Mix by machine only for at least 3 min., but not more than 5 min. Use mortar within 2 hrs of mixing at temperatures over 74°F, and 2-1/2 hrs at temperatures between 50°F and 74°F. Discard hardening mortar.
- G. Cut masonry with a motor driven saw to obtain true, even, and undamaged edges. Do not use overburned or oil or grease-marked masonry. Do not use masonry units with cracks or splits in any face, or with chips extending more than 1/8 in. from edges or 1/4 in. from corners. Do not break masonry with mason's hammer.
- H. Lay all masonry plumb and true, with uniform and level joints. Lay out all face coursing in accordance with approved Shop Drawings. Work from scaffold at heights most conducive to best workmanship. Coursing and patterns to match existing work without exception. Produce a consistent clear cavity in a width shown on the drawings, except where the cavity is adjusted to accommodate structural frame and stone irregularities. The stone shall bear on shelf angles at least 2/3 of the stone width (depth).

- I. Lay the stone masonry following the original coursing and pattern and within the tolerances defined below:
  - 1. External corners and other conspicuous lines and levels: Maximum deviation from plumb or level  $\pm 1/4$  in. in any 10-ft section with a maximum cumulative amount of  $3/8$  in. in any one direction beyond 10 ft.
  - 2. Mortar joint thickness: Maintain joint widths as existing veneer except to minor variations required to maintain bond alignment.
- J. Lay all masonry dry, unless given written permission by the Engineer to wet the stone. At connections to existing masonry and to new masonry previously laid, wet the existing masonry surfaces with clean water before laying new masonry. Avoid standing water on masonry surfaces.
- K. Do not lay bed mortar more than 2 ft ahead of work. Do not furrow the mortar in the bed joint to a depth that results in voids when the units are in their final position. Vary mortar joint thickness to compensate for building dimensions or masonry unit size, but do not exceed the joint thickness tolerances specified above.
- L. Fill all joints solidly with mortar. Completely butter the faces of the masonry units and place them so that mortar squeezes out of the top and sides of the joints requiring mortar to produce well compacted joints of full width, front to back. Do not slush head joints. Do not furrow bed joints. Strike off excess mortar flush with the newly laid unit. Adjust the final position of each masonry unit while the mortar is plastic. To adjust the position of the masonry unit after the mortar has stiffened, remove the unit, replace stiffened mortar with plastic mortar, and replace the unit. At closure units, butter all surfaces of the unit to be placed, as well as the abutting surfaces of the existing unit.
- M. Slightly bevel bed joint mortar away from the cavity space before placing the unit to minimize mortar protrusions into any cavity space intended to be free of mortar. "Roll" unit into place, to reduce amount of mortar oozing from bed joint into cavity. Back parge or strike mortar extrusions in the cavity space and scoop up excess mortar with trowel or parge across inner face to prevent mortar from falling into cavity. Do not obstruct or reduce cavities by mortar protrusions or drippings; clean mortar at openings as necessary prior to the mortar hardening. Keep mortar from lying on ties in the cavity.
  - 1. Leave every third stone out in the course immediately above through-wall flashing, to allow thorough cleaning of the bottom of the cavity. When cavity is cleaned and checked, fill in stone, but leave out one head joint and insert weep holes recessed from face of the stone by approx.  $1/2$  in.
- N. Strike exterior mortar joints flush during laying. When mortar is thumbprint hard on exposed surfaces, tool joints concave with a cylindrical pointing tool slightly larger than the mortar joint to compact the mortar thoroughly. Size tool to form concave joints to match the existing masonry.

- O. Do not stain stone face or any surface with mortar drippings or other substances. Dry-brush newly completed masonry and exposed flashing surfaces daily to clean and remove mortar before it can set.
- P. Protect uncompleted masonry walls, whenever work is not being performed, by well-fastened waterproof coverings. Protect flashings against any penetration or other damage. Turn scaffold boards on edge at end of day and protect base of wall to prevent rain splashed mud or mortar drippings from contacting masonry.

### 3.3 MASONRY REMOVAL, STORAGE AND PREPARATION FOR REINSTALLATION

- A. Before the start of any removal work, locate embedded metal pins with a metal detector or other suitable instruments. Sequence the removal to avoid cracking the stone where pins occur.
- B. Cut mortar around stone with a motorized saw to avoid damaging the edges of the stone. Do not overcut into adjacent materials. Carefully remove existing stones indicated on the Drawings to prevent damage or breakage.
- C. Number each piece as it is removed, using the system submitted and approved with the elevation drawings submitted. Mark numbers on the back (unexposed) face of each piece, using a waterproof marker; do not mark any exposed faces with permanent marker.
- D. Remove mortar from the existing masonry to remain or be reinstalled to the greatest extent possible without damaging stone or precast concrete. Use hand tools, mechanical grinder, and power-washing, as appropriate and as not to damage stone; final procedures to be determined in mockup. Repair or replace stone pieces damaged during the removal as directed by the Engineer.
- E. Store removed stone pieces. Take adequate precautions to prevent theft, breakage, chippage, or scratching. Do not overload underlying pieces; neatly stack pieces to prevent collapse of stacks and to prevent overloading of scaffolding or structure.
- F. Cut and trim backs of existing stone to be reinstalled as noted using skilled workmen in a neat and uniform manner. Saw cut or roughly dress backs of stones; acceptable to provide successive adjacent cuts to a uniform depth and chisel stone away. Provide stone cut within 1/4 in. of a uniform, true plane.
  - 1. Bed and head joints shall be at right angles to the face.
- G. Provide holes and other cutouts to accommodate the stone anchors that will not impair the strength or the appearance of the stone and will provide for the full concealment of all anchors in the finished work. Execute cutting of holes and notches through the stone work using proper templates, verified field dimensions, and the approved Shop Drawings.

- H. Clean removed stones and architectural precast concrete pieces prior to reinstallation following procedures in Para. 3.8

### 3.4 MASONRY VENEER INSTALLATION

- A. Set granite in mortar bed in random ashlar pattern in accordance with the Shop Drawings. At exterior corners, interlace courses (set masonry in running bond) between intersecting walls.
- B. At all flashing, set masonry on a mortar bed; do not set stone directly on flashings. Provide solid mortar on both sides of flashing end dams that turn up into head joints. Provide specified weep holes within 12 in. to 16 in. of flashing end dams.
- C. Leave out one head joint max. 24 in. o.c. immediately above the horizontal leg of all levels of flashing and place a weep vent in the slot. Install weep vent in the collar joint level with the bottom of the last laid stone. Prevent mortar from falling into the open collar joint below.
- D. After installation of wall waterproofing is completed and approved by the Engineer, install adjustable anchor system fastened to metal stud backup wall. Install anchors in accordance with the manufacturer's current recommendations, except as modified herein.
  - 1. Install veneer anchor plates every 16 in. vertically and 16 in. horizontally. Ensure fastener for anchor plate is fully engaged to the backup wall. At building corners and to each side of structural steel framing, install back plate into nearest metal stud or steel column. The maximum distance from the building corner to the first anchor is 8 in. Install back plates such that each anchor plate is supporting a maximum area of 2.67 sq ft.
  - 2. After installation of rigid insulation between back plates, thread the J-hook through the "Flexible Vee Tie" wire anchors and install the "J-Hook" through anchor plate openings. Ensure the J-hook bar is threaded through two anchor plates and the bar extends minimum. 2 in. past bottom plate.
  - 3. Place "Flexible Vee Tie" veneer anchors in a bed of mortar and cover with mortar; direct stone-to-anchor contact is not permitted. Position veneer anchors to lay flat on the mortar bed and terminate minimum 5/8 in. (BIA Bulletin 44B, Fig. 7) from the outside face of the bed joint. Front edge of anchor must lie within middle one-third of stone. Lateral free movement of the anchor should be limited to less than 0.05 in.
  - 4. Install one anchor in the first course above all metal flashings.
  - 5. The "Flexible Vee Tie" maximum vertical spacing between ties shall be 24 in. o.c. Therefore, the maximum vertical dimension of a stone is 24 in.
- E. Below the at-grade precast window surrounds and metal flashing line, masonry ties may be installed for the granite veneer in lieu of the adjustable anchor system. Provide 1 anchor per 16 in. horizontally. Do not install anchor in same bed joint as metal flashing. Where mortar joint alignment does not allow

installation of masonry tie in bed joint (due to height of stone and flashing), install anchor in head joint between stones to satisfy the maximum 16 in. spacing.

- F. Clean down all masonry promptly after curing by wetting surfaces and washing with a stiff-bristle brush to produce a clean and unmarred appearance. Begin cleaning with water only, without chemical cleaners. If water alone with a scrub brush is not successful, as determined by the Engineer, use an approved cleaning compound. Dilute the compound with the maximum amount of water that will allow proper cleaning, as approved by the Engineer. Test the cleaning compound in a small inconspicuous area before beginning full-scale cleaning. Cover all existing exposed metal, precast concrete, glazing, and other areas as required before cleaning the masonry with any cleaning compounds. Remove efflorescence, if any, as directed by the Engineer. Do not use metal scrapers to clean the masonry. Rinse repeatedly with clean water after cleaning to remove all traces of mortar and debris. Protect all exterior finishes from any damage or staining caused by this work.

### 3.5 ARCHITECTURAL PRECAST CONCRETE FABRICATION

- A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.
- B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing architectural precast concrete units to supporting and adjacent construction.
- C. Cast-in reglets, slots, holes, and other accessories in architectural precast concrete units as indicated on the Shop Drawings.
- D. Reinforcement: Comply with recommendations in PCI MNL 117 for fabricating, placing, and supporting reinforcement.
  - 1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcing exceeds limits specified in ASTM A775/A775M, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
  - 2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
  - 3. Place reinforcement to maintain at least 3/4 in. minimum coverage. Arrange, space, and securely tie bars and bar supports to hold

- reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
4. Place reinforcing steel and prestressing strand to maintain at least 3/4 in. minimum concrete cover. Increase cover requirements for reinforcing steel to 1-1/2 in. when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
  5. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.
- E. Reinforce architectural precast concrete units to resist handling, transportation, and erection stresses.
  - F. Comply with requirements in PCI MNL 117 and requirements in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.
  - G. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units.
  - H. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air on surfaces. Use equipment and procedures complying with PCI MNL 117.
  - I. Comply with for hot- and cold-weather concrete placement.
  - J. Identify pickup points of architectural precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each architectural precast concrete unit on a surface that will not show in finished structure.
  - K. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.
  - L. Discard and replace architectural precast concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 117 and Architect's approval.
  - M. Finishes:
    1. Panel faces shall be free of joint marks, grain, and other obvious defects. Corners, including false joints shall be uniform, straight, and sharp. Finish exposed-face surfaces of architectural precast concrete units to match approved sample panels and mockups and as follows:

- a. As-Cast Surface Finish: Provide surfaces free of pockets, sand streaks, and honeycombs.
2. Finish exposed top, bottom, and back surfaces of architectural precast concrete units to match face-surface finish.
3. Finish unexposed surfaces of architectural precast concrete units by float finish.

### 3.6 INSULATION INSTALLATION

- A. Install full sheets of insulation boards between back plates. Stagger joints in insulation boards.
- B. If needed to hold insulation boards in place, install adhesive behind insulation board. Apply adhesive to back of insulation board in vertical ribbons.
- C. Install smaller pieces of insulation board at gaps between larger sections (i.e., between the veneer anchor system back plate and bottom of precast concrete water table) so that insulation board is continuous over the waterproofing.

### 3.7 MASONRY CLEANING

#### A. Preparation

1. Provide all necessary enclosures, barricades, etc., to protect building surfaces, building occupants, etc. Provide ventilation equipment to control odor as necessary.
2. Surface Preparation:
  - a. Preliminary clean surface by dusting and vacuuming areas to be cleaned.
  - b. Remove built-up material from stone surface with plastic scraper and/or stiff natural or synthetic fiber bristle brush. Vacuum or dust surface after. Do not use metal scrapers or brushes.
3. Ensure that building components not to be cleaned, adjacent persons, property, and plant life are protected from all cleaning activities and wind drift. Test adjacent non-masonry materials for reaction with cleaning materials. Cover the lower windows, doors, wood surfaces, metal surfaces, painted surfaces and all non-masonry materials with tape and waterproof plastic during application and cleaning of the stone to protect it from runoff. Test the tape and plastic first before application to make sure the materials are not affected by the cleaning materials.

#### B. General Cleaning Procedures



1. The level of cleanliness will be determined by the Engineer during the mockup phase. The goal of the Project is to achieve a consistent level of clean.
2. Clean the existing masonry using procedures approved during the mockup cleaning. All cleaning methods must be mocked up or tested prior to selecting final procedures. The least-aggressive methods should be utilized to achieve the desired level of cleanliness.
3. Follow manufacturer's recommendations unless directed otherwise by Engineer.
4. Test the stone surface pH upon completion of the surface preparation. Retest the surface upon completion of cleaning.
5. Contain and dispose of cleaning materials daily as recommended by the manufacturer of cleaning product and regulating authorities.
6. Examine all surfaces scheduled for cleaning, for roughness, contaminants, unsound structural substrates, or other conditions that may impair the application. Notify the Engineer in writing of any such conditions; do not continue work until directed by Engineer on how to proceed
7. When cleaning stone in situ, start work at the top of the building.
8. Final General Cleaning for Mortar:
  - a. After mortar has fully hardened, thoroughly clean exposed stone surfaces of excess mortar and foreign matter using stiff nylon or natural bristle brushes and clean water, spray-applied at low pressure (less than 500 psi).
  - b. Do not use metal scrapers or brushes.
  - c. Do not use acid or alkali cleaning agents.
  - d. If cleaning does not successfully clean surface to achieve level of clean prior to pointing, consult with Architect on use of a nonionic, neutral liquid detergent (synthetic organic compound with a neutral pH between 5.5 and 8.5 at dilution). Approval of use of detergent on a case-by-case basis.
9. Chemical Cleaning: This method is only to be used when the stones are off the building, or during final general cleaning if water with a stiff bristle brush is found to be inadequate; use must be approved by Engineer on a case-by-case basis.
  - a. Clean masonry surfaces using the manufacturer's current printed specifications as modified herein. Consult with Engineer on procedure before beginning. Test small area first.
  - b. Brush loose debris and dust off stone surfaces.
  - c. Pre-rinse the stone with water before applying cleaners.
  - d. Dilute cleaner per manufacturer's instructions and as determined in mockups.

- e. Apply cleaning material and agitate the surface with a stiff bristle brush. Dwell times to follow manufacturer recommendations and as determined in mockups.
  - f. Apply cleaning materials with Tampico brushes only; do not use sprayers. Work on areas approximately 5 ft by 5 ft in size, or as dictated by the contours of the building, at one time.
  - g. Rinse stone with a 400 psi to 800 psi using 4 gal/min. Making sure stone remains wet.
  - h. Repeat if required to achieve the desired results as determined by the Owner and Engineer.
10. Remove necessary masking materials, including any residue or markings left by tape, following completion of cleaning operations. Dispose of hazardous materials offsite. Clean all windows and non-masonry areas free of masking materials.

END OF SECTION

**SECTION 04 20 00**  
**CONCRETE UNIT MASONRY**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. General Notes, Sections, Plans, Typical Details, and other notes indicated on the structural drawings. In cases of conflict, information indicated on the structural drawings shall govern.
- C. Statement of Special Inspections

**1.2 WORK INCLUDED**

- A. Standard concrete masonry.
- B. Reinforcement, grout, anchorage, and accessories.

**1.3 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION**

- A. Section 051200 – Structural Steel: Placement of steel anchors and bearing pads.
- B. Section 055000 – Metal Fabrications: Placement of loose steel lintels and other metal fabrications.
- C. Section 081119 – Standard Steel Doors and Frames: Placement and grouting of frames.

**1.4 RELATED SECTIONS**

- A. Section 079000 – Joint Sealers: Rod and sealant at control and expansion joints.
- B. Section 018113 EGC Sustainable Building Requirements; Criterion 6.3 & 6.4

**1.5 REFERENCES**

- A. ANSI/ASTM A82 – Cold-Drawn Steel Wire for Concrete Reinforcement.
- B. ANSI/ASTM C55 – Concrete Building Brick.
- C. ASTM A123 – Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- D. ASTM A525 – Steel Sheet, Zinc Coated, (Galvanized) by the Hot-Dip Process.
- E. ASTM A615 – Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
- F. ASTM C90 – Hollow Load Bearing Concrete Masonry Units.
- G. IMIAC – International Masonry Industry All-Weather Council: Recommended Practices and Guide Specification for Cold Weather Masonry Construction.
- H. UL – Underwriters’ Laboratories.

#### 1.6 SUBMITTALS

- A. Submit product data under provisions of Section 01340
- B. Submit product data for masonry units and fabricated wire reinforcement.

#### 1.7 QUALIFICATIONS

- A. Installer: Company specializing in performing the work of this Section with minimum five years documented experience.

#### 1.8 REGULATORY REQUIREMENTS

- A. Conform to UL Assembly No. requirements for fire rated masonry construction.

#### 1.9 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and protect products under provisions of Section 01600.
- B. Inspect units at job site before accepting.

#### 1.10 ENVIRONMENTAL REQUIREMENTS

- A. Maintain materials and surrounding air temperature to minimum 50° degrees F prior to, during, and 48 hours after completion of masonry work...or...comply with Cold Weather Requirements: IMIAC – Recommended Practices and Specifications for Cold Weather Masonry Construction.

## PART 2 - PRODUCTS

### 2.1 CONCRETE MASONRY UNITS

- A. Hollow Load Bearing Block Units: ASTM C90, Grade N, Type I-Moisture Controlled: normal weight.
  - 1. Provide two core or three core blocks for vertical reinforcement where shown on Structural Drawings. Provide standard bond beam units where shown.
  - 2. Typical Masonry Units: Nominal modular size of 8" high x 16" long x thickness shown. Provide special units for 90° degree corners, bond beams, and lintels.
  - 3. Fire Rated Units: Controlled thickness/density units produced by manufacturer listed in Underwriters' Laboratories Building Materials Directory for the fire rating shown or required.
- B. Concrete Brick Units: ANSI/ASTM C55, Grade N, Type I – Moisture Controlled; normal weight.

### 2.2 REINFORCEMENT AND ANCHORAGE

- A. Single Wythe Joint Reinforcement: Truss type at concrete block units; hot dip galvanized to ASTM A123 G90 finish at 2.0 oz/sf after fabrication, cold-drawn steel conforming to ANSI/ASTM A82, 3/16 inch side rods with 9 ga. cross ties.
- B. Multiple Wythe Joint Reinforcement: Truss type: with moisture drip; hot dip galvanized to ASTM A123 G90 finish at 2.0 oz/sf after fabrication, cold-drawn steel conforming to ANSI/ASTM A82, 9 ga. side rods with 9 ga. cross ties.
- C. Reinforcing Steel: ASTM A615, 60 ksi yield grade, deformed billet bars, unprotected finish.
- D. Strap Anchors: "Z" bent steel shape, 1-1/4 x 12 inch size ¼ inch thick, 3 inch legs, unprotected finish.

- E. Dovetail Anchors: Bent Steel Strap. 1 x 3/16 inch thick x length required, galvanized to ASTM A123 G90 finish at 2.0 oz/sf.

### 2.3 FLASHINGS

- A. Flashing: ASTM B370, cold rolled; soft temper; 16 oz/sq ft. lead coated copper. (Furnished by others.)

### 2.4 ACCESSORIES

- A. Inner Wythe Dampproofing: Per Section 07160
- B. Nailing Strips: Softwood, pressure preservative treated for moisture resistance to AWWA Treatment CZ, dovetail shape, sized to masonry joints.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Verify items provided by other sections of work are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.
- D. Beginning of installation means installer accepts existing conditions.

### 3.2 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied to other sections.
- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

### 3.3 COURSING

- A. Establish lines, levels and coursing indicated. Protect from displacement.
- B. Lay concrete masonry units in running bond, unless shown otherwise.

- C. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

#### 3.4 PLACING AND BONDING

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Lay hollow masonry units with face shell bedding on head and bed joints.
- C. Where joints are reinforced, bedding shall include cross webs.
- D. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
- E. Remove excess mortar as Work progresses.
- F. Interlock intersections and external corners unless shown otherwise.
- G. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustments must be made, remove mortar and replace.
- H. Perform jobsite cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- I. Cut mortar joints flush where bitumen dampproofing is applied.
- J. Isolate masonry partitions from vertical structural framing members with control joint, where indicated.

#### 3.5 REINFORCEMENT AND ANCHORAGES – SINGLE WYTHE MASONRY

- A. Install horizontal joint reinforcement 16 inches o.c.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings (where applicable). Extend minimum 16 inches each side of opening.
- C. Place joint reinforcement continuous in first and second joint below top of walls (where applicable).
- D. Place joint reinforcement in every joint of parapets and in every joint of stacked bond coursing.

- E. In cavity walls, reinforcement of parapets and stacked bond coursing shall be 2 inches less in width than total wall thickness.
- F. Lap joint reinforcement ends a minimum of 6 inches. See Structural Drawings for special reinforcement details.

### 3.6 MASONRY FLASHINGS

- A. Extend flashings through veneer, turn up minimum 8 inches and bed into mortar joint of masonry, reglet in concrete, or seal to sheathing over framed back-up.
- B. Lap end joints a minimum of 6 inches and seal watertight.

### 3.7 LINTELS

- A. Install loose steel or precast concrete lintels over openings, where detailed or required.
- B. Install reinforced unit masonry lintels over openings where indicated on Structural Drawings. Use lintel depth as specified on structural drawings.
- C. See structural drawing for lintel sizes.
- D. Add shear reinforcement as shown on Structural Drawings.
- E. Use single Piece reinforcing bars only.
- F. Support and secure reinforcing bars from displacement. Maintain position within ½ inch of dimensioned position.
- G. Place and consolidate grout fill without displacing reinforcing.
- H. Allow masonry lintels to attain specified strength before removing temporary supports.
- I. Maintain minimum 8 inch bearing on each side of opening.

### 3.8 ONE UNIT GROUTED COMPONENTS

- A. Reinforce bond beam with bars of size and placement as shown on Structural Drawings.
- B. Lap splices minimum 48 bar diameters or 24" minimum, unless shown otherwise.



- C. Support and secure reinforcing bars from displacement. Maintain position with ½ inch of dimensioned position.
- D. Place and consolidate grout fill without displacing reinforcing.
- E. At bearing locations, fill masonry cores with grout for a minimum of 12 inches on either side of opening.

### 3.9 ENGINEERED MASONRY

- A. Lay masonry units with core cells vertically aligned, clear of mortar, and unobstructed.
- B. Place mortar in masonry unit bed joints back ¼ inch from edge of unit grout spaces, bevel back and upward. Permit mortar to cure 7 days before placing grout.
- C. Reinforce masonry unit cores with reinforcement bars and grout as indicated.
- D. Retain vertical reinforcement in position at top and bottom of cells, and at intervals not exceeding 192 bar diameters. Splice reinforcement 48 bar diameters or 24" minimum, unless shown otherwise.
- E. Wet masonry unit surfaces in contact with grout just prior to grout placement.
- F. Grout spaces less than 3 inches in width with fine grout using low lift grouting techniques. Grout spaces 3 inches or greater in width with course grout, using high or low lift grouting techniques.
- G. When grouting is stopped for more than one hour, terminate grout 1-1/2 inches below top upper masonry unit, to form a positive key for subsequent grout placement.
- H. Low Lift Grouting: Place first of grout to a height of 16 inches and rod for grout consolidation. Place subsequent lifts in 8 inch increments and rod for grout consolidation.
- I. High lift grouting:
  - 1. Provide cleanout opening no less than 4 inches high at the bottom of each cell to be grouted, by cutting one face shell of masonry unit.

2. Clean out masonry cells with high pressure water spray. Permit complete water drainage.
3. Request the Inspector (under provisions of Section 01410), to inspect the cells. Allow 2 days advance notice of inspection.
4. After cleaning and cell inspection, seal openings with masonry units.
5. Pump grout into spaces. Maintain water content in grout to intended slump without aggregate segregation.
6. Limit grout lift to 48 inches and rod or vibrate for grout consolidation. Wait 30 to 60 minutes before placing next lift.

### 3.10 CONTROL AND EXPANSION JOINTS

- A. Do not continue horizontal joint reinforcement through control expansion joints.
- B. Form control joint with a sheet building paper bond breaker, fitted to one side of the hollow contour end block unit. Fill the resultant elliptical core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant...or...install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instruction.
- C. Size control joint in accordance with Section 07900 for sealant performance.
- D. Contractor may use preformed elastomeric "+" shaped joint locks with routed head masonry units, at his option.

### 3.11 BUILT-IN WORK

- A. As work progresses, build in metal door frames, fabricated metal frames, window frames, wood nailing strips, accessories, anchor bolts, bearing plates, and other items furnished by other sections.
- B. Build in items plumb and level.
- C. Bed anchors of metal door frames in adjacent mortar joints. Fill frame voids solid with grout. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.

- D. Do not build in organic materials subject to deterioration.

### 3.12 TOLERANCES

- A. Maximum Variation from Alignment of Columns:  $\frac{1}{4}$  inch.
- B. Maximum Variation from Unit to Adjacent Unit:  $\frac{1}{32}$  inch.
- C. Maximum Variation from Plane of Wall:  $\frac{1}{4}$  inch in 10 feet and  $\frac{1}{2}$  inch in 20 feet or more.
- D. Maximum Variation from Plumb:  $\frac{1}{4}$  inch per story, non-cumulative;  $\frac{1}{2}$  inch in two stories or more.
- E. Maximum Variation from Level Coursing:  $\frac{1}{8}$  inch in 3 feet and  $\frac{1}{4}$  inch in 10 feet;  $\frac{1}{2}$  inch in 30 feet.
- F. Maximum Variation of Joint Thickness:  $\frac{1}{8}$  inch in 3 feet.
- G. Maximum Variation from Cross Sectional Thickness of Walls:  $\frac{1}{4}$  inch.

### 3.13 CUTTING AND FITTING

- A. Cut and fit for chases, pipes, conduits, sleeves, grounds and other items furnished by other trades requiring them. Coordinate with other trades to provide correct size, shape, and location.
- B. Obtain Architect approval prior to cutting or fitting masonry work not indicated, or where appearance of strength of masonry work may be impaired.

### 3.14 CLEANING

- A. Clean work under provisions of Section 01700.
- B. Remove excess mortar and mortar smears.
- C. Replace defective mortar. Match adjacent work.
- D. Clean Soiled surfaces with cleaning solution.
- E. Use non-metallic tools in cleaning operations.

### 3.15 PROTECTION OF FINISHED WORK

- A. Protect finished installation under provisions of Section 01500

- B. Without damaging completed work, provide protective boards at exposed external corners which may be damaged by construction activities.

END OF SECTION 042000

## **SECTION 04 43 00**

### **STONE MASONRY**

#### **PART 1 GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 General Requirements, apply to the work of this section.

##### **1.2 DESCRIPTION OF WORK**

- A. Extent of stonework is shown on drawings and specified herein. Work includes but is not limited to the following:

1. Stone stairs and landings at entry steps.
2. Stone veneer finish matching existing.
3. Stone flooring repair.
4. Transaction counter at High School vestibule.
5. All mortar, grout and sealant used in conjunction with handset stone work, as required to provide a watertight installation. Sealing all penetrations required for installation of stone support and attachment system.
6. Provide all reinforcing, struts, anchors, clips, bolts, nuts, shims, etc. as indicated or required to properly support, attach, align and secure all stone work under this section.

- B. Plans And Specifications

1. Architectural drawings are diagrammatic. The Architectural details shown are intended as a guide for the aesthetic and interfacing requirements of the various components to and with other work. The requirements shown by the details are intended to establish basic dimensions of the module and the sight lines, jointing and profiles of members. The Contractor is responsible for the execution of the system within these aesthetic parameters.
3. Minor deviations in dimensions and profiles may be considered provided they do not change the design concept or intended performance as judged by the Architect.
4. It is recognized that the architectural design details do not cover some conditions or modifications, which may be required. It is, however, intended that conditions not detailed shall be developed through the Contractor's shop drawings to the same level of aesthetics and in compliance with performance criteria as indicated for detailed areas and as stipulated in these specifications. The Contractor, by accepting a contract

for the work, acknowledges this and agrees that the Architect shall have the final say as to all matters whether detailed or not on the Architectural design details.

### 1.3 RELATED WORK

- A. Examine Contract Documents for requirements that affect Work of this Section. Other Specification Sections that directly relate to Work of this Section include, but are not limited to:
  - 1. Section 03 30 00, Cast-In-Place Concrete; Concrete backup.
  - 2. Section 04 22 00, Concrete Masonry Units; Concrete masonry unit backup.

### 1.4 QUALITY ASSURANCE

- A. Installer shall be a firm which has successfully installed stonework for comparable project for a period of not less than five years.
- B. Stone suppliers shall be single quarry able to adequately demonstrate to the Architect that it can supply the quantities and types of each stone which are required for the project.
  - 1. The right is reserved, at quarry or job site, to reject materials deemed by the Architect to be unsuitable. Such material shall be removed from the job site at the Contractor's expense.
  - 2. Stone from specified source shall display consistent color range and texture throughout work.
- C. Materials and installation shall meet requirements of latest published specifications and recommendations of the Indiana Limestone Institute.
- D. Allowable Tolerances for stone shall be as follows:
  - 1. Variation from Plumb: For lines and surfaces, do not exceed 1/4 in. in 10 ft. For external corners, expansion joints and other conspicuous lines, do not exceed 1/4 in. in 20 ft. maximum.
  - 2. Variation from Level: For grades shown for exposed conspicuous lines, do not exceed 1/4 in. in 20 ft. maximum, nor 3/4 in. in 40 ft. or more.
  - 3. Variation of Linear Line: For position shown, do not exceed 1/2 in. in 20 ft. maximum, nor 3/4 in. in 40 ft. or more.
  - 4. Variation in Cross-Sectional Dimensions: For thickness of stone faced walls, do not exceed minus 1/4 in., nor plus 1/2 in.

### 1.5 REFERENCES AND STANDARDS

- 1. ASTM A 153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

2. ASTM A 580 - Standard Specification for Stainless Steel Wire.
3. ASTM A 666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
4. ASTM C 91 - Standard Specification for Masonry Cement.
5. ASTM C 97 - Standard Specification for Absorption and Bulk Specific Gravity of Dimension Stone.
6. ASTM C 99 - Standard Specification for Modulus of Rupture of Dimension Stone.
7. ASTM C 144 - Aggregate for Masonry Mortar.
8. ASTM C 150 - Standard Specification for Portland Cement.
9. ASTM C 170 - Standard Specification for Compressive Strength of Dimension Stone.
10. ASTM C 207 - Standard Specification for Hydrated Lime for Masonry Purposes.
11. ASTM C 270 - Mortar for Unit Masonry.
12. ASTM C 616 - Standard Specification for Quartz-Based Dimension Stone.
13. ASTM C 780 - Preconstruction Evaluation of Mortar for Plain & Reinforced Masonry.
14. ACI 530/ASCE 5/TMS 402 - Building Code Requirements for Masonry Structures.
15. ACI 530.1/ASCE 6/TMS 602 - Specifications for Masonry Structures.
16. National Concrete Masonry Association TEK 8-2A for masonry cleaning.

## 1.6 SUBMITTALS

- A. Samples: Submit two sets of each type of stone samples to Architect for review as soon as possible after award of contract, representing sizes and shapes to be used on Project. Include in each set full range of color, finish, and texture to be expected in completed work. Retain samples during construction as standard for completed stonework.
- B. Product Data: Submit specifications and other data for each type of stonework required, including certification that each type complies with specified requirements. Include instructions for handling, storage, installation and protection of each type. Submit product data for stone anchors and accessories. Product data shall include manufacturer's certifications that mortar and sealant materials are non-staining.
- C. Stone Shop Drawings: to confirm fabricator's interpretation of the stone design conforms to the architectural intent, submit shop drawings for handset dimension stone, showing layout, dimensions, joint locations and widths, stone types and finishes relative to building lines. Include full plans and relationships with adjacent and adjoining work by others, supports, enlarged details of joints, finished ends and other decorative features. Show anchors and support back to the building frame or backup masonry wall system.

## 1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Protect stone during storage and construction against moisture, soiling, staining, and physical damage.
- B. Handle stone to prevent chipping, breakage, staining and other damage. Do not use pinch or wrecking bars without protecting edges of stone with wood or other rigid materials. Lift with wide-belt slings wherever possible; do not use wire rope or ropes containing tar or other substances which might cause staining. If required, use wood rollers and provide cushion at end of wood slides.
- C. Store stone on wood skids or pallets, covered with nonstaining, waterproof membrane. Place and stack skids and stones to distribute weight evenly and to prevent breakage or cracking of stones. Protect stored stone from weather with waterproof, nonstaining covers or enclosures, but allow air to circulate around stones.
- D. Protect mortar materials and stonework accessories from weather, moisture and contamination with earth and other foreign materials.

## PART 2 PRODUCTS

### 2.1 LIMESTONE

- A. Stone shall match existing in finish and color as acceptable to the Architect and as required to meet applicable historic restoration requirements. Material shall comply with applicable standards and recommendations of NBGQA and Indiana Limestone Institute Specifications.
  - 1. Density: 2250 kg/m<sup>3</sup>, 140 pcf
  - 2. Porosity: 10.1%
  - 3. Flexural Strength: 10.1Mpa, 1465 psi
  - 4. Compressive Strength: 53.8 Mpa, 7800 psi
- B. Provide stone of soundness (hardness and density), texture, graining, color, tone, matching the samples as selected by the Architect and subject to the Architect's acceptance. Stone shall be sound and free from defects which will impair strength, durability or appearance, and provided from a single quarry source to satisfy the total requirements of the project. Quarry and fabrication plant facilities shall be available for the Architect's inspection at any time.
- C. Nominal Exterior Dimension Stone thickness shall be as indicated on Drawings; increase thickness for strength or aesthetics as required. Also, increase thickness as required relative to span.
- D. The finish, range of texture uniformity, degree of graining, direction of grain drift



and the range of color and value of all material shall match or otherwise conform to the properties as evidenced in existing materials.

- E. Direction of grain drift, if applicable, shall run generally parallel on all finished surfaces or as so directed by the Architect in the final approved shop drawings.
- F. All stone shall be free from abnormally sized voids, seams, shakes, clay pockets, spalls, stains, starts and other defects which would impair the strength, durability and appearance of the work, as determined by the Architect and approved on project samples. For travertine and materials with similar characteristics, void size and frequency is to be determined by the Architect during the stone range approval process.
- G. The following minimum criteria for quality control for stone cracks should be maintained:
  - 1. Cracks greater than 0.002" in width and 0.125" in depth are not acceptable.
  - 2. Cracks less than 0.002" in width can be no longer than 4.0 inches.
- H. All quarry cracks, seams, fissures, veins and other natural cracks are to be prequalified by the Architect as healed, partially healed or open. Partially healed and open cracks are not acceptable, and should not be supplied to the project.
- I. All stone shall be selected for background color and veining. Marking and matching shall run in even shades and shall be set accordingly. Inherent variations characteristic of the stone and the quarry from which the stone is obtained shall have been brought to the attention of the Architect at time of stand-up slab review and shall be represented in the approved stone samples. These conditions shall be subject to Architect's approval.
- J. Match existing for color, finish, and other stone characteristics relating to aesthetic effects.

## 2.3 FABRICATION

- A. General: Fabricate stonework as shown and as detailed on final shop drawings and in compliance with recommendations of NBGQA and Indiana Limestone Institute Specifications, except as modified herein.
- B. Beds and Joints: Pieces shall be bedded and jointed as shown on the approved shop drawings, and bed joint and vertical joint surfaces shall be cut with 3/16 in. beds and joints, as indicated on the approved shop drawings, sawn or cut full square back from the face at least two-thirds of the piece thickness. From that point the bed may fall under square not more than 1 in.
- C. Holes, cut-outs, sinkages and openings in granite work for anchors, cramps, dowels, supports, and lifting devices, shall be accurately cut or drilled to

required dimensions, as shown on the approved shop drawings, and as necessary to secure granite in place to insure correct location and accurate fit of all fixtures. Setting beds shall be shaped to fit supports.

- D. Arrises shall be cut sharp and true to square, and continuous with adjoining arrises. Where exposed, arrises shall be eased.

#### 2.4 MORTAR

- A. Portland Cement: ASTM C 150-07, except complying with non-staining requirements of ASTM C 91-05 for not more than 0.03% water soluble alkali, when tested in conformance with ASTM C 114-07. Furnish Type I, except Type III may be used for setting stonework in cold weather. Obtain cement from single source.
- B. Hydrated Lime: ASTM C 207-06, Type S.
- C. Sand: ASTM C 144-04, except graded with 100% passing the No. 16 sieve for 1/4 in. and narrower joints.
- D. Latex additive for mortar shall be equal to "Laticrete 3701", manufactured by Laticrete International, Inc., Woodbridge, CT 06525.
- E. Water: Clear and free of deleterious materials which would impair the work.
- F. Setting Bed Mortar: Proportions of materials in setting bed mortar mix shall be one part Portland Cement, one part hydrated lime, and six parts clean, white sand.
- G. Pointing Mortar: Mortar for pointing shall be as specified for setting bed mortar. Mortar shall contain an integral color additive; a maximum of three mortar colors are required as selected by the Architect.
- H. Components of mortar mix, including coloring additives, shall be non-staining.

#### 2.4 STONEWORK ACCESSORIES

- A. Anchors and supports in contact with stone or embedded in stone joints shall be stainless steel as specified below. Expansion anchors and stone anchors shall be stainless steel. All other support steel shall be hot dip galvanized conforming to ASTM A 123 or A 153 as applicable.
- B. Dowels, Anchor Bolts, Nuts, Washers, and Shims: Fabricate from AISI Type 302/304 stainless steel.
- C. Stone Anchors: Type and size required to securely anchor and fasten stonework in place. Fabricate anchors and dowels from Type 302/304

stainless steel. Anchors shall be equal to Hohmann & Barnard Inc. (H&B) #406, 435, and 441, or approved equal.

- D. Provide concealed plastic setting buttons sized to maintain uniform joints.
- E. Furnished concealed AISI 302/304 stainless steel flashings, 2D finish, fully annealed or dead-soft temper, 0.012 in. thick, unless otherwise indicated.

## 2.5 JOINT FILLERS AND SEALANTS

- A. Sealant: Polyurethane base, Chem-Calk 550 (Woodmont Prod., Inc.) PRC 210 Sealant (Products Research & Chemical Corp.), Vulkem 45 (Tremco). Furnish and apply primers as recommended by manufacturer.
- B. Back-up Material: Compressible rod stock, Denver Foam, or type recommended by sealant manufacturer.
- C. Joint Fillers: Closed cell synthetic rubber joint filler, ASTM D 1056, Class SC-E, 2 to 5 psi compression, deflection Grade SCE41.
- D. Joint Caps: Provide preformed joint cap, malleable for forming to joint configurations.

## PART 3 EXECUTION

### 3.1 INSPECTION

- A. Examine conditions under which stonework is to be installed, and notify in writing of conditions detrimental to proper and timely completion of work. Do not proceed with the installation of stonework until unsatisfactory conditions have been corrected in acceptable manner.
- B. Do not use stone units with chips, cracks, voids, stains or other defects which might be visible in the finished work unless otherwise acceptable to the Architect.

### 3.2 PREPARATION

- A. Scrub stone with fiber brushes and drench with clear water. Use only mild cleaning compounds that contain no caustic or harsh fillers or abrasives.

### 3.3 INSTALLATION - GENERAL

- A. Set stone in accordance with Drawings and approved Submittals. Provide anchors, supports, fasteners and other attachments shown or necessary to secure stonework in place. Shim and adjust accessories for proper setting of

stone. Completely fill holes for anchors and dowels with mortar during setting of stone.

- B. Stone shall not be dropped upon or slid over masonry, nor shall hammering or turning of stones on the masonry be allowed. Stones shall be carefully set without jarring the stone already laid, and they shall be handled with a lewis or other appliance which will not cause disfigurement.
- C. No pinning up of stones with spalls will be permitted and no spalls will be permitted in beds.
- D. Joints shall be completely filled with mortar and shall then be raked out to one-third the depth of the stone. Raked joints shall be brushed clean, wetted thoroughly before applying fresh mortar, and pointed with mortar as directed by Architect.
  - 1. Joints shall be 3/8 in. wide and uniform unless otherwise indicated.
  - 2. Grout shall be uniform in appearance, texture and color.
  - 3. After initial set of grout, joints shall be tooled with rounded non-staining jointing tool to produce glassy, hardpolished, slightly concave joint.
  - 4. Completed joints shall be smooth and free of cracks.
- E. Mortar shall be mixed in batch machine mixer for at least two minutes for each batch. Mortar shall be used within fifteen minutes after mixing. No retempering will be permitted.
- F. Mortar used for filling vertical and inclined joints shall be of such consistency that it will require rodding. The mortar shall be rodded until it rises to the top and completely fills the joints.
- G. Coordinate setting of copings, sills and other trim closures with installation of flashing and waterproofing.

### 3.4 EXPANSION JOINTS

- A. Stone surfaces in contact with expansion joint material shall be made smooth unless otherwise shown on Drawings. Joint shall be filled with joint filler and sealed with an approved joint sealer as shown on Drawings, or as directed by the Architect.

### 3.5 POINTING

- A. Face joints shall be pointed with colored pointing mortar before mortar sets. Joints shall be prepared for pointing by raking them out to depth of one and one-half times the average width of joint. Face surfaces of stones shall not be smeared with mortar forced out of joints or that used in pointing.

- B. Joints not pointed when stone is laid shall be thoroughly wet with clean water and filled with mortar, driven into joints and finished with approved pointing tool. Wall shall be kept wet while pointing is being done. In hot or dry weather, pointed masonry shall be protected from sun and kept wet for three days after completion.
- C. After pointing is completed and mortar has set, exposed surfaces shall be cleaned of loose mortar and cement stains.

### 3.6 ADJUST AND CLEAN

- A. Remove and replace stone units that are broken, chipped, stained, or otherwise damaged. Where directed, remove and replace units that do not match adjoining stonework. Provide new matching units, install as specified, and point joints to eliminate evidence of replacement. Repoint defective and unsatisfactory joints as required to provide a neat, uniform appearance.
- B. Clean stonework no less than six days after completion of work, using clean water and stiff-bristle brushes. Do not use wire brushes, acid type cleaning agents, or other cleaning compounds containing caustic or harsh fillers.

END OF SECTION



## **SECTION 05 12 00**

### **STRUCTURAL STEEL**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. General Notes, Sections, Plans, Typical Details, and other notes indicated on the structural drawings. In cases of conflict, information indicated on the structural drawings shall govern.

##### **1.2 DEFINITIONS**

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

##### **1.3 PERFORMANCE REQUIREMENTS**

- A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand loads indicated and comply with other information and restrictions indicated.
  - 1. Select and complete connections using schematic details indicated and AISC's "Manual of Steel Construction"
  - 2. Engineering Responsibility: Fabricator's responsibilities include using a qualified professional engineer to prepare structural analysis data for structural-steel connections.

##### **1.4 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication of structural-steel components.
  - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
  - 2. Include embedment drawings.
  - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
  - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.

5. For structural-steel connections indicated to comply with design loads, include structural analysis data prepared by the qualified professional engineer responsible for their preparation.
- C. Welding certificates.
- D. Qualification Data: For Installer and fabricator.
- E. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:
  1. Structural steel including chemical and physical properties.
  2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
  3. Shop primers.
- F. Source quality-control test reports.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
- B. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category Sbd.
- C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."
- D. Comply with applicable provisions of the following specifications and documents:
  1. AISC's "Code of Standard Practice for Steel Buildings and Bridges."
  2. AISC's "Specification for Structural Steel Buildings."
  3. AISC's "Specification for the Design of Steel Hollow Structural Sections."
  4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.
  1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
  2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

#### 1.7 COORDINATION



- A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

## PART 2 - PRODUCTS

### 2.1 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: As noted on structural drawings.
- B. Channels, Angles, M, S-Shapes: As noted on structural drawings.
- C. Plate and Bar: As noted on structural drawings.
- D. Cold-Formed Hollow Structural Sections: As noted on structural drawings.
- E. Other: As noted on structural drawings.
- F. Welding Electrodes: Comply with AWS requirements.

### 2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: As indicated on structural drawings
  1. Nuts: ASTM A 563 heavy hex carbon-steel nuts;
  2. Plate Washers: ASTM A 36/A 36M carbon steel.
  3. Washers: ASTM F 436 hardened carbon steel.
- B. Headed Anchor Rods: As noted on structural drawings.
  1. Nuts: ASTM A 563 heavy hex carbon steel.
  2. Plate Washers: ASTM A 36/A 36M carbon steel.
  3. Washers: ASTM F 436 hardened carbon steel.

### 2.3 PRIMER

- A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.
- B. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20 ASTM A 780.

### 2.4 GROUT

- A. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404, Size No. 2. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

## 2.5 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings."
  - 1. Camber structural-steel members where indicated.
  - 2. Identify high-strength structural steel according to ASTM A 6/ A 6M and maintain markings until structural steel has been erected.
  - 3. Mark and match-mark materials for field assembly.
  - 4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
  - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.
- C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
  - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
  - 2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
  - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

## 2.6 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
  - 1. Joint Type: As indicated on structural drawings
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

## 2.7 SHOP PRIMING

- A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
  2. Surfaces to be field welded.
  3. Surfaces to receive sprayed fire-resistive materials.
  4. Galvanized surfaces.
- B. Painting: Apply a 1-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils.

## 2.8 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/ A 123M.
1. Fill vent holes and grind smooth after galvanizing.
  2. Galvanize lintels attached to structural-steel frame and located in exterior walls.

## 2.9 SOURCE QUALITY CONTROL

- A. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- C. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:
1. Liquid Penetrant Inspection: ASTM E 165.
  2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
  3. Ultrasonic Inspection: ASTM E 164.
  4. Radiographic Inspection: ASTM E 94.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

### 3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings."
- B. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
  - 1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
  - 2. Weld plate washers to top of base plate.
  - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.
  - 4. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
  - 1. Level and plumb individual members of structure.
- E. Do not use thermal cutting during erection.
- F. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

### 3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
  - 1. Joint Type: Snug tightened, unless noted otherwise on structural drawings.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
  - 1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

### 3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.
- B. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.
  - 1. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following inspection procedures, at testing agency's option:
    - a. Liquid Penetrant Inspection: ASTM E 165.
    - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
    - c. Ultrasonic Inspection: ASTM E 164.
    - d. Radiographic Inspection: ASTM E 94.
- D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

### 3.6 REPAIRS AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, bearing plates, and abutting structural steel.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
  2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
- C. Touchup Painting: Cleaning and touchup painting are specified in Division 9 painting Sections.

END OF SECTION 051200

## **SECTION 05 50 00**

### **METAL FABRICATIONS**

#### **PART 1 GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 General Requirements, apply to the work of this section.

##### **1.2 DESCRIPTION OF WORK**

- A. The work of this Section includes, but is not limited to:
  - 1. Railings at entry stairs.
  - 2. Miscellaneous brackets, bearing and leveling plates.

##### **1.3 QUALITY ASSURANCE**

- A. Engineering: Provide the services of a Professional Engineer, who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated, to design and certify that the work of this section meets or exceeds the performance requirements specified in this section.
- B. Shop fabricate work to the greatest extent possible. Clearly label pieces in shop to facilitate field assembly.
- C. Perform welding in compliance with American Welding Society Code. Shop weld and grind connections to the greatest extent possible.

##### **1.4 SUBMITTALS**

- A. Product Data: Submit manufacturer's product data, installation instructions, use limitations, and recommendations for each material used. Provide certifications stating that materials comply with requirements.
- B. Shop Drawings: Provide large scale shop drawings for fabrication, installation and erection of all parts of the work. Provide plans, elevations, and details of anchorages, connections and accessory items. Provide installation templates for work installed by others.
- C. Field Measurements: Take accurate field measurements before preparation of shop drawings and fabrication. Do not delay job progress; allow for field cutting

and fitting where taking field measurements before fabrication is not possible. Do not field cut or fit items which have been hot-dip galvanized after fabrication.

- D. Calculations: Provide professionally prepared calculations and certification of the performance of this work. Show how design load requirements and other performance criteria have been satisfied.
- E. Samples: Submit samples of all types of exposed welded connections, ground smooth, dressed, and primed for Architect's review and approval.

## 1.5 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Handrails:
    - a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
    - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.
  - 2. Top Rails of Guards:
    - a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction 50 lbf/ ft. (0.73 kN/m) applied horizontally and concurrently with 100 lbf/ ft. (1.46 kN/m) applied vertically downward.
    - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.
  - 3. Infill of Guards:
    - a. Concentrated load of 50 lbf (0.22 kN) 200 lbf (0.89 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).

## 1.6 DELIVERY, STORAGE AND HANDLING

- A. Store work off of the ground and under cover. Protect from damage. Maintain shop applied primer coatings until finish painting is complete. Sequence deliveries to avoid delays, but minimize on-site storage.

## 1.7 PROJECT CONDITIONS

- A. Do not permit use of stairs, ladders, handrails, guardrails or other work until work is completely and fully installed and ready to assume its intended design loads. Do not permit overloading of any miscellaneous metal system.



## PART 2 - PRODUCTS

### 2.1 MATERIALS AND PRODUCTS

- A. Steel Shapes: ASTM A36.
- B. Steel Tubing: ASTM A500, cold-formed.
- C. Steel Sheet: ASTM A1008, of grade required for design loading.
- D. Steel Pipe: ASTM A53, black schedule 40, unless indicated otherwise. Type and grade as required for design loading.
- E. Iron Castings: ASTM A47 or A48, grade and class are manufacturer's option.
- F. Grout: Pre-mixed, non-staining, non-corrosive, non-shrink, non-metallic complying with CE CRD-C588, type D.
- G. Bolts and Fasteners: ASTM A307 and other types as appropriate and approved by Architect.
- H. Comply with the latest edition of the following standards:
  - 1. AISI Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.
  - 2. AISC Code of Standard Practice for Steel Buildings and Bridges.
  - 3. AWS Code for Welding in Building Construction.
  - 4. Specifications for Structural Joints using ASTM A325-07a or A490-08a Bolts, Research Council on Riveted and Bolted Structural Joints of Engineering Foundation.
  - 5. SSPC Painting Manual, Vol. 1 - Good Painting Practice and Vol. 2 - Systems and Specifications.
  - 6. Fed. Specs QQ-I-652A, Iron Gray Castings; QQ-S-741A, Steel Plates, Shapes and Bars, Carbon, Structural; WW-P-521, Malleable Iron.

### 2.2 FABRICATION

- A. General Fabrication: Fabricate work to be truly straight, plumb, level and square and to sizes, shapes, and profiles indicated on approved shop drawings. Ease exposed edges. Cut, reinforce, drill and tap metalwork as necessary for proper assembly and use.
  - 1. Fabricate all miscellaneous metal supports, brackets, braces and the like required to fully complete the work of this project.
  - 2. Coordinate miscellaneous metal requirements with other specification sections to ensure proper interface of various parts of the work.

3. Obtain loading requirements from suppliers of work to be supported and design and fabricate support systems with factor of safety of at least 6.
- B. Work Exposed To View: Take special care in choosing materials that are smooth and free of blemishes such as pits, roller marks, trade names, scale and roughness. Fabricate work with uniform, hairline tight joints. Form welded joints and seams continuously and grind flush and smooth to be invisible after painting. Fillet welds will not be accepted; plug welds and flush welds are required. For exposed fasteners, use hex head bolts or Phillips head machine screws.
- C. Galvanizing: Hot-dip galvanize all exterior miscellaneous metalwork, all items located in exterior wall and roof assemblies, and all items indicated to be galvanized in strict compliance with ASTM A123, A143, A153. Any item that is cut, welded, or is otherwise damaged must be repainted with an acceptable zinc-rich coating product. Any item that is cut, welded, or is otherwise damaged must be repainted with an acceptable zinc-rich coating product.
1. Nickel Zinc: Comply with ASTM B6-07.
  2. Coverage: Provide at least 2. oz./sq. ft. nickel zinc coverage, but not less than the coverage required by referenced standards.
  3. Fabrication: To the greatest extent possible, galvanize after fabrication is completed.
  4. Touch Up: Touch-up damaged or abraded galvanized surfaces with ZRC Cold Galvanizing Compound, Duncan ZiRP or Architect approved equal is compliance with ASTM A780-01.
- D. Painting & Preparation, Exposed Steel: Prime paint all work not indicated to be galvanized. Prepare work for shop priming in compliance with Steel Structures Painting Council SP-6 *Commercial Blast Cleaning*. Provide 1 mil dry film thickness of rust inhibitive primer specified in Section 09910 - Painting. Provide two coats with two mils total dry film thickness for surfaces which are inaccessible after assembly or erection.
- E. Painting & Preparation, Egress Stairs and Miscellaneous Metals Concealed From View: Prime paint all work not indicated to be galvanized. Prepare work for shop priming by power tool cleaning. Provide 1 mil dry film thickness of rust inhibitive primer specified in Section 09910 - Painting. Provide two coats with two mils total dry film thickness for surfaces which are inaccessible after assembly or erection.
- F. Bearing and Leveling Plate Fabrication: Design and fabricate plates for steel and wood members bearing on masonry or concrete. Provide flat, uniform bearing areas of size and thickness required for loading conditions encountered. Use standard AISC and AITC design criteria. Drill plates as necessary to receive anchor bolts and for grouting access. Units in exterior wall construction shall be hot dip galvanized.

- G. Railing fabrication: Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

## 2.3 FINISHING

- A. General: Shop prime work to greatest extent possible, except those items indicated to be embedded in concrete, and those items indicated to receive fireproofing. Field touch-up shop applied coatings after installation.
- B. Prepare work for shop priming in compliance with SSPC SP6.
- C. Provide 1 mil dry film thickness of rust inhibitive primer over properly prepared, non-galvanized and/or non-fireproofed surfaces. Provide two coats with 2 mils total dry film thickness for surfaces which are inaccessible after assembly or erection.
- D. Primer for Non-Galvanized Ferrous Surfaces (except interior handrail and railing assemblies and interior steel stairs): Provide high-quality, lead-free, rust-inhibitive primer, equal to one of the following:
  - 1. Series 10 Metal Primer, Tnemec.
  - 2. Bar-ox Quick Dry Universal Primer; Devoe and Reynolds.
  - 3. Ironclad Retardo; Benjamin Moore.
- E. Shop Primer for Galvanized Fabrications: Exterior galvanized handrails, ladders, exhaust lintels, shelf angles, pipe bollards, and other items as indicated or directed by Architect to be painted, shall be primed with one of the following shop primers within 12 hours of the galvanizing process. Provide one coat of the following at 3. to 4. mils DFT for galvanized items indicated to be painted:
  - 1. No. 69 Hi-Build Epoxoline; Tnemec.
  - 2. International Protective Coatings equal.
  - 3. Valspar equal.

## PART 3 - EXECUTION

### 3.1 INSTALLATION - GENERAL

- A. Provide suitable anchors and fasteners to connect miscellaneous metal items to other construction. Provide setting templates and diagrams and coordinate with other work so that adequate anchor bolts, blocking and bracing is in place and accurately located. Beginning work means Installer accepts substrates and conditions.

- B. Set work accurately and truly plumb, level and aligned. Make field assembly and connections with the same level of quality as shop fabricated work.
- C. Miscellaneous Bearing and Leveling Plates: Clean concrete and masonry surfaces of bond reducing materials. Roughen surfaces if required to improve bond to surface. Clean bottom surface of leveling plates immediately prior to installation.
  - 1. Set loose leveling and bearing plates on wedges or other adjustable devices. Tighten anchor bolts after plates have been positioned plumb and level. Pack voids between plates and bearing surfaces solidly with specified grout.
- D. Miscellaneous Framing and Supports: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings. Anchor supports securely to and rigidly brace from building structure.

### 3.2 INSTALLATION - RAILINGS

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
  - 1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
  - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
  - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (5 mm in 3 m).
- C. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.
- E. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.
- F. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in Part 2

"Fabrication" Article whether welding is performed in the shop or in the field.

- G. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches (50 mm) beyond joint on either side, fasten internal sleeve securely to 1 side, and locate joint within 6 inches (150 mm) of post.

### 3.3 TOLERANCES

- A. The following allowable installed tolerances are allowable variations from locations and dimensions indicated by the Contract Document and shall not be added to allowable tolerances indicated for other work.

- 1. Allowable Variation from True Plumb, Level and Line:  $\pm 1/8"$  in 20'-0".

### 3.4 REPAIRING, CLEANING, & PROTECTION

- A. Touch-up damaged coatings and finishes to eliminate evidence of repair.
- B. Repair minor damage to eliminate all evidence of repair. Remove and replace work which cannot be satisfactorily repaired.

END OF SECTION



## **SECTION 05 53 16**

### **PLANK GRATINGS**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. Section includes formed-metal plank gratings and metal frames and supports for gratings.
- B. Related Requirements:
  - 1. Section 051200 "Structural Steel Framing" for structural-steel framing system components.

##### **1.3 COORDINATION**

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for gratings, grating frames, and supports. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

##### **1.4 ACTION SUBMITTALS**

- A. Product Data: For the following:
  - 1. Formed-metal plank gratings.
  - 2. Paint products.
- B. Shop Drawings: Include plans, sections, details, and attachments to other work.
- C. Delegated-Design Submittal: For gratings, including manufacturers' published load tables.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

## 1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  - 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

## 1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with gratings by field measurements before fabrication.

# PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Gratings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Walkways and Elevated Platforms Used as Exits: Uniform load of 100 lbf/sq. ft.
  - 2. Limit deflection to L/360 or ¼ inch, whichever is less.
- B. Seismic Performance: Gratings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  - 1. Component Importance Factor: 1.5.

## 2.2 FORMED-METAL PLANK GRATINGS

- A. C-shaped channels rolled from heavy sheet metal of thickness as required to comply with structural performance requirements and punched in serrated diamond shape to produce raised slip-resistant surface and drainage holes.
  - 1. Channel Width: As required to comply with structural performance requirements.
  - 2. Channel Depth: As required to comply with structural performance requirements.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Galvanized-Steel Sheet: ASTM A 653/A 653M, structural quality.



## 2.3 FASTENERS

- A. General: Unless otherwise indicated, provide zinc-plated fasteners with coating complying with ASTM B 633.

## 2.4 MISCELLANEOUS MATERIALS

- A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
  - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- B. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

## 2.5 FABRICATION

- A. Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- B. Fit exposed connections accurately together to form hairline joints.
- C. Welding: Comply with AWS recommendations and the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
- D. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.
  - 1. Fabricate toe plates for attaching in the field.
  - 2. Toe plate Height: 4 inches (100 mm) unless otherwise indicated.
- E. Fabricate cutouts in grating sections for penetrations of sizes and at locations indicated. Cut openings neatly and accurately to size. Edge-band openings with metal sheet or bars having a thickness not less than grating material.
  - 1. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.

- F. Where gratings are pierced by pipes, ducts, and structural members, cut openings neatly and accurately to size and weld a strap collar not less than 1/8 inch (3.2 mm) thick to the cut ends. Divide panels into sections only to extent required for installation where grating platforms and runways are to be placed around previously installed pipe, ducts, and structural members.

## 2.6 GRATING FRAMES AND SUPPORTS

- A. Frames and Supports: Fabricate from metal shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter and weld connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items. Unless otherwise indicated, fabricate from same basic metal as gratings.
- B. Galvanize steel frames and supports in the following locations:
  - 1. Exterior.
  - 2. Interior, where indicated.

## 2.7 ALUMINUM FINISHES

- A. Class I, Clear Anodic Finish: AA-M12C22A41 complying with AAMA 611.

## 2.8 STEEL FINISHES

- A. Finish gratings, frames, and supports after assembly.
- B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
  - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- C. Shop prime gratings, frames and supports not indicated to be galvanized unless otherwise indicated.
  - 1. Shop prime with zinc-rich primer unless otherwise noted in "Exterior Paint" specification sections.
- D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below.
  - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 3. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

- 4. Other Items: SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
- E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.
- D. Fit exposed connections accurately together to form hairline joints.
  - 1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- E. Attach toe plates to gratings by welding at locations indicated.
- F. Field Welding: Comply with AWS recommendations and the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
- G. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

### 3.2 INSTALLING METAL PLANK GRATINGS

- A. General: Comply with manufacturer's written instructions for installing gratings. Use manufacturer's standard anchor clips and hold-down devices for bolted connections.
- B. Attach removable units to supporting members by bolting at every point of contact.

- C. Attach nonremovable units to supporting members by welding unless otherwise indicated. Comply with manufacturer's written instructions for size and spacing of welds.
- D. Attach aluminum units to steel supporting members by bolting at side channels at every point of contact and by bolting intermediate planks at each end on alternate sides. Bolt adjacent planks together at midspan.

### 3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 055316

## SECTION 06 10 01

### CARPENTRY-ROOFING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

- A. All plant, labor, materials, equipment, testing and services necessary to complete the work shown on the drawings, schedules and notes, as specified herein, and as may be required by conditions and authorities having jurisdiction, including, but not limited to, the following:

- 1. Roof related wood nailers, blocking, shims, and plywood.
- 2. Re-secure existing roof related blocking; remove and separate multiple layers of blocking, and secure each layer individually if necessary.

- B. Related Requirements

- |                                       |                    |
|---------------------------------------|--------------------|
| 1. Masonry Maintenance                | - Section 04 01 00 |
| 2. EPDM Roofing                       | - Section 07 53 23 |
| 3. Sheet Metal Flashing & Specialties | - Section 07 62 00 |
| 4. Roof Accessories                   | - Section 07 72 00 |

##### 1.3 QUALITY ASSURANCE

- A. Installer Qualifications:

- 1. A firm (Installer) with at least 5 continuous years experience performing work similar to that required for this project, employing personnel skilled in the work specified.
  - a. The Installer shall directly employ the personnel performing the work of this section.
  - b. The Installer shall have a full time supervisor on the roof when work is in progress. The Supervisor shall have a minimum of 5 years experience with work similar in nature and scope to this project, and speak fluent English.
    - i) Submit the supervisor's resume upon request.

2. The Installer shall provide a reference list of at least three previously completed projects of comparable size and similar design, within a fifty mile radius of this project, which may be observed by representatives of the Owner:
  - a. The reference list shall include at a minimum, the completion date, a description of the work performed, the Owner's name - contact person - phone number and address and the Architect's name - contact person and phone number.
  - b. Submit the reference list upon request.
- B. Material Quality: Obtain each type of material from a single source to ensure consistent quality, color, pattern, and texture.
- C. Pre-Construction Conference: Attend the pre-construction meeting and discuss how and when carpentry work will be performed and coordinated with other work, and how the building will be kept watertight as work occurs.

#### 1.4 SUBMITTALS

- A. Submit the following items far enough in advance to obtain approval prior to performing any work on site:
  1. A pre-work site and building inspection report with photos, to document conditions before work starts on site.
  2. Manufacturer's technical literature for all materials.
  3. Test reports and certifications substantiating compliance with specification requirements if requested by the Architect.
  4. 2 foot long on-site samples which show the size, shape, configuration and method of fastening for all wood blocking assemblies, and which show how the blocking assemblies will relate to and fit on adjoining work.
- B. Simultaneously provide all technical submittals needed for this project, for all technical sections, collated by section. Incomplete submittals will not be reviewed.
  1. Submittals shall be prepared and made by the firm that will perform the actual work.
  2. Provide electronic submittals via an on-line submittal exchange program if one is established for this project; if an on-line program isn't established, provide the submittals on portable USB drives in pdf format, organized in folders by Section.

- C. Safety Data Sheets: Simultaneously provide all Safety Data Sheets needed for this project, for all specification sections - collated by section, in three ring binders. Provide two binders.
- D. Payment requisitions will not be processed until all submittals are received and approved.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver and store materials dry at all times. Cover with tarps and protect against exposure to weather and contact with damp or wet surfaces.
- B. Do not overload the structure when storing material on the roof.
- C. Protect roof surfaces where material and equipment is placed on them, and where construction traffic occurs, with 6 mil fire retardant polyethylene, covered with 1-1/2 inch thick foam insulation, overlaid with 2 by 10 wooden planks.
- D. Do not overload the structure when storing materials on the roof.
- E. Protect roof surfaces where material and equipment is placed on them, and where construction traffic occurs, with 6 mil fire retardant polyethylene, covered with 1-1/2 inch thick foam insulation, overlaid with 2 by 10 wooden planks.

#### 1.6 GUARANTEE

- A. Provide a written Contractor's Guarantee which guarantees that all work will remain free of material and workmanship defects and in a watertight condition for a five year period beginning upon Final Completion:
  - 1. Defects include but are not limited to the following: leakage, delamination, lifting, loosening, splitting, cracking, joint separation and movement.
  - 2. The Contractor shall make the repairs and modifications necessary to enable the work to perform as guaranteed at his own expense:
  - 3. Guarantee coverage shall include removing and replacing items installed as part of the original work, if removal is needed to make repairs.
- B. Provide one Guarantee that covers "all work performed" when a single contractor is awarded work specified in multiple Sections.
- C. The Guarantee shall take effect no more than 30 days before the satisfactory completion of all punch list work.
- D. The Contractor's Surety Company may add a rider to the Performance Bond which clarifies that Performance Bond Coverage expires two years after Final Completion; i.e., Performance Bond Coverage does not run for the entire five year term of the Contractor's Guarantee.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. WOOD, including shims, nailers, blocking, furring and similar members, in the sizes indicated, worked into the shapes shown, and as follows:
  - 1. Lumber: Douglas Fir dimension lumber, free of large knots and other imperfections.
  - 2. Plywood: Exterior grade APA rated Type CDX underlayment plywood.
  - 3. Beveled Siding: Utility grade cedar, redwood, or synthetic siding, 1/2 inch by 6 inches and 3/4 inch by 10 inches wide, tapered to 1/8 inch thick.

### 2.2 FASTENERS

- A. Hot dipped galvanized steel, stainless steel, or steel covered with a proprietary rust inhibiting coating.
  - 1. Do not use un-coated steel nails. Remove and replace carpentry components installed with un-coated steel nails.
- B. Use screws wherever possible, minimum size diameter #12. If nails are used they shall be annular ring shank type.
  - 1. Do not use dry wall screws to secure wood blocking assemblies. Remove and replace carpentry components installed with drywall screws.

## PART 3 - EXECUTION

### 3.1 INSTALLATION – GENERAL

- A. Coordinate carpentry work with the installation of the roofing system, insulation, flashings, and other similar items.
- B. Shim and set carpentry work plumb and true, except provide slope at the top surfaces of horizontal members as indicated.
- C. Stagger joints in built up assemblies at least 2 feet to obtain maximum strength. Provide the shapes needed and adjust wood blocking to suit the existing conditions and achieve full bearing and secure attachment. Discard defective material, and pieces which are too small, and fabricate the work with a minimum of joints and an optimum joint arrangement.
- D. Securely attach carpentry work to resist a force of 275 pounds per lineal foot in any direction. Countersink all fasteners flush unless otherwise shown.



- E. Space fasteners to achieve adequate holding power, and generally 12 inches apart:
  - 1. Space nails in wood blocking 8 inches apart.
  - 2. Install two rows of fasteners on blocking wider than 5 inches.
- F. Fit carpentry work neatly scribed and cut to fit within 1/8 inch of adjoining materials. Position furring, nailers, blocking, shims and similar supports for the proper attachment of subsequent work.
- G. Fasten wood and metal blocking assemblies to concrete decks and masonry walls with 1/4 inch diameter Spike or Drive fasteners. Pre-drill the holes.

### 3.2 CLEANING, PROTECTION AND WATERTIGHTNESS

- A. Inspect the interior and exterior of the building and grounds, and submit a written report with photos to document any leaks or damage, prior to performing any work.
- B. The Owner will conduct a similar inspection at the completion of the work, and the Contractor will be charged for all leaks and damage that weren't documented in the Contractor's report, or repaired to the Owners satisfaction at the Contractor's expense.
- C. Provide any equipment, material and labor necessary to protect the site, the building, its contents and occupants, pedestrians, and surrounding landscaped and paved areas from damage due to the construction work or from inclement weather during construction.
- D. Do not perform work during inclement weather. Protect incomplete work and the building from damage by inclement weather - which may occur unexpectedly. Make all work areas watertight at the end of each day's work.
- E. Clean up all litter, refuse, rubbish, scrap materials and debris at least twice a day; at noon and at the end of the work day, so the roof and site presents a neat, orderly and workmanlike appearance. Place the debris in a dumpster, and remove the dumpster from the site as soon as it is full or no longer being used.
- F. Carefully and thoroughly clean the entire roof to remove all residual debris when all work is complete. After cleaning the roof, thoroughly clean all drain sumps, drain lines, leader heads and leaders. Do not allow debris to enter the drainage system.

END OF SECTION 06 10 00



## **SECTION 061053**

### **MISCELLANEOUS ROUGH CARPENTRY**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Wood blocking and nailers.
  - 2. Utility shelving.

##### **1.3 DEFINITIONS**

- A. Boards or Strips: Lumber of less than 2 inches nominal (38 mm actual) size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater size but less than 5 inches nominal (114 mm actual) size in least dimension.

##### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
  - 1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
  - 2. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.

##### **1.5 INFORMATIONAL SUBMITTALS**

- A. Evaluation Reports: For the following, from ICC-ES:
  - 1. Fire-retardant-treated wood.

2. Power-driven fasteners.
3. Metal framing anchors.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

## PART 2 - PRODUCTS

### 2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
  1. Factory mark each piece of lumber with grade stamp of grading agency.
  2. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal (38-mm actual) thickness or less, 19 percent for more than 2-inch nominal (38-mm actual) thickness unless otherwise indicated.

### 2.2 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
  1. Treatment shall not promote corrosion of metal fasteners.

2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- E. Application: Treat all miscellaneous carpentry unless otherwise indicated.
  1. Concealed blocking.

## 2.3 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
  1. Blocking.
  2. Nailers.
  3. Furring.
  4. Utility shelving.
- B. Dimension Lumber Items: Construction or No. 2
  1. Mixed southern pine or southern pine; SPIB.
- C. Utility Shelving: Lumber with 15 percent maximum moisture content of the following species and grades:
  1. Eastern white pine, Idaho white, lodgepole, ponderosa, or sugar pine; Premium or No. 2 Common (Sterling) grade; NeLMA, NLGA, WCLIB, or WWPA.
- D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

## 2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F1667.
- C. Screws for Fastening to Metal Framing: ASTM C954, length as recommended by screw manufacturer for material being fastened.
- D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- E. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to Architect and authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC58, ICC-ES AC193, or ICC-ES AC308 as appropriate for the substrate.
  1. Material: Carbon-steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5.
  2. Material: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2 (ASTM F738M and ASTM F836M, Grade A1 or A4).

## 2.5 METAL FRAMING ANCHORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. KC Metals Products, Inc.
  2. Simpson Strong-Tie Co., Inc.
  3. USP Structural Connectors.
- B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 (Z180) coating designation.
  1. Use for interior locations unless otherwise indicated.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

- C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- E. Do not splice structural members between supports unless otherwise indicated.
- F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
  - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.
- G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
  - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches (2438 mm) o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
  - 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches (2438 mm) o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal (38-mm actual) thickness.
  - 3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. (9.3 sq. m) and to solidly fill space below partitions.
  - 4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet (6 m) o.c.
- H. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- I. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
  - 2. ICC-ES evaluation report for fastener.

### 3.2 INSTALLATION OF WOOD BLOCKING AND NAILER

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

### 3.3 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061053



## **SECTION 061600**

### **SHEATHING**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Wall sheathing.
  - 2. Sheathing joint and penetration treatment.
- B. Related Requirements:
  - 1. Section 061053 "Miscellaneous Rough Carpentry" for plywood backing panels.
  - 2. Section 071326 "Self Adhering Sheet Waterproofing"
  - 3. Section 072500 "Weather Barriers" for water-resistive barrier applied over wall sheathing.

##### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
  - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
  - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
  - 3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based

on testing by a qualified independent testing agency according to ASTM D 5516.

4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Sustainable Design Submittals:

#### 1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preserved-treated plywood.
2. Fire-retardant-treated plywood.

#### 1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: As tested according to ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

## 2.2 FIRE-RETARDANT-TREATED PLYWOOD

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
  - 1. Use treatment that does not promote corrosion of metal fasteners.
  - 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
  - 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201/D 3201M at 92 percent relative humidity. Use where exterior type is not indicated.
  - 4. Design Value Adjustment Factors: Treated lumber plywood shall be tested according to ASTM D 5516 and design value adjustment factors shall be calculated according to ASTM D 6305. Span ratings after treatment shall be not less than span ratings specified
- C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.
- E. Application: Treat all plywood unless otherwise indicated.

## 2.3 WALL SHEATHING

- A. Glass-Mat Gypsum Sheathing: ASTM C 1177/1177M.
  - 1. Type and Thickness: Type X, 5/8 inch (15.9 mm)] thick.
  - 2. Size: 48 by 96 inches (1219 by 2438 mm) or 48 by 120 inches (1219 by 3048 mm) for vertical installation.

## 2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
  - 1. For wall sheathing, provide fasteners of Type 304 stainless steel.
- B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- C. Screws for Fastening Sheathing to Wood Framing: ASTM C 1002.
- D. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
- E. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.
  - 1. For steel framing less than 0.0329 inch (0.835 mm) thick, use screws that comply with ASTM C 1002.
  - 2. For steel framing from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick, use screws that comply with ASTM C 954.

## 2.5 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.
  - 1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches (50 mm) wide, 10 by 10 or 10 by 20 threads/inch (390 by 390 or 390 by 780 threads/m), of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.
- B. Sheathing Tape for Foam-Plastic Sheathing: Pressure-sensitive plastic tape recommended by sheathing manufacturer for sealing joints and penetrations in sheathing.

## 2.6 MISCELLANEOUS MATERIALS

- A. Adhesives for Field Gluing Panels to Wood Framing: Formulation complying with APA AFG-01 or ASTM D 3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
  - 1. Table 2304.9.1, "Fastening Schedule," in the ICC<sup>®</sup> International Building Code.
  - 2. ICC-ES evaluation report for fastener.
- D. Coordinate wall sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

### 3.2 GYPSUM SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.
  - 1. Fasten gypsum sheathing to cold-formed metal framing with screws.
  - 2. Install panels with a 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.
  - 3. Install panels with a 1/4-inch (6.4-mm) gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

- B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.
- C. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.
  - 1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of panels.
- D. Seal sheathing joints according to sheathing manufacturer's written instructions.
  - 1. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

END OF SECTION 061600

## **SECTION 06 20 00**

### **FINISH CARPENTRY**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Interior standing and running trim.
- B. Related Sections include the following:
  - 1. Division 6 Section "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view.
  - 2. Division 9 Section "Painting" for priming and backpriming of finish carpentry.

##### **1.3 DEFINITIONS**

- A. Inspection agencies, and the abbreviations used to reference them, include the following:
  - 1. NELMA - Northeastern Lumber Manufacturers Association.
  - 2. NHLA - National Hardwood Lumber Association.
  - 3. NLGA - National Lumber Grades Authority.
  - 4. SPIB - Southern Pine Inspection Bureau.
  - 5. WWPA - Western Wood Products Association.

##### **1.4 SUBMITTALS**

- A. Product Data: For each type of process and factory-fabricated product. Include construction details, material descriptions, dimensions of individual components and profiles, textures, and colors.
  - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.

2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Samples for Verification:

1. For each species and cut of lumber and panel products with nonfactory-applied finish, with 1/2 of exposed surface finished, 50 sq. in. (300 sq. cm) for lumber and 8 by 10 inches (203 by 250 mm) for panels.

C. Research/Evaluation Reports: Showing that fire-retardant-treated wood complies with building code in effect for Project.

## 1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer.

B. Fire-Test-Response Characteristics: Where fire-retardant materials are indicated, provide materials with specified fire-test-response characteristics as determined by a testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency on surfaces of materials that will be concealed from view after installation.

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect materials against weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.

B. Deliver interior finish carpentry only when environmental conditions meet requirements specified for installation areas. If finish carpentry must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

## 1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install interior finish carpentry until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit work to be performed according to



manufacturer's written instructions and warranty requirements and at least one coat of specified finish to be applied without exposure to rain, snow, or dampness.

## PART 2 - PRODUCTS

### 2.1 MATERIALS, GENERAL

- A. Lumber: DOC PS 20 and applicable grading rules of inspection agencies certified by the American Lumber Standards' Committee Board of Review.
  - 1. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.
- B. Softwood Plywood: DOC PS 1.
- C. Hardwood Plywood: HPVA HP-1.
- D. Hardboard: AHA A135.4
- E. Medium-Density Fiberboard: ANSI A208.2, Grade MD-Exterior Glue.

### 2.2 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated lumber and plywood are indicated, use materials impregnated with fire-retardant chemicals by a pressure process or other means acceptable to authorities having jurisdiction to produce products with the following fire-test-response characteristics:
  - 1. Flame-spread index of not greater than 25 when tested according to ASTM E 84
- B. For exposed items indicated to receive transparent finish, do not use chemical formulations that contain colorants or that bleed through or otherwise adversely affect finishes.
- C. Interior, Low-Hygroscopic-Type, Fire-Retardant Treatment: Formulation that results in treated material with an apparent moisture content of not more than 28 percent when tested according to ASTM D 3201 at 92 percent relative humidity.
- D. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber and plywood from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.

- E. Kiln-dry material after treatment to levels required for untreated material. Do not use material that does not comply with requirements for untreated material or is warped or discolored.

## 2.3 INTERIOR STANDING AND RUNNING TRIM

- A. Softwood Lumber Trim for Transparent Finish (Stain or Clear Finish): Kiln-dried finished lumber (S4S) of one of the following species and grades:
  - 1. Select eastern white pine; Idaho white, poplar, or sugar pine NELMA, NLGA.or WWPA.
- B. Hardwood Lumber Trim for Transparent Finish (Stain or Clear Finish): Clear Grade A finish, kiln-dried, white maple unless otherwise indicated.
- C. Lumber Trim for Opaque Finish (Painted): Finished lumber (S4S), either finger-jointed or solid lumber, of one of the following species and grades:
  - 1. Grade: Finish or 1 Common. Poplar or Birch, NELMA WWPA.or NLGA.

## 2.4 PANELING

- A. Hardwood Veneer Plywood Paneling: Manufacturer's stock hardwood plywood panels complying with applicable requirements in HPVA HP-1.
- B. Board Paneling: Interior wood board paneling complying with WMMPA WM 9.

## 2.5 MISCELLANEOUS MATERIALS

- A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.
  - 1. Where finish carpentry materials are exposed in areas of high humidity, provide fasteners and anchorages with hot-dip galvanized coating complying with ASTM A 153/A 153M.

## 2.6 FABRICATION

- A. Wood Moisture Content: Comply with requirements of specified inspection agencies and with manufacturer's written recommendations for moisture content of finish carpentry at relative humidity conditions existing during time of fabrication and in installation areas.
- B. Back out or kerf backs of the following members, except members with ends exposed in finished work:
  - 1. Interior standing and running trim, except shoe and crown molds.
  - 2. Wood board paneling.

- C. Ease edges of lumber less than 1 inch (25 mm) in nominal thickness to 1/16-inch (1.5-mm) radius and edges of lumber 1 inch (25 mm) or more in nominal thickness to 1/8-inch (3-mm) radius.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Before installing finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours[, unless longer conditioning is recommended by manufacturer].

### 3.3 INSTALLATION, GENERAL

- A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.
  - 1. Do not use manufactured units with defective surfaces, sizes, or patterns.
- B. Install finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
  - 1. Scribe and cut finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
  - 2. Countersink fasteners, fill surface flush, and sand where face fastening is unavoidable.
  - 3. Install to tolerance of 1/8 inch in 96 inches (3 mm in 2438 mm) for level and plumb. Install adjoining finish carpentry with 1/32-inch (0.8-mm) maximum offset for flush installation and 1/16-inch (1.5-mm) maximum offset for reveal installation.
  - 4. Coordinate finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate finish carpentry.

### 3.4 STANDING AND RUNNING TRIM INSTALLATION

- A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches

(610 mm) long, except where necessary. Stagger joints in adjacent and related standing and running trim. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.

1. Match color and grain pattern across joints.
2. Install trim after gypsum board joint finishing operations are completed.
3. Drill pilot holes in hardwood before fastening to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.

### 3.5 ADJUSTING

- A. Replace finish carpentry that is damaged or does not comply with requirements. Finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

### 3.6 CLEANING

- A. Clean finish carpentry on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

END OF SECTION 06 20 00

## **SECTION 064116**

### **PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. Section Includes:

- 1. Plastic-laminate-clad architectural cabinets.
- 2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-clad architectural cabinets that are not concealed within other construction.

- B. Related Requirements:

- 1. Section 061053 "Miscellaneous Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets that are concealed within other construction before cabinet installation.
- 2. Section 123623.13 "Plastic-Laminate-Clad Countertops."

##### **1.3 COORDINATION**

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.
- B. Hardware Coordination: Distribute copies of approved hardware schedule specified to manufacturer of architectural cabinets; coordinate Shop Drawings and fabrication with hardware requirements.

##### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

- 1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Show large-scale details.
3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
4. Show locations and sizes of cutouts and holes for items installed in plastic-laminate architectural cabinets.
5. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples: For each exposed product and for each color and texture specified, in manufacturer's or manufacturer's standard size.

D. Samples for Initial Selection: For each type of exposed finish.

E. Samples for Verification: For the following:

1. Plastic Laminates: 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish required.
  - a. Provide one sample applied to core material with specified edge material applied to one edge.
2. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.

## 1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and Installer.

B. Product Certificates: For each type of product.

1. Composite wood and agrifiber products.
2. High-pressure decorative laminate.
3. Adhesives.

C. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

D. Field quality-control reports.

## 1.6 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: AWI Quality Certification Program.

## 1.7 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
  - 1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.
- B. Installer Qualifications: Licensed participant in AWI's Quality Certification Program.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

## 1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install cabinets until building, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
- B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  - 1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.
- C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

## PART 2 - PRODUCTS

### 2.1 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.
  - 1. Provide labels and / or certificates from AWI certification program indicating that woodwork and installation complies with requirements of grades specified.
- B. Architectural Woodwork Standards Grade: Custom.
- C. Type of Construction: Frameless
- D. Door and Drawer-Front Style: As indicated on drawings
- E. Laminate Cladding for Exposed Surfaces:
  - 1. Horizontal Surfaces: Grade HGS
  - 2. Postformed Surfaces: Grade HGP.
  - 3. Vertical Surfaces: Grade HGS
  - 4. Edges: Grade HGS
  - 5. Pattern Direction: As indicated.
- F. Materials for Semiexposed Surfaces:
  - 1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS.
  - 2. Drawer Sides and Backs: Solid-hardwood lumber
  - 3. Drawer Bottoms: Hardwood plywood.
- G. Dust Panels: 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers unless located directly under tops.
- H. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces:
- I. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
  - 1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.
- J. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
  - 1. Match Architect's sample.



## 2.2 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
  - 1. Softwood Plywood: DOC PS 1, medium-density overlay.

## 2.3 FIRE-RETARDANT-TREATED MATERIALS, As indicated.

- A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
  - 1. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.
  - 2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
  - 3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.
- B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
  - 1. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
  - 2. For items indicated to receive a stained or natural finish, use organic resin chemical formulation.
  - 3. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking shop certified by testing and inspecting agency.

## 2.4 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets .

- B. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, B01602, 135 degrees of opening, self-closing.
- C. Back-Mounted Pulls: ANSI/BHMA A156.9, B02011.
- D. Wire Pulls: Back mounted, solid metal as indicated on Drawings
- E. Catches: Ball friction catches, ANSI/BHMA A156.9, B03013.
- F. Adjustable Shelf Standards and Supports: ANSI/BHMA A156.9, B04071; with shelf rests, B04081.
- G. Shelf Rests: ANSI/BHMA A156.9, B04013; metal
- H. Drawer Slides: ANSI/BHMA A156.9.
  - 1. Grade 1 and Grade 2: Side mounted and extending under bottom edge of drawer.
    - a. Type: Full extension.
    - b. Material: Zinc-plated steel with polymer rollers.
  - 2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full extension type; zinc-plated-steel ball-bearing slides.
  - 3. For drawers not more than 3 inches (75 mm) high and not more than 24 inches (600 mm) wide, provide Grade 2
  - 4. For drawers more than 3 inches (75 mm) high, but not more than 6 inches (150 mm) high and not more than 24 inches (600 mm) wide, provide Grade 1HD-100.
  - 5. For drawers more than 6 inches (150 mm) high or more than 24 inches (600 mm) wide, provide Grade 1HD-100
  - 6. For trash bins not more than 20 inches (500 mm) high and 16 inches (400 mm) wide, provide Grade 1HD-200 .
- I. Door Locks: ANSI/BHMA A156.11, E07121.
- J. Drawer Locks: ANSI/BHMA A156.11, E07041.
- K. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.
- L. Exposed Hardware Finishes: For exposed hardware, provide finish as indicated on Drawings that complies with ANSI/BHMA A156.18 for ANSI/BHMA finish number.
  - 1. Dark, Oxidized, Satin Bronze, Oil Rubbed: ANSI/BHMA 613 for bronze base; ANSI/BHMA 640 for steel base; match Architect's sample.
  - 2. Bright Brass, Clear Coated: ANSI/BHMA 605 for brass base; ANSI/BHMA 632 for steel base.
  - 3. Bright Brass, Vacuum Coated: ANSI/BHMA 723 for brass base; ANSI/BHMA 729 for zinc-coated-steel base.

4. Satin Brass, Blackened, Bright Relieved, Clear Coated: ANSI/BHMA 610 for brass base; ANSI/BHMA 636 for steel base.
  5. Satin Chromium Plated: ANSI/BHMA 626 for brass or bronze base; ANSI/BHMA 652 for steel base.
  6. Bright Chromium Plated: ANSI/BHMA 625 for brass or bronze base; ANSI/BHMA 651 for steel base.
  7. Satin Stainless Steel: ANSI/BHMA 630.
- M. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

## 2.5 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- C. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement
  1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

## 2.6 FABRICATION

- A. Fabricate architectural cabinets to dimensions, profiles, and details indicated.
- B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
  1. Notify Architect seven days in advance of the dates and times architectural cabinet fabrication will be complete.
  2. Trial fit assemblies at manufacturer's shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
- C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

### 3.2 INSTALLATION

- A. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.
- C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.
- D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm) using concealed shims.
  - 1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
  - 2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
  - 3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches (400 mm) apart o.c. (minimum 4 bolts per cabinet) with toggle bolts supporting minimum of 200 pounds each bolt, through metal backing or metal framing behind wall finish. Contractor to provide and document pull test in wall blocking to determine proper anchorage before cabinets are installed.

### 3.3 FIELD QUALITY CONTROL

- A. Inspections: Provide inspection of installed Work through AWI's Quality Certification Program certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.
  - 1. Inspection entity shall prepare and submit report of inspection.

### 3.4 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION 064116



## **SECTION 071000**

### **WALL WATERPROOFING SYSTEMS**

#### **PART 1 – GENERAL**

##### **1.1 GENERAL REQUIREMENTS**

- A. The General Conditions of the Contract and the General Requirements are hereby made part of this Section.

##### **1.2 SCOPE OF WORK**

- A. The work includes furnishing all labor, materials, equipment, and supervision to accomplish the following work in accordance with the Drawings and Specifications.
- B. Coordinate work with exterior wall sheathing removal and reinstallation and installation at columns and over exposed metal studs.
- C. Fill all openings in the back up wall between existing sheathing and columns. At openings less than 1 in., provide backer rod. At openings more than 1 in., provide sheet metal. Assume a gap on each of each column.
- D. Provide cant over all horizontal ledges at floor slabs with mortar.
- E. Prime all surfaces to receive sheet-applied wall waterproofing membrane.
- F. Provide sheet-applied wall waterproofing membrane and attendant membrane flashings to the face of the backup wall shingled to the flow of water. This includes all window openings, penetrations and terminations, counterflashings, parapets and other areas shown in the Drawings.
- G. Provide membrane jamb and sill pan flashing at the windows as shown in the Drawings. Coordinate with sheet metal sill pan flashing (Specification Section 076000).
- H. Provide Liquid Membrane or similar over all masonry anchors and fasteners.

##### **1.3 COORDINATE WITH RELATED WORK**

- A. Coordinate the work of this Section with the work of other trades under this Contract, including but not limited to:

1. Section 042000 – Masonry Veneer
2. Section 076000 – Sheet Metal Flashing

#### 1.4 SUBMITTALS

- A. Submit the following items in time to allow for review by the Engineer and resubmittals, if needed, without delaying the work. Do not order materials or start work before receiving the Engineer's written approval.
- B. Submit the following items from the manufacturer to the Engineer for approval:
  1. Samples and/or manufacturer's literature for all materials specified and proposed for use on this project, each properly labeled.
  2. Manufacturer's installation recommendations for all materials used on this project.
  3. Certifications by the producers of all materials that all materials supplied comply with all the requirements of these specifications and the appropriate standards.
- C. Contractor Qualifications:
  1. The contractor performing the work under this section must have a minimum of five years' experience in comparable work and must submit a list, with references, of three buildings on which they worked in the last five years, employing workers skilled in the restoration processes and operations indicated.
  2. List building name and address, architect, general contractor, and appropriate subcontractors and foreman with phone numbers and contact person.
- D. Submit the following items:
  1. Submit shop drawings showing elevations, section details and intersections, terminations, intersections, and integration of waterproofing membrane with wall components. Show integration of wall waterproofing with copings and flashing; show membrane sheet layout and direction of seams.
  2. Submit shop drawings of any waterproofing details not explicitly shown or directly inferred from the design details.

#### 1.5 EXAMINE EXISTING CONDITIONS

- A. Verify all site conditions and dimensions by measurements in the field. Verify existing construction in consideration of the special conditions associated with working in and repairing and modifying an existing building.



- B. Notify the Engineer immediately of any inconsistencies between field conditions and those shown in the Contract Drawings. The Engineer will determine what modifications or additional repairs are necessary.

## 1.6 QUALIFICATIONS

- A. The work of this Section shall be performed by a contractor acceptable to the Owner prior to bid. The waterproofing contractor, the contractor's superintendent and foreman will have at least five years' experience successfully completed work described in this section.

## 1.7 MOCKUPS

- A. Notify the Engineer at least 72 hrs before starting work on each mockup. Do not proceed with any part of the work before the Engineer approves the appropriate mockups. The mockups will be used to establish both technical and aesthetic standards for the project. Reconstruct mockups as many times as necessary to obtain the Engineer's approval at no additional cost to the Owner. The approved mockups may be used as a guideline for the remainder of the work and installed work will be judged accordingly.
- B. Provide the following mockups:
  - 1. 5 lf of waterproofing installation at column, including infill of gap.
  - 2. Flashing at one window
  - 3. Waterproofing work as specified in this section to complete the mockups specified in related sections.

## 1.8 PRECONSTRUCTION CONFERENCE

- A. Attend a preconstruction conference to be held with representatives of the Owner, the Contractor, the Engineer, and all other trades to discuss the work covered under this Section. Review methods and procedures related to waterproofing installation, including inspection of substrate prior to installation, installation procedures, protection from damage, replacement materials, submittals, and schedules.

## 1.9 QUALITY CONTROL AND PROJECT PROCEDURES

- A. The Contractor shall conduct a quality control program that includes, but is not limited to, the following:
  - 1. Inspection of all materials to ensure that they conform to contract requirements and that all materials are new and undamaged.

2. Establishment of procedures for executing the work.
  3. Inspection of work in progress to ensure that work is being done in accordance with established procedures and specific instructions, if given by the Engineer.
  4. Inspection of all work completed, including visually examining all masonry work, and correction of all defective work.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

#### 1.10 DELIVERY, STORAGE AND HANDLING

- A. Store all materials in a location selected by the Owner. Store all materials neatly on pallets to prevent wetting or damage. Use fire-retardant canvas tarpaulins to cover all exterior stored materials, top to bottom. Polyethylene covers are not acceptable.
- B. Protect ALL materials from the weather. Promptly remove from the site all materials rejected by the Engineer or harmed by moisture anywhere, at any time, during transportation, storage, handling, and installation.
- C. Do not stockpile materials or equipment to overload any building or site component.

#### 1.11 PROTECTION

- A. Protect the building, occupants, pedestrians, and building contents from all risks associated with this work including inclement weather. Replace damaged components at no charge to the Owner and to the satisfaction of the Owner using mechanics skilled in the appropriate trade and approved by the Owner.
- B. Do not damage existing building components, including flashing, roofing and backup materials scheduled to remain when removing masonry. Provide adequate protection of the window glass and frames to prevent breakage, scratches, and any other damage during work associated with this Section.
- C. Provide window, door and louver protection.
- D. Proceed with installation only when existing and forecasted weather conditions permit materials to be installed according to manufacturer's written instructions and industry guidelines.

## 1.12 WARRANTY/GUARANTEE

- A. Guarantee all work under this Section in a document. State that if, within two years after the Date of Substantial Completion of the Work any of the work of this Section is found to be defective or not in accordance with the Contract Documents, the Contractor shall correct it promptly after receipt of a written notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. Also, state that the Contractor shall bear all costs incurred by the Owner, including reasonable attorney's fees, to enforce compliance with the obligations of this guarantee. The obligation of these Guarantees shall run directly to the Owner, and may be enforced by the Owner against the Contractor, shall survive the termination of the Contract, and shall not be limited by conditions other than this Contract.

## PART 2 – PRODUCTS

### 2.1 WALL WATERPROOFING MATERIALS

- A. Wall Waterproofing Membrane and Membrane Flashings: 0.040 in. thick self-adhering rubberized-asphalt membrane with integrally bonded polyethylene laminate, Perm-A-Barrier System, 40 mil membrane, by GCP Applied Technologies, or approved equal.
  - 1. Accessories for Self-Adhered Membrane: Provide all membrane manufacturers' accessories, including primers (Perm-A-Barrier WB Primer over sheathing and wood blocking, Primer Bituthene System 4000 Surface Conditioner over concrete) as manufactured by GCP Applied Technologies.
- B. Liquid Membrane for Cants, Seams, Fillets and Lap Seals: Two-component, elastomeric, cold-applied, trowel-grade material; Bituthene Liquid Membrane by GCP Applied Technologies.
- C. Metal Hose Clamp: Stainless steel with worm drive, sized to fit wall penetration.

### 2.2 PREPARATION MATERIALS

- A. Backer Rod (at backup wall openings less than 1 in.): Closed-cell nongassing polyethylene rod. The diameter of the rod is to be approximately 25% in excess of joint width.
- B. Sheet Metal at backup wall openings greater than 1 in.: 20 ga stainless steel, flat stock width as required to cover opening.
  - 1. Fasteners: #8 metal screws.

- C. Mortar: ASTM C270, Type S. Proportions by volume 1 : 1/2 : 4-1/2 (portland cement: hydrated lime: mason's sand). Do not use ground limestone or prepared masonry cement mixes. Use the same brands of cement and lime, and the same source of sand throughout the project, for each mix. Do not use any admixture except those called for herein without written approval by the Engineer.

## PART 3 – EXECUTION

### 3.1 EXAMINATION

- A. Before starting work in a given area, examine all surfaces to receive waterproofing membrane for roughness, contaminants, unsound substrates or other conditions that may impair the installation. Promptly report any such conditions to the Engineer. Correct all defective conditions before commencing work.
- B. Examine all existing waterproofing and flashings to remain. Promptly report any such conditions to the Engineer. Repair all tears, holes or other discontinuities in the materials before proceeding with the Work.

### 3.2 PREPARATION

- A. Inspect backup walls. Provide a smooth, clean, dry surface for the waterproofing membrane and flashings, remove remnants or protrusions to provide smooth surface.
- B. Cover or fill all openings in the backup wall to provide a continuous substrate for waterproofing membrane.
  - 1. At openings less than 1 in. wide, install backer rod.
  - 2. At other openings larger than 1 in. cover the gaps in the backup wall with sheet metal, securely fastened to the backup wall.
  - 3. Cover all floor slab edges (where the backup wall is recessed creating a ledge) with a mortar cant, sloped toward the outside. Let mortar fully cure before installing primer or waterproofing membrane.

### 3.3 GENERAL WORKMANSHIP FOR WALL WATERPROOFING MEMBRANE

- A. Follow all manufacturers' recommendations, except as modified herein.
- B. Install a liquid membrane cant at all inside corners.

- C. Prime all surfaces to receive waterproofing membrane. Allow primer to dry, until it is clear and slightly tacky.
- D. Apply waterproofing membrane in compliance with the printed instructions of the manufacturer, unless modified by this Section.
  - 1. See drawing details for specific installation requirements and sequence.
  - 2. Coordinate wall and flashing membrane installation with metal flashings.
  - 3. Do not install rubberized-asphalt membrane over EPDM membrane. Provide a metal separator sheet or install butyl-rubber membrane between rubberized-asphalt wall waterproofing and exposed EPDM membrane.
  - 4. Begin application of sheets at bottom of wall and work up the surface; install the waterproofing membrane horizontally over the exterior sheathing. Install successive courses in shingle fashion, lapping the upper course over the lower course 4 in. minimum so that all membrane waterproofing layers shingle "downstream" (to the flow of water). Lap vertical joints at end laps 6 in. minimum and stagger end laps 24 in. minimum.
  - 5. Install membrane sheets in 8 ft maximum lengths. Roll out sheets on primed surfaces and align. Reroll one-half of sheet in its long direction and cut through release paper, taking care not to cut membrane.
  - 6. Roll membrane onto primed surfaces, pulling release paper in front of roll such that once release paper is removed membrane is immediately set onto surface. Place sheets without fishmouths or wrinkles. Do not stretch the membrane.
  - 7. If fishmouths and wrinkles appear, cut out and flatten the affected area, and cover with membrane extending at least 6 in. beyond the cut on all sides. Examine ALL seams in membrane thoroughly for fishmouths and wrinkles and repair as described above.
  - 8. Immediately after applying membrane sheet, hand press into contact with the surface, and roll entire membrane towards lap seams with a hand held neoprene roller. Remove air pockets and patch as described in Step 6. Create a uniform and complete bond.
  - 9. Seal all exposed perimeter edges at temporary tie-ins with specified mastic each day and remove mastic before applying additional membrane.
  - 10. Reprime areas that become dirty or debris covered during the course of the work prior to installing the membrane.
- E. Lap waterproofing membrane over upturned legs of all flashings in wall system as shown on the Drawings.
- F. Provide target patch over all fasteners and anchor plates for veneer anchor system. Target patch must be large enough to extend minimum 3 in. beyond anchor plate onto wall waterproofing.
- G. Install a bead of liquid membrane over all misshingled seams.

### 3.4 WINDOW AND DOOR MEMBRANE FLASHING INSTALLATION

- A. Coordinate this work with window installation and sheet metal installation (Section 076000).
- B. Work at the window and door requires close coordination with other trades to install all materials (e.g., wall waterproofing and membrane flashing, metal flashing, etc.) as shown on the Drawings. Generally, installation shall proceed from the bottom up so that all materials, regardless of trade, are integrated to shingle “downstream” (to the flow of water).
- C. At the sills, install a membrane sill pan flashing with end dams, as shown in the Drawings. The general procedure for membrane sill pan flashing is as follows:
  - 1. Install horizontal liquid membrane cants between the sill and the sheet metal angle and the metal studs at the jambs. Install vertical liquid membrane cants at all inside corners.
  - 2. Install the first sheet of waterproofing membrane across the base of the window rough opening. Embed the ends of the membrane in the liquid membrane cant. Do not allow membrane to “cant” or bridge at corners; cut membrane to lie flat.
  - 3. Install the next sheets of waterproofing membrane as the end-dams and back-dams of the sill pan flashing by installing a strip of membrane to each precast concrete jamb and a strip of membrane to the sheet metal angle. Embed the edges of the membrane in the liquid membrane cants. Terminate the front edge of the membrane in line with the outside edge (face) of the window frame.
  - 4. Install an additional bead of liquid membrane over the edges of the membrane at all corners.
- D. Install membrane strip flashing over all upturned legs of end dams, and fasteners in metal sill pan flashing. Coordinate with Section 076000 – Sheet Metal Flashing.
- E. Strip-in full height of jamb with membrane strip flashing to the top corners, shingling membrane 2 in. minimum over previous lift.
- F. Execute details so as to provide air- and watertight closure of wall waterproofing membrane, strip flashing, and metal flashing at all window and door, independent of exterior cladding and surface seals.
- G. Do not install sealant over membrane flashing.

END OF SECTION 071000

## **SECTION 071326**

### **SELF-ADHERING SHEET WATERPROOFING**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section includes self-adhering modified bituminous sheet waterproofing.

##### **1.2 PREINSTALLATION MEETINGS**

- A. Pre-installation Conference: Conduct conference at Project site

##### **1.3 ACTION SUBMITTALL**

- A. Product Data: For each type of product.
- B. Shop Drawings: Show locations and extent of waterproofing and details of substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

##### **1.4 INFORMATIONAL SUBMITTALS**

- A. Sample warranties.

##### **1.5 QUALITY ASSURANCE**

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.

##### **1.6 WARRANTY**

- A. Manufacturer's Warranty: Manufacturer's standard materials-only warranty in which manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.
  - 1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MODIFIED BITUMINOUS SHEET WATERPROOFING

- A. Modified Bituminous Sheet: Minimum 60-mil (1.5-mm) nominal thickness, self-adhering sheet consisting of 56 mils (1.4 mm) of rubberized asphalt laminated on one side to a 4-mil- (0.10-mm-) thick, polyethylene-film reinforcement, and with release liner on adhesive side; formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Carlisle Coatings & Waterproofing Inc.; CCW MiraDRI 860/861.
    - b. CETCO Building Materials Group, a subsidiary of AMCOL International Corp.; Envirosheet.
    - c. Grace, W. R., & Co. - Conn.; Bituthene 3000/Low Temperature or Bituthene 4000.
    - d. Henry Company; Blueskin WP 100/200.
    - e. Meadows, W. R., Inc.; SealTight Mel-Rol.
    - f. Tamko Building Products, Inc.; TW-60.
  2. Physical Properties:
    - a. Tensile Strength, Membrane: 250 psi (1.7 MPa) minimum; ASTM D 412, Die C, modified.
    - b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
    - c. Low-Temperature Flexibility: Pass at minus 20 deg F (minus 29 deg C); ASTM D 1970.
    - d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch (3-mm) movement; ASTM C 836.
    - e. Puncture Resistance: 40 lbf (180 N) minimum; ASTM E 154.
    - f. Water Absorption: 0.2 percent weight-gain maximum after 48-hour immersion at 70 deg F (21 deg C); ASTM D 570.
    - g. Water Vapor Permeance: 0.05 perms (2.9 ng/Pa x s x sq. m) maximum; ASTM E 96/E 96M, Water Method.
    - h. Hydrostatic-Head Resistance: [200 feet (60 m)] <Insert value> minimum; ASTM D 5385.
  3. Sheet Strips: Self-adhering, rubberized-asphalt strips of same material and thickness as sheet waterproofing.



## 2.2 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
  - 1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Primer: Liquid waterborne primer recommended for substrate by sheet-waterproofing material manufacturer.
- C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by sheet-waterproofing material manufacturer.
- D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, of trowel grade or low viscosity.
- E. Substrate Patching Membrane: Low-viscosity, two-component, modified asphalt coating.
- F. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick, predrilled at 9-inch (229-mm) centers.
- G. Protection Course: ASTM D 6506, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners and as follows:
  - 1. Thickness: 1/8 inch (3 mm), nominal, for vertical applications; 1/4 inch (6 mm), nominal, elsewhere.
  - 2. Adhesive: Rubber-based solvent type recommended by waterproofing manufacturer for protection course type.
- H. Protection Course: Fan folded, with a core of extruded-polystyrene board insulation faced on one side or both sides with plastic film, nominal thickness 1/4 inch (6 mm), with compressive strength of not less than 8 psi (55 kPa) per ASTM D 1621, and maximum water absorption by volume of 0.6 percent per ASTM C 272.
- I. Protection Course: Extruded-polystyrene board insulation, unfaced, ASTM C 578, Type X, 1/2 inch (13 mm) thick.
- J. Protection Course: Molded-polystyrene board insulation, ASTM C 578, Type I, 0.90-lb/cu. ft. (15-kg/cu. m) minimum density, 1-inch (25-mm) minimum thickness.

## PART 3 - EXECUTION

### 3.1 MODIFIED BITUMINOUS SHEET-WATERPROOFING APPLICATION

- A. Prepare surfaces and install modified bituminous sheets according to waterproofing manufacturer's written instructions and recommendations in ASTM D 6135.
- B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.
- C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- (64-mm-) minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure watertight installation.
  - 1. When ambient and substrate temperatures range between 25 and 40 deg F (minus 4 and plus 5 deg C), install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F (16 deg C).
- D. Horizontal Application: Apply sheets from low to high points of decks to ensure that laps shed water.
- E. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.
- F. Seal edges of sheet-waterproofing terminations with mastic.
- G. Install sheet-waterproofing and auxiliary materials to tie into adjacent waterproofing.
- H. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches (150 mm) beyond repaired areas in all directions.
- I. Immediately install protection course with butted joints over waterproofing membrane.
  - 1. Molded-sheet Insulation drainage panels may be used in place of a separate protection course to vertical applications when approved by waterproofing manufacturer and installed immediately.

2. .

### 3.2 Molded INSULATION DRAINAGE-PANEL INSTALLATION

- A. Install insulation drainage panels over waterproofed surfaces; cut and fit to within 3/4 inch (19 mm) of projections and penetrations.
- B. Ensure that drainage channels are aligned and free of obstructions.
- C. On vertical surfaces, set insulation drainage panels in adhesive or tape applied according to manufacturer's written instructions.
- D. On horizontal surfaces, loosely lay insulation drainage panels according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

### 3.3 PROTECTION, REPAIR, AND CLEANING

- A. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Protect installed insulation drainage panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.
- D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 071326



**SECTION 072100**  
**THERMAL INSULATION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Mineral-wool blanket.
  - 2. Mineral-wool board.

**1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

**1.3 INFORMATIONAL SUBMITTALS**

- A. Product test reports.
- B. Research reports.

**PART 2 - PRODUCTS**

**2.1 MINERAL-WOOL BLANKETS**

- A. Mineral-Wool Blanket, ASTM C 665, Type I consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics. Refer to drawings for location.

**2.2 MINERAL-WOOL BOARD**

- A. Mineral-Wool Board, Type III,: ASTM C 612, Type III; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics. Nominal density of 8 lb/cu. ft. (128 kg/cu. m). Refer to drawings for location.

**2.3 ACCESSORIES**

- A. Insulation for Miscellaneous Voids:

1. Spray Polyurethane Foam Insulation: ASTM C 1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
- B. Insulation Anchors, Spindles, and Standoffs: As recommended by manufacturer.
- C. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.
- D. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide ventilation between insulated attic spaces and vented eaves.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

### 3.2 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
  1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
  2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
  4. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
  5. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
  6. For wood-framed construction, install blankets according to ASTM C 1320 and as follows:
    - a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.
  7. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.
    - a. Exterior Walls: Set units with facing placed toward as indicated on Drawings.
    - b. Interior Walls: Set units with facing placed toward areas of high humidity
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
1. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

END OF SECTION 072100





**SECTION 072500**  
**WEATHER BARRIERS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

1. Section Includes:
  1. Building paper.
  2. Building wrap.
  3. Flexible flashing.
  4. Drainage material.

**1.2 ACTION SUBMITTALS**

1. Product Data: For each type of product.

**1.3 INFORMATIONAL SUBMITTALS**

1. Evaluation Reports: For water-resistive barrier and flexible flashing, from ICC-ES.

**PART 2 - PRODUCTS**

**2.1 WATER-RESISTIVE BARRIER**

1. Building Paper: ASTM D 226, Type 1 (No. 15 asphalt-saturated organic felt), unperforated.
  1. Building Wrap: ASTM E 1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:  
Henry Company  
Grace, W. R., & Co.  
Carlisle Coatings & Waterproofing Inc

2. Water-Vapor Permeance: Not less than 75 perms (4300 ng/Pa x s x sq. m) per ASTM E 96/E 96M, Desiccant Method (Procedure A).
  3. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.
2. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

## 2.2 FLEXIBLE FLASHING

1. Rubberized-Asphalt Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density polyethylene film, or spunbonded polyolefin to produce an overall thickness of not less than 0.030 inch (0.8 mm). Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:  
Henry Company  
Grace, W. R., & Co.  
Carlisle Coatings & Waterproofing Inc
1. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

## 2.3 DRAINAGE MATERIAL

1. Drainage Material: Product shall maintain a continuous open space between water-resistive barrier and exterior cladding to create a drainage plane and shall be used under adhered masonry veneer. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:  
Owens Corning Insulating Systems LLC  
Grace, W. R., & Co.  
Dow Chemical Company (The)  
Carlisle Coatings & Waterproofing Inc
  2. Unfaced Wall-Insulation Drainage Panels: Extruded-polystyrene board insulation complying with ASTM C 578, Type IV, 25-psi (173-kPa) or Type VI, 40-psi (276-kPa) minimum compressive strength; unfaced; fabricated with shiplap or channel edges and with one side having grooved drainage channels
1. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

## PART 3 - EXECUTION

### 3.1 WATER-RESISTIVE BARRIER INSTALLATION

1. Cover sheathing with water-resistive barrier as follows:
  1. Cut back barrier 1/2 inch (13 mm) on each side of the break in supporting members at expansion- or control-joint locations.
  2. Apply barrier to cover vertical flashing with a minimum 4-inch (100-mm) overlap unless otherwise indicated.
2. Building Paper: Apply horizontally with a 2-inch (50-mm) overlap and a 6-inch (150-mm) end lap; fasten to sheathing with galvanized staples or roofing nails.
3. Building Wrap: Comply with manufacturer's written instructions and warranty requirements.
  1. Seal seams, edges, fasteners, and penetrations with tape.
  2. Extend into jambs of openings and seal corners with tape.

### 3.2 FLEXIBLE FLASHING INSTALLATION

1. Apply flexible flashing where indicated to comply with manufacturer's written instructions.
  1. Lap seams and junctures with other materials at least 4 inches (100 mm) except that at flashing flanges of other construction, laps need not exceed flange width.
  2. Lap flashing over water-resistive barrier at bottom and sides of openings.
  3. Lap water-resistive barrier over flashing at heads of openings.

### 3.3 DRAINAGE MATERIAL INSTALLATION

1. Install drainage material over building wrap and flashing to comply with manufacturer's written instructions.

END OF SECTION 072500



## **SECTION 07 31 26**

### **SLATE ROOFING**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. All plant, labor, materials, equipment, testing and services necessary to complete the work shown on the drawings, schedules, and keynotes, as specified, and as may be required by conditions and authorities having jurisdiction, including, but not limited to, the following:
  - 1. Remove and set aside limited portions of the existing slate to install new flashings.
  - 2. Install a new EPDM and metal flashings.
  - 3. Reinstall the existing slate. Provide additional matching slate as needed to supplement the existing slate. Include an additional 250 pieces of slate in the Base Bid.
- B. Related Requirements
  - 1. Masonry Maintenance - Section 04 01 00
  - 2. Carpentry - Section 06 10 00
  - 3. EPDM Roofing - Section 07 53 23
  - 4. Sheet Metal Flashing & Specialties - Section 07 62 00
  - 5. Roof Accessories - Section 07 72 00

##### **1.3 CODE APPROVAL REQUIREMENTS**

- A. Install roofing and insulation system components to meet the following minimum requirements:
  - 1. New York State Uniform Fire Prevention and Building Code, which includes by reference the New York State Energy Conservation Code.
  - 2. Underwriters Laboratories Inc. Class A External Fire Rating for roof assemblies tested in accordance with ASTM E 108 or UL 790.
  - 3. Underwriters Laboratories Inc. Standard 1256 for roof assemblies with foam insulation.

## 1.4 QUALITY ASSURANCE

### A. Installer Qualifications:

1. A firm (Installer) with at least 5 continuous years experience performing work similar to that required for this project, employing personnel skilled in the work specified.
  - a. The Installer shall directly employ the personnel performing the work of this section.
  - b. The Installer shall have a full time supervisor on the roof when work is in progress. The Supervisor shall have a minimum of 5 years experience with work similar in nature and scope to this project, and speak fluent English.
    - i. Submit the supervisor's resume upon request.
2. The Installer shall provide a reference list of at least three previously completed projects of comparable size and similar design within a fifty mile radius of this project, which may be observed by representatives of the Owner:
  - a. The reference list shall include at a minimum, the completion date, a description of the work performed, the Owner's name - contact person - phone number and address and the Architect's name - contact person and phone number.
  - b. Submit the reference list upon request.
3. The Installer shall be acceptable to or licensed by the Manufacturer of the primary roofing materials, and provide written certification from the Manufacturer to confirm this prior to award if requested.

B. Material Quality: Obtain each product, including vapor barrier, insulation, cover board, roof and flashing sheets, and the cements, primers and adhesives from a single Manufacturer which has manufactured the same products in the United States of America for not less than 5 continuous years.

C. Material Quality: Obtain each type of material from a single source to ensure consistent quality, color, pattern, and texture.

## 1.5 PRE-CONSTRUCTION CONFERENCE

- A. Meet at the project site approximately two weeks prior to starting work, with the Architect, Owner and other representatives to discuss the following:

1. How the building will be kept watertight as old roofing is removed and the work progresses.
2. How new roofing will be coordinated with the installation of new flashings and other items to provide a watertight installation.
3. Generally accepted industry practice and the Manufacturer's instructions for handling and installing his products.
4. The condition of the substrate (deck), curbs, penetrations and other preparatory work needed.
5. Incomplete submittals; note that progress payments will be not processed until all submittals are received and approved.
6. The construction schedule, weather forecast, availability of materials, personnel, equipment and facilities needed to proceed and complete the work on schedule.
7. A schedule for Manufacturer and Architect inspections.

#### 1.6 MOCK-UP SAMPLES

- A. Construct each mock-up where designated on the site to establish the standard of quality and appearance which will be used for the actual roof installation.
- B. Rework the mock-up until the configuration of new slate is approved by the Architect.
- C. Remove rejected mock-ups.

#### 1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Store material on raised platforms.
- B. Keep slate free of ice and snow. Store slate on pallets as shipped from the Manufacturer, stacked on edge and supported at quarter points on wood runners.
- C. Keep all other material dry until installed. Store rolled goos on end. Replace material which gets wet or damaged.
- D. Do not overload the structure when storing materials on the roof.

#### 1.8 GUARANTEE

- A. Provide a Contractor's written Guarantee which warrants that all work will remain free of material and workmanship defects and in a watertight condition for a five year period beginning upon Final Completion:

1. Defective work includes but is not limited to the following types of failure: leakage, delamination, lifting, loosening, splitting, cracking, and undue expansion.
- B. The Guarantee shall provide that the Contractor will make the repairs and modifications necessary to enable the work to perform as warranted at his own expense:
  1. The Guarantee shall include the removal and replacement of items or materials installed with the slate as part of the original work, if removal is needed to effect guaranteed repairs.
- C. The Guarantee shall be issued no more than 30 days before the satisfactory completion of punch list work.

## PART 2 - PRODUCTS

- A. Ice and Water Shield: 30 mil thick polyethylene backed high temperature synthetic rubber-based adhesive coated membrane with a release paper for peel and stick application directly to the prepared roof deck: Grace Ultra Ice and Water Shield.
- B. Bituminous Plastic Cement: heavy trowel consistency asbestos free grade, Federal Specification SS-C-153B, Type 1.
- C. Fasteners:
  1. Felt - galvanized steel or aluminum cap nails with galvanized or plastic caps.
  2. Slate - 10 gauge hard copper roofing nails with a annular ringed shank, and a large head, long enough to penetrate into the deck a minimum of 1 inch - minimum length 1-3/4 inches.
- D. Slate: Clear Vermont slate
  1. Minimum thickness 1/4 inch, and thicker as required to match the existing slate.
  2. Color to match the existing slate.
  3. Slate shall have quarry punched nail holes.

## PART 3 - EXECUTION

### 3.1 PREPARATION



- A. Remove the existing slate and set good, sound slate aside for reuse. Remove existing underlayment and all protruding nails, mastic and other material which may affect the installation of new materials.
- B. Carefully inspect the roof deck to confirm it is suitable for the installation of new materials. Notify the Architect if defects are present. Maintain the building watertight in the interim, but do not permanently install new ice & water shield until the defects have been corrected.
- C. Replace rotted sections of wood decking in accordance with the Unit Price Bid.

### 3.2 ICE AND WATER SHIELD

- A. Install ice & water shield on dry surfaces only, and when the temperature is at least 40 F degrees.
- B. Install ice & water shield fully adhered to the sheathing surface and lapped over the metal drip edge to shed water at all roof eaves and over the EPDM gutter lining, extending from the eave up the slope at least 3 feet or over the entire roof where shown.
- C. Overlap ends at least 4 inches; overlap plies at least 3 inches.

### 3.3 SLATE INSTALLATION

- A. General:
  - 1. Protect underlayment material from damage until covered with slate. Do not apply slate over wet underlayment. Utilize chalk lines and lay slate with straight courses and a uniform exposure. Lay slate with a minimum 3 inch head lap.
  - 2. Fit slate neatly around pipes, ventilators and other projections in roof.
  - 3. Extend slate to overhang 1-1/2 inches at the eaves and 1 inch at the gable ends.
  - 4. Nail each slate with two copper nails. Drive the nails until the undersides of the heads just make contact with the slate surface. Do not strain slates.
  - 5. Install cedar or redwood lath strips cut from solid lumber to begin slate coursing.
  - 6. Install a starter course slate, equal in length to the exposure plus 3 inches, at eaves and cornice lines.
  - 7. Offset joints between rows of slate as close to the center of the slate as possible, but not less than 3 inches.

8. At transition with existing slates install the new slate under the exiting slates and nail it with two nails spaced approximately 1-1/2 inches apart through the top of the vertical joint of the slates in the overlying course.
9. Cover the nails with a copper “bib” (a piece of copper approximately 3 inches wide by 8 inches long) slid under the overlying course of slate, positioned to cover the nails.
  - a. Bend the piece of copper into an flattened “S” shape prior to installation, to insure it will remain in place.
  - b. Do not use slate hooks or copper tabs to secure replacement slate.

B. Localized Replacement:

1. Perform localized slate replacement to restore the roof to functional condition. Slates having small chips, missing corners smaller than 3/4 inch in all dimensions, and other cosmetic imperfections need not be replaced.
2. Remove individual broken slates by cutting the nails with a ripper; then remove any remaining small pieces of slate.
3. Insert the new slate and nail it with two nails spaced approximately 1-1/2 inches apart through the top of the vertical joint of the slates in the overlying course.
4. Cover the nails with a copper “bib” (a piece of copper approximately 3 inches wide by 8 inches long) slid under the overlying course of slate, positioned to cover the nails.
  - a. Bend the piece of copper into an flattened “S” shape prior to installation, to insure it will remain in place.
  - b. Do not use slate hooks or copper tabs to secure replacement slate.

### 3.4 CLEANING, PROTECTION AND WATERTIGHTNESS

- A. Inspect the interior and exterior of the building and grounds, and submit a written report with photos to document any existing leaks or damage, prior to performing any work on site.
- B. The Owner will conduct a similar inspection at the completion of the work, and the Contractor will be charged for all leaks and damage that weren’t documented in the Contractor’s report, or repaired to the Owners satisfaction at the Contractor’s expense.
- C. Provide any equipment, material and labor necessary to protect the site, the building, its contents and occupants, pedestrians, and surrounding landscaped

and paved areas from damage due to the construction work or from inclement weather during construction.

- D. Do not perform work during inclement weather. Protect incomplete work and the building from damage by inclement weather - which may occur unexpectedly. Make all work areas watertight at the end of each day's work.
- E. Clean up all litter, refuse, rubbish, scrap materials and debris at least twice a day; at noon and at the end of the work day, so the roof and site presents a neat, orderly and workmanlike appearance. Place the debris in a dumpster, and remove the dumpster from the site as soon as it is full or no longer being used.
- F. Carefully and thoroughly clean the entire roof to remove all residual debris when all work is complete. After cleaning the roof, thoroughly clean all drain sumps, drain lines, leader heads and leaders. Do not allow debris to enter the drainage system.

END OF SECTION 07 31 15



## 074200

### **METAL WINDOW PANELS**

#### PART 1 - GENERAL

##### 1.01 □ Summary

1. Panels consist of metal skins laminated to stabilizer substrates with an insulating core material. Panels are designed to be glazed into a window system or curtain wall system.
2. Related Work
  1. Section 089000 - Storefront/Curtain Wall
  2. Section 092900 - Interior Wall Finish

##### 1.02 - Quality Assurance

1. Panel manufacturer shall have a minimum of 25 years experience.
2. Field measurements shall be taken prior to completion of manufacturing and cutting.
3. Maximum deviation from vertical and horizontal alignment of installed panels is 1/8" (3mm) in 20' (6m) non-commutative.

##### 1.03 □ References

1. American Society of Testing Materials (ASTM)
  - A. E330-84: Structural Performance of Exterior Windows, Curtain Walls and Doors under the influence of wind loads.
  - B. D1781-76: Climbing Drum Peel Test for Adhesives.
  - C. D3363-74: Method for Film Hardness by Pencil Test.
  - D. D2794-90: Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
  - E. D3359-90: Method for Measuring Adhesion by the tape test.

##### 1.04 □ Substitutions

1. The materials and products specified in this section establish a minimum standard of required function, design, appearance quality and warranty to be met by any proposed substitution.
2. No substitutions will be considered unless a written request for approval has been submitted by the bidder and received by the architect 10 days prior to the bid date.

## 1.05 □ Submittals

### Product Data and Samples.

1. Samples:
  - A. Panel makeup - 2 samples - 10"x10"
  - B. Two samples of each color and finish texture - 3"x5"
2. Submission Drawings: Indicate thickness, dimension and components of parts. Detail glazing methods, framing and tolerances to accommodate thermal movement.
3. Affidavit certifying materials meet all requirements as specified.
4. 2 copies of manufacturers standard literature for specified material.

## 1.06 - Delivery, Storage and Handling

1. Protect finish and edge in accordance with panel manufacturer's recommendations.
2. Store materials in accordance with panel manufacturer's recommendations.

## PART 2 - PRODUCTS

### 2.01 - Panels □ Laminated

1. Laminated metal faced Mapes Shield panels as manufactured by Mapes Industries, Inc. as Bases of Design
2. Acceptable alternatives: Panels having similar composite construction and finish providing manufacturer has a minimum of 25 years panel laminating experience and comparable published warranties.

### 2.02 □ Finish

1. Finishes
2. Exterior: Standard Kynar
3. Interior: Standard Kynar
4. Color as selected by architect.

### 2.03 - Panel Fabrication

1. Bullet Resistant Layer: UL Level as described by Architect.
2. Cores: Polyisocyanurate
3. Interior Substrate: Tempered Hardboard
4. Tolerances - .8% of panels dimension length and width - (+/-) 1/16" thickness
5. Panel Thickness - 1"

6. R-Value - 3.56
7. U-Value - 0.28

#### 2.04 □ Accessories

1. Recommended for use as an infill panel component in window and curtain wall systems. Related material to complete installation as recommended by the manufacturer.
2. Seals against moisture intrusion as recommended by the manufacturer. Polyurethane and silicone based sealant with a 20 year life are recommended.

### PART 3 - EXECUTION

#### 3.01 □ Installation

1. Panel surfaces shall be free from defects prior to installation.

#### 3.02 □ Execution

1. Erect panels plumb, level and true.
2. Glaze panels securely and in accordance with approved shop drawings and manufacturers instructions to allow for necessary thermal movement and structural support.
3. Do not install panels that are observed to be defective including warped, bowed, dented, scratched and delaminating components.
4. Weatherseal all joints as required using methods and materials as previously specified.
5. Separate dissimilar metals using gasketed fasteners and blocking to eliminate the possibility of electrolytic reaction.

#### 3.03 - Adjusting and Cleaning

1. Remove masking film as soon as possible after installation. Masking intentionally left in place after panel installation will be the responsibility of the contractor.
2. Weep holes and drainage channels must be unobstructed and free from dirt and sealant.

END OF SECTION 074200





**SECTION 074213.19**  
**INSULATED CORE METAL WALL PANELS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Foamed-insulation-core vertical metal wall panel assembly, with related metal trim and accessories.

**1.2 RELATED REQUIREMENTS**

- A. Division 07 Section "Joint Sealants" for field-applied joint sealants.

**1.3 REFERENCES**

A. American Architectural Manufacturers Association (AAMA):

- 1. AAMA 621 - Voluntary Specification for High Performance Organic coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates.

B. American Society of Civil Engineers (ASCE):

- 1. ASCE 7 - Minimum Design Loads for Buildings and Other

Structures.

C. ASTM International (ASTM):

- 1. ASTM A 653/A 653M - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc/Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- 2. ASTM A 755/A 755M - Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
- 3. ASTM B 117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.
- 4. ASTM C 920 - Specification for Elastomeric Joint Sealants.
- 5. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus.

6. ASTM D 968 - Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive.
7. ASTM D 4585 - Standard Practice for Testing Water Resistance of Coatings Using Controlled Condensation.
8. ASTM D 4587 - Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings.
9. ASTM E 72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
10. ASTM E 84 - Test Methods for Surface Burning Characteristics of Building Materials.
11. ASTM E 119 - Test Methods for Fire Tests of Building Construction and Materials.
12. ASTM E 283 - Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences across the Specimen.
13. ASTM E 330 - Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
14. ASTM E 331 - Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
15. ASTM G 154 - Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials.

D. Factory Mutual Global (FMG):

1. ANSI/FMG 4880 Standard for Evaluating Insulated Wall & Roof/Ceiling

Assemblies.

E. Sheet Metal and Air Conditioning Contractors National Association, Inc.

(SMACNA):

1. Architectural Sheet Metal

Manual.

F. Underwriters Laboratories, Inc. (UL):

1. UL 263 - Fire Tests of Building Construction and Materials.
2. UL 723 - Test for Surface Burning Characteristics of Building Materials.
3. Fire Resistance Directory.

## 1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide metal wall panel system meeting performance requirements as determined by application of specified tests by a qualified testing agency on manufacturer's standard assemblies.
- B. Air Infiltration: Maximum 0.03 cfm/sq. ft. (0.3 L/s per sq. m) per ASTM E 283 at a static-air pressure difference of 6.24 lb. /sq. ft. (299 Pa).
- C. Water Penetration, Static Pressure: No uncontrolled water penetration per ASTM E 331 at a minimum static differential pressure of 10 lb./sq. ft. (479 Pa).
- D. Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects of indicated loads and stresses within limits and under conditions indicated, per ASTM E 72:
  - 1. Wind Loads: Determine loads based on uniform pressure, importance factor, exposure category, and basic wind speed indicated on drawings.
  - 2. Seismic Performance: Comply with ASCE 7 Sections 11 - 23, "Seismic".
- E. Thermal Movements: Allow for thermal movements from variations in both ambient and internal temperatures. Accommodate movement of support structure caused by thermal expansion and contraction.
- F. Thermal Performance: Thermal-resistance (R) value indicated, per ASTM C 1363, corrected for air film with dynamic wind perpendicular to panel and still air inside.
- G. Fire Performance Characteristics: Provide metal wall composite wall systems that comply with the performance requirements of Chapter 26 Plastic of the International Building Code.

## 1.5 QUALITY ASSURANCE

- A. Manufacturer/Source: Provide metal wall panel assembly and accessories from a single manufacturer.
- B. Manufacturer Qualifications: Approved manufacturer listed in this Section with minimum 5 years' experience in manufacture of similar products in successful use in similar applications.

1. Approval of Comparable Products: Submit the following in accordance with project substitution requirements, within time allowed for substitution review:
    - a. Product data, including certified independent test data indicating compliance with requirements.
    - b. Samples of each component.
    - c. Sample submittal from similar project.
    - d. Project references: Minimum of 5 installations not less than 5 years old, with Owner and Architect contact information. Sample warranty.
  2. Substitutions following award of contract are not allowed except as stipulated in Division 01 General Requirements.
  3. Approved manufacturers must meet separate requirements of Submittals Article.
- C. Installer Qualifications: Experienced Installer with minimum of 5 years' experience with successfully completed projects of a similar nature and scope.
- D. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as specified in Division 07 Section "Joint Sealants."

## 1.6 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Prior to erection of wall framing, conduct preinstallation meeting at site attended by Owner, Architect, manufacturer's technical representative, and other trade contractors.
1. Coordinate building framing in relation to Metal Wall Panel system.
  2. Coordinate windows, doors, and other openings and penetrations of metal wall panel system.

## 1.7 ACTION SUBMITTALS

- A. Product Data: Manufacturer's data sheets for specified products.
- B. Shop Drawings: Provide shop drawings prepared by manufacturer or manufacturer's authorized dealer. Include full elevations showing openings and penetrations. Include details of each condition of installation and attachment. Provide details at a minimum scale 1-1/2-inch per foot of all required trim and extrusions needed for a complete installation
1. Include data indicating compliance with performance requirements.

2. Indicate points of supporting structure that must coordinate with metal wall panel system installation.
  3. Include structural data indicating compliance with performance requirements.
- C. Samples for Initial Selection: For each product specified including sealants and gaskets. Provide representative color charts of manufacturer's full range of colors.
- D. Samples for Verification: Provide 12-inch- (305 mm-) long section of metal wall panel showing finishes, vertical joint return, injected core material, and anchoring details. Provide 12-inch- (305 mm-) long pieces of each extruded aluminum trim and gaskets.

## 1.8 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Indicating compliance of products with requirements, from a qualified independent testing agency.
- B. Buy American Act Certification: Submit documentation certifying that products comply with provisions of the Buy American Act 41 U.S.C 10a - 10d.
- C. Qualification Information: For Installer firm and Installer's field supervisor.
- D. Manufacturer's warranty: Submit sample warranty.

## 1.9 CLOSEOUT SUBMITTALS

- A. Maintenance data.

## 1.10 DELIVERY, STORAGE, AND HANDLING

- A. Protect products of metal wall panel system during shipping, handling, and storage to prevent staining, denting, deterioration of components or other damage. Protect panels and trim bundles during shipping with protective wrap. Protect painted surfaces with a strippable protective covering before shipping.
  1. Deliver, unload, store, and erect metal wall panel system and accessory items without misshaping panels or exposing panels to surface damage from weather or construction operations.
  2. Store in accordance with Manufacturer's written instruction.

## 1.11 WARRANTY

- A. Special Panel Finish Warranty: On manufacturer's standard form, in which manufacturer agrees to repair or replace wall panels that evidence deterioration of finish within 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 SYSTEM DESCRIPTION

- A. Insulated Core Metal Wall Panel System: Factory-foamed-in-place vertical wall panel system consisting of an exterior metal face sheet with interior metal liner panel, bonded to factory foamed-in-place core in thermally-separated profile, with factory sealed tongue-and-groove side joint, attached to supports using concealed fasteners.

### 2.2 MANUFACTURERS

- A. Basis of Design: CENTRIA Versawall Insulated Core Metal Wall Panels. Provide basis of design product or comparable product approved by Architect prior to bid.

- 1. CENTRIA Architectural Systems; Moon Township, PA 15108-2944. Tel: (800)759-7474. Web: [www.centria.com](http://www.centria.com).

### 2.3 PANEL MATERIALS

- A. Metallic Coated Steel Sheet: Zinc-Coated (Galvanized) Steel Sheet ASTM A 653/A 653M, Grade 37, G90, structural quality coil coated per ASTM A 755/A 755M.

- B. Exposed Coil-Coated Finish:

- 1. Fluoropolymer Two-Coat System: 0.8 mil primer with 0.8 mil 70 percent PVDF fluoropolymer color coat, AAMA 621.

Basis of Design: CENTRIA Duragard.

- 2. Color: As selected by Architect from manufacturer's standard colors.

- C. Interior Face Sheet Coil-Coated Finish System: 0.2 mil primer with 0.6 mil acrylic color coat.

### 2.4 INSULATION FOR PANEL CORES

- A. Metal Panel Foamed-Insulation Core: Closed cell, isocyanurate foam using a non-CFC blowing agent, foamed-in-place type.
  - 1. Density: 2.4-2.7 lb./cu. ft. (43.3 kg/cu. m).
  - 2. Shear stress: 20 lb./sq. in. (138 kPa).
  - 3. Compressive strength: 20 lb./sq. in. (138 kPa).
  - 4. Tensile strength: 20 lb./sq. in. (138 kPa).

## 2.5 FOAMED-INSULATION-CORE METAL WALL PANELS

- A. Concealed Fastener, Foamed-Insulation-Core Metal Wall Panels: Factory-foamed vertical wall panel system consisting of an exterior metal face sheet with interior metal liner panel, bonded to factory foamed-in-place core in thermally-separated profile, with no glues or adhesives, and with factory sealed double tongue-and-groove joint, attached to supports using concealed fasteners.
  - 1. Exterior Face Sheet:
    - a. Metal Thickness: 0.030 inch/22 gage (0.76 mm)
    - b. Surface: Striated, refer to Architects sample
  - 2. Interior Face Sheet:
    - a. Thickness: 0.019 inch/26 gage (0.48 mm)
    - b. Surface: Embossed, Planked.
  - 3. Panel Width: 30 inch (762 mm)
  - 4. Panel Thickness and Thermal Resistance (R) Value: 2.0 inch (51 mm), R-14 per ASTM C 1363.
  - 5. Panel Sealant/Vapor Seal: Factory-applied non-curing butyl.

## 2.6 METAL WALL PANEL ACCESSORIES

- A. General: Provide complete metal wall panel assembly incorporating trim, copings, fasciae, parapet caps, soffits, sills, inside and outside corners, and miscellaneous flashings. Provide manufacturer's factory-formed clips, shims, flashings, gaskets, lap tapes, closure strips, and caps for a complete installation. Fabricate and install accessories in accordance with SMACNA Manual.
- B. Formed Flashing and Trim: Match material, thickness, and finish of the metal wall panel face sheet.

- C. Extrusion Trim: Provide manufacturer-provided extruded trim for the following locations and as indicated on Drawings:
  - 1. Base trim.
  - 2. Coping.
  - 3. Panel installation perimeter.
  - 4. Opening perimeters.
- D. Sealants: Type recommended by metal wall panel system manufacturer for application, meeting requirements of Division 07 Section "Joint Sealants."
- E. Panel Clips: Concealed galvanized steel clip configured specifically for metal wall panel profile, engaging face and liner panel edge without compressing panel insulation.
- F. Fasteners: Self-tapping screws, bolts, nuts, and other acceptable fasteners recommended by panel manufacturer. Where exposed fasteners cannot be avoided, supply corrosion-resistant fasteners with heads matching color of metal wall panels.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine metal wall panel system substrate with Installer present. Inspect for erection tolerances and other conditions that would adversely affect installation of metal wall panels.
- B. Wall Substrate: Confirm that wall substrate is within tolerances acceptable to metal wall panel system manufacturer.
  - 1. Maximum deviations acceptable:
    - 3/8 inch (9.5 mm) in 20 foot (610 cm) vertically or horizontally from face plane of framing.
    - 3/4 inch (19 mm) on any building elevation. Within 1/8" in transition areas.
- C. Framing: Inspect framing that will support metal wall panels to determine if support components are installed as indicated on approved shop drawings. Confirm presence of acceptable framing members at recommended spacing to match installation requirements of metal wall panels.



- D. Openings: Verify that louvers and other penetrations match layout on shop drawings.
- E. Advise G.C., in writing, of all out- of-tolerance work and other deficient conditions prior to proceeding with metal wall panel installation.
- F. Correct out of tolerance work and other deficient conditions prior to proceeding with insulated composite backup panel installation.

### 3.2 METAL WALL PANEL SYSTEM INSTALLATION

- A. General: Install metal wall panel system in accordance with approved shop drawings and manufacturer's recommendations. Install metal wall panels in orientation, sizes, and locations indicated. Anchor metal wall panels and other components securely in place. Provide for thermal and structural movement
- B. Attach panels to metal framing using recommended clips, screws, fasteners, sealants, and adhesives indicated on approved shop drawings.
  - 1. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as approved by manufacturer.
  - 2. Fasten metal wall panels to supports with concealed clips at each joint at location, spacing, and with fasteners recommended by manufacturer. Install clips to supports with self-tapping fasteners.
  - 3. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.
  - 4. Dissimilar Materials: Where elements of metal wall panel system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by manufacturer.
- C. Joint Sealers: Install joint fillers and sealants where indicated and where required for weatherproof performance of metal wall panel assemblies.
  - 1. Seal panel end utilizing 2 beads of non-curing butyl; apply continuously without gaps to complete panel system air barrier.
  - 2. Seal metal wall panel to supports or back-up flashing sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
  - 3. Prepare joints and apply sealants per Division 07 Section "Joint Sealants."

### 3.3 ACCESSORY INSTALLATION

*Rye City School District*

High School/Middle School    *INSULATED CORE METAL WALL PANELS*    074213.19 - 9

- A. General: Install metal wall panel accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
  - 1. Install related flashings and sheet metal trim of Division 07 Section
  - 2. Install components required for a complete metal wall panel assembly, including trim, copings, corners, flashings, sealants, gaskets, fillers, closure strips, and similar items.
  - 3. Comply with performance requirements and manufacturer's written installation instructions.
  - 4. Provide concealed fasteners except where noted on approved shop drawings.
  - 5. Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

### 3.4 FIELD QUALITY CONTROL

- A. The panel installer shall water test panel areas for each crew at least twice during installation schedule and once at the conclusion of the installation.
- B. Progress or check tests can be performed by the installer following test procedures noted in AAMA 501.2. No independent test agency need to be employed in this test phase. Results of this test phase is to be recorded and reported to the panel manufacturer.
- C. Final AAMA 501.2 testing will be conducted by an independent test agency following project completion. Areas of test are to be determined by the Architect/Engineer and General Contractor/Contract Manager and the panel installer. Engagement of the test agency is the responsibility of the panel installer. A field representative from the panel manufacturer is required for the final inspection and testing.

### 3.6 CLEANING AND PROTECTION

- A. Remove temporary protective films. Clean finished surfaces as recommended by metal wall panel manufacturer. Clear weep holes and drainage channels of obstructions, dirt, and sealant. Maintain in a clean condition during construction.
- B. Replace damaged panels and accessories that cannot be repaired by field repair.

END OF SECTION

## **SECTION 07 53 23**

### **EPDM ROOFING**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. All plant, labor, materials, equipment, testing and services necessary to complete the work shown on the drawings, schedules, and keynotes, as specified, and as may be required by conditions and authorities having jurisdiction, including, but not limited to, the following:
  - 1. Inspect the underside of the roof deck before starting work, and periodically each day as work occurs, to determine if there are conduits, pipes, ceiling hangers or fixtures next to the deck or fastened to the deck that could be affected as roof work occurs.
    - a. Perform roof removal work so any conduits, pipes, ceiling hangers or fixtures are not disturbed.
    - b. Replace and reset any conduits, pipes, ceiling hangers or fixtures that are affected by the work.
  - 2. Remove and dispose of existing gravel surfacing, roofing, insulation, the vapor barrier, underlayment, wood blocking, and flashing.
    - a. Clean all residual material from the surface of the decks.
    - b. The work may include removing asbestos containing roofing materials. Refer to the asbestos abatement specification for additional information and asbestos removal requirements.
  - 3. Install a new fully adhered unreinforced 60 mil thick EPDM roofing system, including a vapor barrier on the concrete decks, insulation, cover board, flashing, stripping and related accessories.
  - 4. Provide miscellaneous mechanical, electrical, hoisting and other work needed, and remove, adjust, modify, reset and reconnect all roof-mounted and roof-penetrating equipment.

5. Install new flashings at the roof drains, and all roof-mounted and roof-penetrating equipment.
6. Disconnect and remove abandoned mechanical equipment and curbs, and infill the roof deck.
7. Repair deterioration less than 1/2 inch deep in the surface of the existing concrete / gypsum / structural wood fiber plank deck as Base Bid work.
8. Replace deteriorated portions of existing deck in accordance with the Unit Prices.
9. Cover new rooftop ductwork with isocyanurate insulation and fully adhered unreinforced EPDM. Configure the insulation so the top surfaces slopes for drainage. Install acrylic color coating on the EPDM duct wrap.
10. Install new EPDM flashings at new equipment curbs on existing EPDM roofs. Refer to the Mechanical Drawings for the locations, types and quantities of new equipment.
11. Protect roof surfaces where material and equipment is placed on them, and where construction traffic occurs, with 6 mil fire retardant polyethylene covered with 1-1/2 inch thick foam insulation, overlaid with 2 by 10 wooden planks.

B. Related Requirements

- |                                       |                    |
|---------------------------------------|--------------------|
| 1. Masonry Maintenance                | - Section 04 01 00 |
| 2. Carpentry                          | - Section 06 10 00 |
| 3. Sheet Metal Flashing & Specialties | - Section 07 62 00 |
| 4. Roof Accessories                   | - Section 07 72 00 |

### 1.3 CODE APPROVAL REQUIREMENTS

- A. Install roofing and insulation system components to meet the following minimum requirements:
1. New York State Uniform Fire Prevention and Building Code, which includes by reference the New York State Energy Conservation Code.
  2. Underwriters Laboratories Inc. Class A External Fire Rating for roof assemblies tested in accordance with ASTM E 108 or UL 790.
  3. Underwriters Laboratories Inc. Standard 1256 for roof assemblies with foam insulation.
  4. Minimum wind uplift pressure calculated using ASCE 7 and a safety factor of 2:

- a. Field Zone - 60 psf
  - b. Perimeter Zones - 100 psf
  - c. Corner Zone - 150 psf
- B. Provide written certification from the roof material Manufacturer, before beginning work, to confirm the roofing system meets these requirements.

#### 1.4 QUALITY ASSURANCE

##### A. Installer Qualifications:

- 1. A firm (Installer) with at least 5 continuous years experience performing work similar to that required for this project, employing personnel skilled in the work specified.
    - a. The Installer shall directly employ the personnel performing the work of this section.
    - b. The Installer shall have a full time supervisor on the roof when work is in progress. The Supervisor shall have a minimum of 5 years experience with work similar in nature and scope to this project, and speak fluent English.
      - i. Submit the supervisor's resume upon request.
  - 2. The Installer shall provide a reference list of at least three previously completed projects of comparable size and similar design within a fifty mile radius of this project, which may be observed by representatives of the Owner:
    - a. The reference list shall include at a minimum, the completion date, a description of the work performed, the Owner's name - contact person - phone number and address and the Architect's name - contact person and phone number.
    - b. Submit the reference list upon request.
  - 3. The Installer shall be acceptable to or licensed by the Manufacturer of the primary roofing materials, and provide written certification from the Manufacturer to confirm this prior to award if requested.
- B. Material Quality: Obtain each product, including vapor barrier, insulation, cover board, roof and flashing sheets, and the cements, primers and adhesives from a single Manufacturer which has manufactured the same products in the United States of America for not less than 5 continuous years.
- C. Material Quality: Obtain each type of material from a single source to ensure consistent quality, color, pattern, and texture.

## 1.5 PRE-CONSTRUCTION CONFERENCE

- A. Meet at the project site approximately two weeks prior to starting work, with the Architect, Owner and other representatives to discuss the following:
  - 1. How the building will be kept watertight as old roofing is removed and the work progresses.
  - 2. How new roofing will be coordinated with the installation of the vapor barrier, insulation, cover board, flashings and other items to provide a watertight installation.
  - 3. Generally accepted industry practice and the Manufacturer's instructions for handling and installing his products.
  - 4. The condition of the substrate (deck), curbs, penetrations and other preparatory work needed.
  - 5. Incomplete submittals; note that progress payments will be not processed until all submittals are received and approved.
  - 6. The construction schedule, weather forecast, availability of materials, personnel, equipment and facilities needed to proceed and complete the work on schedule.
  - 7. A schedule for Manufacturer and Architect inspections.

## 1.6 SUBMITTALS

- A. Submit the following items far enough in advance to obtain approval prior to performing any work on site:
  - 1. A pre-work site and building inspection report with photos to document conditions before work starts.
  - 2. Written certification from the Manufacturer which states that the Installer is acceptable or licensed to install the specified roofing; if not previously provided.
  - 3. Manufacturer's technical literature for all materials.
  - 4. Samples of the Contractor's Guarantee and Manufacturer's warranty forms.
  - 5. Test reports and certifications substantiating compliance with specification requirements if requested by the Architect.
- B. Simultaneously provide all technical submittals needed for this project, for all technical sections, collated by section. Incomplete submittals will not be reviewed.

1. Submittals shall be prepared and made by the firm that will perform the actual work.
  2. Provide electronic submittals via an on-line submittal exchange program if one is established for this project; if an on-line program isn't established, provide the submittals on portable USB drives in pdf format, organized in folders by Section.
- C. Safety Data Sheets: Simultaneously provide all Safety Data Sheets needed for this project, for all specification sections - collated by section, in three ring binders. Provide two binders.
- D. Payment requisitions will not be processed until all submittals are received and approved.

#### 1.7 JOB CONDITIONS (CAUTIONS & WARNINGS)

- A. Do not use oil or solvent based roof cement with EPDM roofing. Do not allow waste products, (petroleum grease or oil, solvents, vegetable or mineral oil, animal fat) or direct steam venting to come in contact with any roofing, insulation or flashing product. Do not expose EPDM roofing and accessories to a temperature in excess of 175 degrees Fahrenheit.
- B. Splice cleaner, primer, cements and bonding adhesives are flammable. Do not breathe vapors or use near fire or flame or in a confined or unventilated area. Dispense only from a UL listed safety can or the Manufacturer's original container.
- C. Remove empty adhesive, cleaner and solvent containers and contaminated rags from the roof and legally dispose of them daily.
- D. Do not apply primer, cleaners or adhesives next to ventilation system louvers or windows. Temporarily cover the louvers and windows with 6 mil fire retardant polyethylene and prevent odors from entering the building. Remove temporary covers at the end of each days work.

#### 1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver material to the site in the Manufacturer's original and unopened packaging, with intact and legible labels which identify the products and Manufacturers,
- B. Cover all stored materials, except rolls of EPDM and sealed cans of adhesives, with watertight tarpaulins installed immediately upon delivery.
- C. Immediately remove insulation which gets wet from the job site.

- D. Store and install all material within the Manufacturer's recommended temperature range.
- E. Do not overload the structure when storing materials on the roof.
- F. Protect roof surfaces where material and equipment is placed on them, and where construction traffic occurs, with 6 mil fire retardant polyethylene, covered with 1-1/2 inch thick foam insulation, overlaid with 2 by 10 wooden planks.

## 1.9 GUARANTEE AND WARRANTY

- A. Provide a written Manufacturer's Full System Warranty which warrants that the roofing system, including the insulation, cover board, EPDM roofing and flashings, will remain in a watertight condition for a 20 year period, beginning upon Final Completion.
  - 1. Guarantee coverage shall remain in effect for gust wind speeds up to 72 miles per hour, measured at ground level at the site.
  - 2. Guarantee coverage shall have no dollar value limit.
- B. Provide a written Contractor's Guarantee which guarantees that all work will remain free of material and workmanship defects and in a watertight condition for a five year period beginning upon Final Completion:
  - 1. Defects include but are not limited to the following: leakage, adhesive separation, delamination, lifting, loosening, splitting, cracking, joint separation, movement and undue expansion or shrinkage.
  - 2. The Contractor shall make the repairs and modifications necessary to enable the work to perform as guaranteed at his own expense:
  - 3. Guarantee coverage shall include removing and replacing materials installed as part of the original work, if removal is needed to affect guaranteed repairs.
  - 4. Guarantee coverage shall remain in effect for gust wind speeds up to 72 miles per hour, measured at ground level at the site.
  - 5. Guarantee coverage shall have no dollar value limit.
- C. Provide one Contractor's Guarantee that covers "all work performed" when a single contractor is awarded work specified in multiple Sections.
- D. The Manufacturer's Warranty and Contractor's Guarantee shall take effect no more than 30 days before the completion of all punch list work.



- E. The Contractor's Surety Company may add a rider to the Performance Bond which clarifies that Performance Bond Coverage expires two years after Final Completion; i.e., Performance Bond Coverage does not run for the entire five year term of the Contractor's Guarantee.
- F. Guarantee and Warranty coverage may be cancelled, for the affected portion of the roof, if the work is damaged by winds in excess of 72 mph, by hail, lightning, insects or animals, by failure of the structural substrate, by exposure to harmful chemicals, by other trades on the roof, or by vandalism, or if the Owner fails to maintain the roof in accordance with, or makes roof alterations contrary to, the Manufacturer's printed recommendations.
  - 1. Guarantee and Warranty coverage shall be reinstated, for the remainder of the original period; if the Owner restores the roof to the condition it was in prior to the damage occurring.

#### 1.10 SUBSTITUTIONS

- A. The following factors will be considered when evaluating a possible alternative to the roofing system specified:
  - 1. The wording and intent of the warranty to be issued.
  - 2. The financial status, numbers of years in business, and stability of the entity that will issue the warranty.
  - 3. A reference list of at least five completed similar projects of comparable size, with a successful functional history of at least five years, within an approximate fifty mile radius of the Project.
  - 4. Technical aspects of the system, especially relating to durability, serviceability and performance.
  - 5. The Manufacturer's ability and history providing technical support, on-site inspections and in progress assistance.
  - 6. The availability and experience of local authorized applicators to install and maintain the proposed alternate system.
  - 7. The Manufacturer's willingness and history responding to warranty claims previously made by the Owner, Architect or Consultant's involved in this project.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. EPDM roof system components are specified as products of Firestone Building Products Company to establish a standard of quality. Equal products and systems from Carlisle SynTec will be accepted.
- B. Primary products required for this project include:
  1. Vapor barrier
  2. Cover board
  3. EPDM roofing
  4. Primers and adhesives
  5. Sealants
  6. EPDM flashing
  7. Fasteners
  8. Acrylic coating

## 2.2 EPDM

1. Unreinforced 60 mils thick, fire retardant, EPDM (Ethylene Propylene Diene Monomer) sheet membrane conforming to the following minimum physical properties.

| PROPERTY                | TEST METHOD | SPECIFICATION                               |
|-------------------------|-------------|---|
| Color                   | —           | Gray/Black                                  |
| Tensile Strength        | ASTM D-412  | 1305 psi min.                               |
| Elongation              | ASTM D-412  | 300% min                                    |
| Tear Strength           | ASTM D-624  | 150 lb/in min                               |
| Ozone Resistance        | ASTM D-1149 | No cracks, 7 days/100 pphm/100°F/50% strain |
| Heat Aging              | ASTM D-573  | 1200 psi min@ 200% elongation/4 wks/240°F   |
| Brittleness Temperature | ASTM D-746  | -49°F                                       |
| Water Vapor Permanence  | ASTM E-96   | 2.0 perm max                                |
| Thickness               | ASTM D-412  | 60 mils plus/minus 6 mils                   |
| Fire Retardant          |             | UL Class A                                  |

## 2.3 RELATED MATERIALS

- A. Cleaners, adhesives, sealants, caulking and fasteners furnished by the EPDM system Manufacturer, that comply with low VOC regulations in effect at the time of application.
  1. Stripping: 90 mil thick 5 inch and 9 inch wide self adhering flashing, consisting of 45 mils of semi-cured EPDM factory laminated to 45 mils of cured seaming tape.
  2. Bonding Adhesive: High strength contact adhesive.

3. Splice Adhesive: High strength synthetic polymer based contact cement formulated specifically to splice EPDM sheets.
  4. Lap Sealant: EPDM rubber based gun grade sealant.
  5. Water Block Seal: One component low viscosity butyl rubber sealant.
  6. Pre-Molded Pipe Flashing: Pressure sensitive prefabricated flashings with pre-applied adhesive.
  7. Pourable Sealer: Two component, solvent free polyurethane based sealant.
  8. Reinforced Perimeter Fastening Strips: .030 inch thick reinforced cured EPDM.
  9. Seam Tape Primer: Synthetic rubber polymer based primer designed to clean and prime seam tape splice areas prior to installing the tape.
  10. Seam Splice Tape: Nominal 30 mil thick cured polymer self adhesive tape with release paper carrier, 6 inches wide.
  11. Plates and Bars: Galvanized and corrosion resistant specialty products.
  12. Fasteners: #14 Fluorocarbon polymer coated heavy duty screws.
- B. Primer & Vapor Barrier:
1. Primer: Thin, cut back asphalt meeting ASTM D41.
  2. Vapor Barrier: Fire resistant torch grade SBS modified granular surfaced polyester and glass scrim reinforced cap sheet meeting ASTM D 6163 Type I, Grade G, furnished by the same manufacturer as the EPDM.
- C. Gypsum Cover Board: 1/4 inch thick fire resistant gypsum board decking with inorganic glass mat facers and a water resistant core, formulated in 48 x 48 inch square edge boards, UL Class A, meeting ASTM C-1177, manufactured under the trade name Dens-Deck Prime.
- D. Insulation: Flat and tapered rigid cellular polyisocyanurate boards with fibrous felt/fiberglass mat facers, minimum compressive strength 20 psi, meeting ASTM C1289-01, Type II, Class1, Grade 2, as manufactured by Firestone under the trade name of "ISO 95+ Isocyanurate Insulation". Minimum thickness as shown on the roof plan.
1. Tapered insulation sloping 1/4 inch per foot.
  2. Crickets sloping 1/4 inch per foot.

- E. Tapered edge strips – high density isocyanurate or wood fiberboard strips installed at the drain sumps, and insulation transition points.
- F. Insulation adhesive: Two component low rise polyurethane foam adhesive, installed with a mixing extruding Pace Cart dispenser, or with a pleural heated foam rig, Firestone I.S.O. Adhesive.
  - 1. Use insulation adhesive suitable for application at the intended application temperatures.
  - 2. Do not use twin cartridge “caulking gun” adhesive except on very small isolated sections of roof.
- G. Acrylic Color Coating: Latex based acrylic coating containing 67% solids by weight, resistant to heat, cold water, ozone, ultraviolet rays, and intended for installation on weathered EPDM. Custom color tint as selected by the Architect.
- H. Concrete Grout: Fast setting Portland cement based polymer modified repair mortar as manufactured by The Quikrete Companies, under the trade name Quick-Setting Cement, or equal.

### PART 3 - EXECUTION

#### 3.1 GENERAL

- A. Install the new roofing system in a watertight, workmanlike manner, meeting the guarantee requirements specified herein; in accordance with the drawings and in conformance with the Manufacturer’s requirements, except as enhanced by the drawings and specifications.
- B. Perform work next to roof mounted mechanical equipment, so the work coincides with equipment shutdown periods and does not affect building occupants. Temporarily cover and protect equipment openings, and windows next to the work area, with 6 mil fire retardant polyethylene, so dirt, dust and odors do not enter the equipment or building. Remove covers as soon as the work is complete and at the end of each workday.
- C. Clean substrate surfaces of all laitance, dirt, oil, grease or other foreign matter.
- D. Remove debris daily and as it is generated. Do not stock-pile debris on the roof. Do not leave any debris on the roof at the end of the day. Do not overload the roof structure when moving debris.
- E. Install roof system components on dry surfaces only. Do not install any components when the weather and outside temperatures are not suitable in accordance with the Manufacturer’s recommendations.
- F. Complete all work including the equipment flashings, in sequence as quickly as possible so the smallest area possible is under construction at any one time.

Complete the entire area of work begun each day, the same day, and make all exposed edges watertight at the end of each day's work.

- G. Protect roof surfaces where material and equipment is placed on them, and where construction traffic occurs, with 6 mil fire retardant polyethylene, covered with 1-1/2 inch thick foam insulation, overlaid with 2 by 10 wooden planks.

### 3.2 SUBSTRATE INSPECTION

- A. Remove existing roofing, insulation, flashings, underlayment material, and the vapor barrier as indicated, and carefully check the existing deck to confirm it is to be well secured to the underlying structure and not rotted or otherwise deteriorated.
- B. Immediately notify the Architect and Owner by telephone and in writing if defects in the substrate are discovered.
- C. Maintain the building watertight in the interim, but do not install new roof system components until defects have been corrected.

### 3.3 DECK REPAIR

- A. Concrete deck repairs:
  - 1. Perform repairs to the surface of concrete deck areas, 1/2 inch or less in depth, with quick setting non-shrink grout under the Base Bid.
  - 2. Deterioration greater than 1/2 inch deep shall be brought to the Architects attention for his review and direction.

### 3.4 VAPOR BARRIER

- A. Install primer and a vapor barrier on the concrete decks: install the primer and allow it to dry.
- B. Starting at the low point, torch apply and fully adhere modified bitumen vapor barrier sheets to the primed substrate. Lap sheets at least 4 inches at the ply overlaps and at least 6 inches at the end laps.
- C. Carefully install the vapor barrier sheets to achieve only the minimum required bleed out.
- D. Extend vapor barrier up vertical surfaces at the roof perimeter, and up and around all penetrations and curbs, and seal the vapor barrier to provide continuity of the building air/vapor envelope.

### 3.5 INSULATION AND COVER BOARD

- A. Install insulation neatly cut at all miters and transitions. Do not lace corner boards.
- B. Install insulation with joints offset between rows and layers a minimum of 12 inches. Cut insulation to fit neatly at penetrations and joints. Fill any gap which is greater than 1/4 inch.
- C. Fasten all layers of insulation on areas with steel decks only to the top flute of steel decks, with screws and discs which penetrate through the deck a minimum of 3/4 inch and a maximum of 1-1/2 inches.
  - 1. Install 16 fasteners per 4 by 8 foot insulation board in the field of the roof.
  - 2. Install 28 fasteners per 4 by 8 foot insulation board in 8 foot wide perimeter zones.
  - 3. Install 32 fasteners per 4 by 8 foot insulation board in 8 foot square corner zones.
- D. Install all layers of insulation on areas with concrete decks, and all gypsum cover board, using low rise polyurethane foam adhesive applied in accordance with the Manufacturer's recommendations and to achieve the specified minimum uplift resistance, with joints offset between rows and layers a minimum of 12 inches. Cut gypsum cover board to fit neatly at penetrations and joints. Fill any gap which is greater than 1/4 inch.
  - 1. Install 1/2 inch diameter adhesive beads 12 inches on center in the field of the roof.
  - 2. Install 1/2 inch diameter adhesive beads 6 inches on center in 8 foot wide perimeter zones.
  - 3. Install 1/2 inch diameter adhesive beads 4 inches on center in 8 foot square corner zones.
  - 4. Place 5 gallon pails half full of gravel or concrete on the insulation and gypsum cover boards to hold them firmly in position for at least 15 minutes while the low rise foam adhesive sets. Position the pails no more than 24 inches apart in all directions.
  - 5. Remove and replace insulation and cover board installed without using pails of gravel or concrete ballast.

### 3.6 EPDM

- A. Place EPDM roofing on the substrate without stretching it, and allow it to relax approximately one hour – before starting to adhere it to the substrate and form the seams.
- B. Place adjoining sheets in the same manner lapping the edges to shed water.
- C. Fully adhere EPDM to the substrate with bonding adhesive.

1. Open each can of adhesive and stir it with an electric paddle mixer for at least 5 minutes before applying the adhesive. Re-stir adhesive that isn't used within two hours of initial mixing.
  2. Do not punch holes in cans of adhesive and use them in a "Better Spreader" without first opening the cans to mix them.
  3. Replace used roller covers each day; discard covers after each days use.
  4. Allow bonding adhesive to dry to the touch before joining the EPDM to the substrate.
  5. Roll the EPDM onto the dried bonding adhesive and immediately rub it vigorously with a soft bristle broom to ensure complete adhesion.
- D. EPDM installed over improperly applied adhesive or with adhesive that wasn't stirred, and roofing installed with blisters, ridges, mole runs and similar deficiencies shall be removed and replaced at the Contractor's expense. Removal shall include the insulation and cover board assembly.

### 3.7 SPLICING

- A. Form EPDM roof splices with 6 inch wide field applied seam tape, or with 3 inch wide factory applied seam tape.
1. Fold the top sheet back and clean mating surfaces using clean rags with splice wash.
  2. Scrub a smooth coat of QuickPrime onto mating surfaces, with long strokes, and to obtain complete coverage, using approximately 1 gallon per 225 square feet. Do not allow the QuickPrime to glop, streak or puddle; allow it to dry to the touch before installing the seam tape.
  3. Seam tape shall be positioned so 1/8 inch minimum and 1/2 inch maximum will be exposed at the seam edge when the seam is complete.
    - a. Install 5 inch uncured EPDM stripping over any seam where the tape is exposed less than 1/8 inch or more than 1/2 inch.
  4. Roll and allow the top sheet to fall freely into place without stretching or wrinkling it.
  5. Pull splice tape release paper from within the seam and neatly mate the seam using hand pressure to rub the membrane together.
  6. Immediately roll the splice with a 2 inch wide roller, using positive pressure, toward the outer edge of splice.

- B. Install uncured EPDM target patches with rounded corners, over all T-Seam intersections.

### 3.8 PERIMETER FASTENING

- A. Secure the EPDM at the perimeter of each roof level, and at eaves, penetrations, expansion joints and slope changes greater than 1 inch in 12 inches. Utilize surface applied discs or adhere the EPDM to continuous reinforced EPDM fastening strips. Secure the discs and EPDM fastening strips 12 inches on center.

### 3.9 FLASHINGS

- A. Utilized cured EPDM for all flashings; utilize self-curing EPDM at corners and angle changes only where required by the Manufacturer.
  - 1. Form flashing splices, and the splice between the flashing and main roof sheet with 6 inch seam tape.
  - 2. Adhere the flashing to vertical surfaces with bonding adhesive.
  - 3. Fasten the top edge of all flashings, positioning the fasteners 12 inches on center, to be covered by a cap flashing.
- B. Install premolded pipe flashings wherever possible. Where premolded pipe flashings cannot be installed, use field wrapped flashings. Install sealant pockets as a last resort.
- C. Remove existing pipe flashings and Kennedy type couplings and extend the vent pipes to finish a minimum of 18 inches above the roof surface.
  - 1. Extend the pipes using the same type of pipe material as the original vent pipe.
  - 2. Use threaded or no-hub couplings, positioned within the insulation layer to extend the pipes.
    - a. Exposed no-hub couplings will not be accepted.

### 3.10 DUCT WRAP WATERPROOFING:

- A. Cover the ductwork with isocyanurate insulation and fully adhered 60 mil thick EPDM roofing.
  - 1. Install EPDM cover strips and target patches to seal all duct air leaks before covering them.
  - 2. Install flat 3 inch thick insulation on the sides and bottom of the ducts.



3. Install tapered insulation sloping 1/4 inch per foot, minimum-starting thickness 3 inches on top of the ducts.
4. Secure the isocyanurate insulation with screws and plates, installed at the rate of one fastener per 2 square feet.
5. Cover the insulation with fully adhered 60 mil fire retardant EPDM.
6. Install two roller applied coats of acrylic color coating on the EPDM duct cover.

### 3.11 MISCELLANEOUS

- A. Provide any miscellaneous roofing, flashing, caulking, and metal work needed to leave the work complete and entirely watertight, neatly and carefully executed in a thorough and workmanlike manner.
- B. Use mechanics skilled and licensed in the trades to perform mechanical and electrical work. Provide new material, couplings, transition pieces, blocking, fasteners and the like needed to complete the work.

### 3.12 CLEANING, PROTECTION AND WATERTIGHTNESS

- A. Inspect the interior and exterior of the building and grounds, and submit a written report with photos to document any existing leaks or damage, prior to performing any work on site.
- B. The Owner will conduct a similar inspection at the completion of the work, and the Contractor will be charged for all leaks and damage that weren't documented in the Contractor's report, or repaired to the Owners satisfaction at the Contractor's expense.
- C. Provide any equipment, material and labor necessary to protect the site, the building, its contents and occupants, pedestrians, and surrounding landscaped and paved areas from damage due to the construction work or from inclement weather during construction.
- D. Do not perform work during inclement weather. Protect incomplete work and the building from damage by inclement weather - which may occur unexpectedly. Make all work areas watertight at the end of each day's work.
- E. Clean up all litter, refuse, rubbish, scrap materials and debris at least twice a day; at noon and at the end of the work day, so the roof and site presents a neat, orderly and workmanlike appearance. Place the debris in a dumpster, and remove the dumpster from the site as soon as it is full or no longer being used.

- F. Carefully and thoroughly clean the entire roof to remove all residual debris when all work is complete. After cleaning the roof, thoroughly clean all drain sumps, drain lines, leader heads and leaders. Do not allow debris to enter the drainage system.

### 3.13 ROOF INSPECTIONS BY MANUFACTURER

- A. Arrange for the roofing Manufacturer, or his authorized representative, to make a minimum of five inspections in accordance with the following schedule and submit a written report of each inspection to the Architect.
  - 1. First inspection during the first two days of new roof installation.
  - 2. Second inspection when roofing is approximately one third complete.
  - 3. Third inspection when roofing is approximately two thirds complete.
  - 4. Fourth inspection when all roofing and flashings are installed.
  - 5. Final inspection at the completion of all work.
- B. Arrange for the existing EPDM roofing Manufacturer, or his authorized representative, to conduct an inspection when all work is complete on the existing EPDM roofs. Perform any work they require, and have them issue a letter stating that the existing warranty remains in effect.
- C. Provide 48 hours advance written notice to the Architect, so he may have a representative attend the inspections.
- D. Submit the inspection reports within one week following each inspection.
  - 1. Payment requisitions will not be reviewed nor approved until the inspection reports are received.

END OF SECTION 07 53 23

**SECTION 076000**  
**SHEET METAL FLASHING**

**PART 1 – GENERAL**

**1.1 GENERAL REQUIREMENTS**

- A. The General Conditions of the Contract and the General Requirements are hereby made part of this Section of the Specifications.

**1.2 SCOPE OF WORK**

- A. The work includes furnishing all labor, materials, equipment, and supervision to accomplish the following work in accordance with the Drawings and Specifications.
- B. Provide metal flashing with riveted and soldered end- and back- dams, riveted and soldered transverse joints (except at expansion joints), and end dams at all terminations where shown in the Drawings, included but not limited to:
1. Sill pan flashing below windows.
  2. Above precast concrete window surrounds at windows and doors.
  3. Below water course.
  4. At base of granite veneer and stucco clad walls, including above all low-sloped roofs and grade.
  5. Head flashing above all doors and windows set in granite veneer and stucco.
  6. Built-in gutters and coping flashing adjacent to the slate roof. Provide high-temperature self-adhered membrane and rosin paper below sheet metal gutters.

**1.3 COORDINATE WITH RELATED WORK**

- A. Coordinate the work of this Section with the work of other trades under this Contract, including but not limited to:
1. Section 042000 – Masonry
  2. Section 071000 – Waterproofing Systems

#### 1.4 SUBMITTALS

- A. Submit the following items in time to allow for review by the Engineer and resubmittals, if needed, without delaying the work. Do not order materials or start work before receiving the Engineer's written approval.
- B. Submit the following items from the manufacturer to the Engineer for approval:
  - 1. Samples and/or manufacturer's literature for all materials specified and proposed for use on this project, each properly labeled.
  - 2. Manufacturer's installation recommendations for all materials used on this project.
  - 3. Certifications by the producers of all materials that all materials supplied comply with all the requirements of these Specifications and the appropriate standards.
- C. Contractor Qualifications:
  - 1. The Contractor performing the work under this Section must have a minimum of five years' experience in comparable work and must submit a list, with references, of three buildings on which they worked in the last five years, employing workers skilled in the restoration processes and operations indicated.
  - 2. List building name and address, architect, general contractor, and appropriate subcontractors and foreman with phone numbers and contact person.
- D. Shop Drawings:
  - 1. Submit shop drawings of flashing including elevations showing flashing locations, full-scale section details and intersections, terminations, intersections, and integration of waterproofing membrane with flashing components.
  - 2. Submit shop drawings of all metal flashings showing exact profile, joints, terminations, transitions, and methods of attachment; include details for repairs of, and additions to, existing materials.

#### 1.5 REFERENCED STANDARDS

- A. "Copper and Common Sense" by Revere Copper Products, Rome, New York. Referenced for general sheet metal workmanship and detailing.
- B. SMACNA's Architectural Sheet Metal Manual.
- C. American Society of Testing Materials (ASTM).

1. ASTM B370 – Standard Specification for Copper Sheet and Strip for Building Construction.

#### 1.6 EXAMINE EXISTING CONDITIONS

- A. Verify all site conditions and dimensions by measurements in the field. Verify existing construction in consideration of the special conditions associated with working in and repairing and modifying an existing building.
- B. Notify the Engineer immediately of any inconsistencies between field conditions and those shown in the Contract Drawings. The Engineer will determine what modifications or additional repairs are necessary.

#### 1.7 QUALIFICATIONS

- A. The work of this Section shall be performed by a contractor acceptable to the Owner prior to bid. The sheet metal contractor, the contractor's superintendent and foreman will have at least five years experience successfully completed work described in this section.

#### 1.8 MOCKUPS

- A. Mockups: Perform the following mockups on the building, at locations approved by the Engineer in advance. Notify the Engineer at least 48 hrs before starting the work on each mockup. Reconstruct each mockup as many times as necessary to meet the approval of the Engineer. Do not proceed with any part of the work before the mockup is approved by the Engineer. Mockups will be used to establish both technical and aesthetic standards for the remainder of the project. Once the mockup is approved, the mockup may become part of the finished work.
  1. A 5 ft section of through-wall flashing including a riveted and soldered joint and an expansion joint.
  2. Metal sill pan flashing.
  3. Coping installation.
- B. Mockups must be prepared by scheduled installer. Include all required flashing, membranes, fasteners, and other components as required. Note that flashing installation mockups must be in place and approved before subsequent installation can continue.

## 1.9 PRECONSTRUCTION CONFERENCE

- A. Attend a preconstruction conference to be held with representatives of the Owner, the Contractor, the Engineer, and all other trades to discuss the work covered under this Section. Review methods and procedures related to waterproofing installation, including inspection of substrate prior to installation, installation procedures, protection from damage, replacement materials, submittals, and schedules.

## 1.10 QUALITY CONTROL AND PROJECT PROCEDURES

- A. The Contractor shall conduct a quality control program that includes, but is not limited to, the following:
  - 1. Inspection of all materials to ensure that they conform to contract requirements and that all materials are new and undamaged.
  - 2. Establishment of procedures for executing the work.
  - 3. Inspection of work in progress to ensure that work is being done in accordance with established procedures and specific instructions, if given by the Engineer.
  - 4. Inspection of all work completed, including visually examining all masonry work, and correction of all defective work.
- B. Correct deficiencies in work that test reports and inspections indicate does not comply with the Contract Documents.

## 1.11 SPECIAL QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS

- A. All persons who will perform soldering on the project will be required to pass a soldering test.
- B. To become approved, each worker shall, in the presence of the Engineer, satisfactorily solder 1 If each of vertical soldered lock and rivet joints.

## 1.12 PERFORMANCE REQUIREMENTS

- A. Flashing: Provide base flashing, perimeter flashing, detail flashing, and component materials that comply with requirements and recommendations in FM 1-49 Loss Prevention Data Sheet for Perimeter Flashing, FM 1-29 Loss Prevention Data Sheet for Above Deck Roof Components, ANSI/SPRI ES-1, NRCA Roofing and Waterproofing Manual for Construction Details, and SMACNA Architectural Sheet Metal Manual for construction details as applicable.

### 1.13 DELIVERY, STORAGE AND HANDLING

- A. Store all materials in a location selected by the Owner. Store all materials neatly on pallets to prevent wetting or damage. Use fire-retardant canvas tarpaulins to cover all exterior stored materials, top to bottom. Polyethylene covers are not acceptable.
- B. Protect ALL materials from the weather. Promptly remove from the site all materials rejected by the Engineer or harmed by moisture anywhere, at any time, during transportation, storage, handling, and installation.
- C. Do not stockpile materials or equipment to overload any building or site component.

### 1.14 PROTECTION

- A. Protect the building, occupants, pedestrians, and building contents from all risks associated with this work including inclement weather. Replace damaged components at no charge to the Owner and to the satisfaction of the Owner using mechanics skilled in the appropriate trade and approved by the Owner.
- B. Do not damage existing building components, including flashing, roofing and backup materials scheduled to remain when removing masonry. Provide adequate protection of the window glass and frames to prevent breakage, scratches, and any other damage during work associated with this Section.
- C. Provide window, door and louver protection.
- D. Proceed with installation only when existing and forecasted weather conditions permit materials to be installed according to manufacturer's written instructions and industry guidelines.

### 1.15 WARRANTY

- A. Guarantee all work under this Section in a document. State that if, within two years after the Date of Substantial Completion of the Work any of the work of this Section is found to be defective or not in accordance with the Contract Documents, the contractor shall correct it promptly after receipt of a written notice from the Owner to do so, unless the Owner has previously given the contractor a written acceptance of such condition. Also, state that the contractor shall bear all costs incurred by the Owner, including reasonable attorney's fees, to enforce compliance with the obligations of this guarantee. The obligation of these Guarantees shall run directly to the Owner, and may be enforced by the Owner against the contractor, shall survive the termination of the Contract, and shall not be limited by conditions other than this Contract.

## PART 2 – PRODUCTS

### 2.1 MATERIALS

- A. Metal Flashing: 20 oz tin-zinc-alloy-coated, H00 cold-rolled copper, conforming to ASTM B370. All sheets shall carry markings of producer, temper, and weight. Coating to consist of alloy that is approximately 50% tin and 50% zinc, and be applied by the hot-dipped process with an approximate 0.5 mils thickness to both sides. FreedomGray by Revere Copper Products Inc. or similar.
- B. Solder and Flux for Zinc-Tin Coated Copper: Solder shall conform to ASTM B32 and flux shall conform to ASTM B813. Solder shall be composed of 60% block tin and 40% pig lead.
- C. Rivets for Metal Flashing Connections: Solid copper 3/16 in. dia. flat head rivets of proper length for the material being fastened; available from JAY–CEE Sales and Rivet Inc., Phone: 1-800-521-6777. “Pop Rivets” are prohibited.
- D. Fasteners and Accessories for Flashings:
  - 1. Fasteners for attaching flashing to concrete or block: 1/4 in. dia. Nylon Nailin with stainless steel drive pin, with mushroom head and length to provide a minimum of 1-1/2 in. embedment into backup.
  - 2. Fasteners and accessories for attaching to metal studs: Use stainless steel, AISI Type 304 screw as required.
  - 3. Fasteners for attaching to wood blocking: Use stainless steel, AISI Type 304 screws, bolts or nails, 12 ga, with minimum 1/4 in. diameter flat head, annular threaded, with needle point, and of sufficient length to obtain 1-1/4 in. embedment into blocking, and for full depth into plywood.
- E. Membrane at Metal Flashing Splice Joints: 0.060 in. thick uncured EPDM; minimum 6 in. wide strip. Use manufacturer’s recommended primers, adhesives, sealants, and solvent cleaners.
  - 1. “Form Flash,” by Firestone.
  - 2. Sure Seal by Carlisle.
- F. Bond Breaker (Release) Tape: 0.006 in. thick polyethylene tape, adhesive-backed on one side, width as required.
- G. Rosin Paper Separator Sheet: Heavy duty rosin-sized kraft paper, 3 lb/100 sq ft minimum.
- H. Pre-shimmed Butyl Glazing Tape (for Receiver Strip): Pre-shimmed butyl glazing tape by Tremco or approved equal.
- I. Metal Angle (for Membrane Sill Pan Flashing Support): 20 ga sheet metal.



- J. High-temperature Self-Adhered Membrane: Self-adhered membrane consisting of butyl adhesive backed by a layer of high-density cross-laminated polyethylene film, 30 mils thick, Grace Ultra by GCP Applied Technologies, or approved equal.

## PART 3 – EXECUTION

### 3.1 EXAMINATION

- A. Verify all site conditions and dimensions by field measurements in consideration of the special conditions associated with alterations of existing construction and reconstruction. Notify the Engineer immediately of any inconsistency between field conditions found during demolition and those shown in the Contract Drawings. The Engineer will determine what modifications or additional repairs are necessary.
- B. Inspect all existing metal roofs and flashings to remain for unsoldered seams, holes or other defects in the metal. The Engineer will determine what repairs are necessary.

### 3.2 GENERAL WORKMANSHIP FOR SHEET METAL FLASHINGS

- A. Prior to all metal flashing installation, inspect the wall waterproofing and membrane flashing for holes and tears in the membrane. Provide repair patches and liquid membrane at edges and at all deficiencies. Extend repair patches a minimum of 6 in. beyond the tear on all sides.
- B. As a minimum, comply with all recommendations of the Eighth Edition of Revere's "Copper and Common Sense" Standards for Details, and SMACNA's Architectural Sheet Metal Manual. Completed metal shall be straight, flat, and without buckles, dents, scratches, or other blemishes.
- C. Form sheet metal on a bending brake. Perform shaping, trimming, and hand seaming in the shop as far as practicable, with the proper sheet-metal working tools. Make the angle of the bends and the folds for interlocking the metal with full regard for expansion and contraction, to avoid buckling or other deformation in service. Make "right angle" bends slightly more than 90° to ensure a "spring-clip" engagement of the flashing horizontal leg to the counterflashed surface; in no case shall the horizontal leg be flat or slope toward the element being flashed. All lines and arises shall be straight and crisp except where thickness of metal dictates radius bend. Hem all exposed edges 1/2 in. minimum.
- D. Soldering:

1. Immediately prior to soldering, mechanically clean all metal to be soldered with steel wool or by other acceptable means, apply flux, and pre-tin. Clean metal again if it is not soldered on the same work day.
  2. Lap metal and fully sweat all flashing corners, end dams and joints with solder for permanently waterproof connections. Maintain continuity of flashings and watertightness at all jogs, steps, transitions, corners and similar areas.
  3. Reinforce all metal flashing corners as required; rivet and solder all flashing corners for permanently waterproof connections. Space rivets at 1 in. o.c. in staggered pattern unless otherwise noted.
  4. Perform all soldering slowly with well-heated heavy (10 lbs/pr) irons with properly tinned clean blunt tips. Do not use torches. Apply enough heat to sweat the solder completely through the full width of the seam. Close clinch lock seams gently with a block of wood and mallet, then flux and show at least one full inch of continuous and evenly flowed solder. Whenever possible, do all soldering in flat position. All sloped and vertical seams shall be laced and soldered a second time.
  5. After soldering, immediately remove all traces of acid of flux with an appropriate neutralizer, followed by repeated washing and scrubbing.
- E. Isolate all dissimilar metals with bond breaker tape.
- F. Provide metal flashings as indicated in the approved shop drawings. Coordinate metal flashing details with other shop drawings.
- G. Hook Strips: Provide continuous hook strips where indicated on the Drawings, fastened 6 in. o.c. into substrate in staggered pattern. Crimp the formed hook of metal flashing onto the hook strip, forming a 3/4 in. loose lock, and overlapping the hook strip at least 1/2 in.
- H. Fasteners: Nail all roof metal flashings with two rows of approved fasteners at 4 in. o.c. in each row, staggered. Nail all through-wall metal flashings with two rows of approved fasteners at 16 in. o.c. in each row, staggered. Bend all drip edges 1/4 in.
- I. Cleats: Provide 2 in. wide metal cleats at 12 in. o.c., two fasteners per cleat, where shown on the Drawings. Crimp the formed hook of the metal flashing into the cleat, overlapping the cleat at least 1/2 in.
- J. Receiver Strips: Provide metal receiver strips where detailed. Break metal as detailed. Provide a solid bed of sealant in joints and behind receiver metal. Provide pre-shimmed butyl tape behind receiver strip.
- K. Thimbles: Provide watertight sheet metal thimbles over all dowel locations. A thimble consists of a cylindrical length of sheet metal with cap in which all seams are soldered watertight, as shown in the Drawings. All soldered seams must be flat sheet to flat sheet; soldered at raw edges is not permitted.

- L. Skirt Flashings: Provide metal skirt flashing with 2 in. wide loose cleats at 12 in. o.c., to cover the top of the metal and membrane flashing where shown on the Drawings. At transverse joints, lap the adjacent skirt flashings, as shown on the Drawing, a minimum of 2 in. Bend the bottom edges of the skirt to form a smooth surface and the top to hook into the flashing receiver. Do not solder cleat to skirt.
- M. Expansion Joints: Lay out metal flashing to minimize transverse joints. Provide expansion joints within 2 ft of end caps, inside and outside corners and soldered intersections (adjoining T- or cross-shaped flashings). At through-wall flashings, provide expansion joints at every 30 ft. At all other flashings provide expansion joints at every 20 ft.
  - 1. At expansion joints in metal flashings (including through-wall flashings), install 6 in. wide metal backer plate with hemmed edges on both sides. Install the adjoining flashings on a 1 in. wide continuous bead of sealant between the backer plate and flashings. Separate the metal flashings 1/4 in. Apply adhered EPDM strip flashing over the 1/4 in. expansion joint as described in Para. 3.02-O.3.
  - 2. At expansion joints in metal coping flashings, lap all joints at least 4 in. minimum, and apply release tape, adhered EPDM strip flashing and metal cover plate. Apply release tape, centered over exposed edge of joint, and adhere EPDM strip flashing over joint as described in Para. 3.02-P.3.
  - 3. EPDM installation is as follows:
    - a. Brush-apply a full continuous coat of primer without holidays to the substrate and the sheet, using circular motion; roller application is not allowed. Allow adhesives to dry until tacky. Do not exceed maximum "open time" recommended by the manufacturer, or twelve hours. Do not use, and remove from the site, all EPDM that has been coated with adhesive and allowed to exceed the maximum "open time," exposed for more than 12 hrs, or that has been exposed to any moisture before being applied to the substrate. Do not expose adhesive coated substrate to any moisture, or to air for more than 12 hrs. Protect adhesive from air-borne dust and debris while drying.
    - b. Once the primer is dry but tacky, lay sheets into it promptly. Do not move or reposition sheets once they have contacted the primer. Immediately roll entire sheet into firm contact with the substrate using a smooth metal roller. Form sheets tightly into bends in flashing without stretching or cutting rubber sheet.
    - c. After 1 hr, apply sealant continuously to all edges of EPDM flashing and tool out over edges.
- N. Copings and Cap Flashings: Provide metal ridge flashing on the roofs and copings and cap flashings at all parapets as shown in the Drawings. Secure outside edges of coping flashing onto continuous hook strips on each side,

anchored to the substrate. Lock transverse joints 1/2 in. and solder watertight, except provide expansion joints 2 ft of end caps and every 20 ft of run.

- O. Base-of-Wall Flashings: Provide continuous base-of-wall metal flashings at perimeter of building as shown in the Drawings.

### 3.3 WINDOW AND DOOR SILL FLASHING INSTALLATION

- A. Work at the windows, doors, and louvers requires close coordination with other trades to install all materials (e.g., wall waterproofing and membrane flashing, metal flashing, wood blocking, interior finishes, etc.) as shown on the Drawings. Generally, installation shall proceed from the bottom up so that all materials, regardless of trade, are integrated to shingle “downstream” (to the flow of water).
- B. At windows provide metal angle for membrane sill pan flashing. Fabricate and install angle so that vertical leg angle of sheet metal terminates just short of the bottom of interior finishes. Fasten horizontal leg to precast concrete sill as shown on the Drawings.
- C. After installation of membrane sill pan (Section 071000), install metal sill flashing with end- and back- dams, fully soldered watertight, to fit inside precast concrete opening. Install metal flashing tight to all sides of the opening.
- D. If required to hold the flashing pan in place, fasten through the back leg of the pan flashing or end dams with nail of similar material as flashing, min. 1 in. above the horizontal leg.
- E. “Strip-over” all upturned legs, end dams, and fasteners in metal flashing with membrane (Section 071000 – Wall Waterproofing).
- F. Provide separator sheet between sill pan flashing and window frame.

END OF SECTION

## SECTION 07 62 00

### SHEET METAL FLASHINGS & SPECIALTIES

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

- A. All plant, labor, materials, equipment, testing and services necessary to complete the work shown on the drawings, schedules and keynotes, as specified herein, and as may be required by conditions and authorities having jurisdiction, including, but not limited to, the following:
  - 1. Sheet metal work that is compatible with the roofing systems specified, including factory fabricated roof edge systems, cap flashings, hook strips, copings, and miscellaneous flashings.
- B. Related Requirements
  - 1. Masonry Maintenance - Section 04 01 00
  - 2. Carpentry - Section 06 10 00
  - 3. EPDM Roofing - Section 07 53 23
  - 4. Roof Accessories - Section 07 72 00

##### 1.3 CODE APPROVAL REQUIREMENTS

- A. Fabricate and install roof perimeter flashings that comply with the NY State Uniform Fire Prevention and Building Code and with ANSI/SPRI ES-1 "Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems" requirements.

##### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. A firm (Installer) with at least 5 continuous years experience performing work similar to that required for this project, employing personnel skilled in the work specified.
    - a. The Installer shall directly employ the personnel performing the work of this section.

- b. The Installer shall have a full time supervisor on the roof when work is in progress. The Supervisor shall have a minimum of 5 years experience with work similar in nature and scope to this project, and speak fluent English.
    - i) Submit the supervisor's resume upon request.
  - 2. The Installer shall provide a reference list of at least three previously completed projects of comparable size and similar design, within a fifty mile radius of this project, which may be observed by representatives of the Owner:
    - a. The reference list shall include at a minimum, the completion date, a description of the work performed, the Owner's name - contact person - phone number and address and the Architect's name - contact person and phone number.
    - b. Submit the reference list upon request.
- B. Material Quality:
  - 1. Obtain each product from a single Manufacturer which has manufactured the same product in the United States of America for not less than 5 continuous years.
  - 2. Obtain copper and pre-finished sheet metal items from the same mill run to maintain consistent color hue and surface finish.
- C. Pre-Construction Conference: Meet at the project site between one and two weeks prior to starting work, with the Architect, Owner and other representatives concerned about the work, to discuss the following:
  - 1. How the building will be kept watertight as work progresses.
  - 2. How sheet metal work will be coordinated with the installation of the vapor barrier, insulation, cover board, roofing, flashings, roof accessories and other items to provide a watertight installation.
  - 3. Generally accepted industry practice and the Manufacturer's instructions for handling and installing his products.
  - 4. The condition of the substrate, curbs, penetrations and other preparatory work needed.
  - 5. Incomplete submittals; note that progress payments will not be processed until all submittals are received and approved.

6. The construction schedule, weather forecast, availability of materials, personnel, equipment and facilities needed to proceed and complete the work on schedule.
7. A schedule for Manufacturer and Architect inspections.

## 1.5 SUBMITTALS

- A. Submit the following items far enough in advance to obtain approval prior to performing any work on site:
  1. A pre-work site and building inspection report with photos to document conditions before work starts.
  2. Manufacturer's technical literature for all materials.
  3. Test reports and certifications substantiating compliance with specification requirements if requested by the Architect.
  4. Shop drawings, or 2 foot long samples, for each sheet metal item, to show how it relates and fits on adjoining masonry and wood blocking assemblies, and with the roof, stripping, and flashings.
  5. 6 inch square pieces of each type of sheet metal to show surface finish, texture and color.
  6. A sample of the Contractor's guarantee form.
- B. Simultaneously provide all technical submittals needed for this project, for all technical sections, collated by section. Incomplete submittals will not be reviewed.
  1. Submittals shall be prepared and made by the firm that will perform the actual work.
  2. Provide electronic submittals via an on-line submittal exchange program if one is established for this project; if an on-line program isn't established, provide the submittals on portable USB drives in pdf format, organized in folders by Section.
- C. Safety Data Sheets: Simultaneously provide all Safety Data Sheets needed for this project, for all specification sections - collated by section, in three ring binders. Provide two binders for each building.
- D. Payment requisitions will not be processed until all submittals are received and approved.

## 1.6 JOB MOCK-UPS

- A. After the submittals are approved, prepare in actual job locations, mock-ups of cap flashings, hook strips, copings, and all other items of sheet metal and related work, for inspection and approval by the Architect.
- B. Construct each mock-up of two full lengths of metal, fastened, connected and stripped-in to the related roofing system, to show the following:
  - 1. Type, gauge, color, cross-sectional dimensions and shape, and joint and mitering techniques.
  - 2. Related masonry work, wood blocking, and the attachment techniques and fasteners for all wood and metal components.
  - 3. Other sheet metal related materials and their installation techniques to fully define the detailing of each mock-up.
- C. Mock-ups shall be constructed to establish the minimum standard of materials and workmanship, and to assure that completed work which matches the mock-ups will be fully functional and serve the purpose for it has been designed.
- D. Approved mock-ups may be left in place and incorporated into the permanent installation. Rejected mock-ups shall be removed and replaced until an acceptable mock-up is approved.
- E. Do not purchase or fabricate sheet metal items until mock-up installation, inspection and approval are completed and approval is documented in writing.

## 1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver material to the site in the Manufacturer's original and unopened packaging, with intact and legible labels which identify the products and Manufacturers,
- B. Cover all stored materials with watertight tarpaulins installed immediately upon delivery.
- C. Do not overload the structure when storing materials on the roof.
- D. Protect roof surfaces where material and equipment is placed on them, and where construction traffic occurs, with 6 mil fire retardant polyethylene, covered with 1-1/2 inch thick foam insulation, overlaid with 2 by 10 wooden planks.

## 1.8 GUARANTEE



- A. Provide a written Contractor's Guarantee which guarantees that all work will remain free of material and workmanship defects and in a watertight condition for a five year period beginning upon Final Completion:
  - 1. Defects include but are not limited to the following: peeling paint, leakage, adhesive separation, delamination, lifting, loosening, splitting, cracking, and undue expansion.
  - 2. The Contractor shall make the repairs and modifications necessary to enable the work to perform as warranted at his own expense.
  - 3. Guarantee coverage shall include removing and replacing materials installed as part of the original work, if removal is needed to affect guaranteed repairs.
  - 4. Guarantee coverage shall have no dollar limit.
- B. Provide one Contractor's Guarantee that covers "all work performed" when a single contractor is awarded work specified in multiple Sections.
- C. The Guarantee coverage shall take effect no more than 30 days before the completion of all punch list work.
- D. The Contractor's Surety Company may add a rider to the Performance Bond which clarifies that Bond Coverage expires two years after Final Completion; i.e., Performance Bond Coverage does not run for the entire five year term of the Contractor's Guarantee.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Copper sheet: ASTM B370, 99.0 % pure copper, thickness 16 ounces per square foot. Use copper for all metal items not otherwise indicated
- B. Solder: 50-50 tin and lead for plain copper, supplied in one pound bars with the alloy mixture stamped into the bar by the Manufacturer.
- C. Flux: Water-Soluble Liquid Flux, Kester #3345 for iron soldering of brass and copper.
- D. Aluminum hook strips, cap flashings and miscellaneous trim: #3105-H14 alloy aluminum, minimum thickness .040 inches unless otherwise indicated, factory finished with a Fluoropolymer Kynar 500 finish, color as selected by the Architect, from the full range of custom and standard colors.
- E. Factory Fabricated Roof Edge System: Extruded aluminum anchor bars secured with #9 stainless steel screws spaced 12 inches on center and .050 inch thick Kynar 500 prefinished aluminum trim covers, independently tested to

comply with the ANSI / SPRI ES-1 Wind Design Guide, provided by the roofing membrane manufacturer.

- F. Fasteners: fabricated of stainless steel, or material that matches the sheet metal being fastened.
- G. Eveco ventilators: single cone gravity type ventilators, with no moving parts, fabricated of mill finish aluminum, furnished with #8 aluminum insect screen, 1/2 inch aluminum bird screen and factory fabricated curb mount bases, as manufactured by Empire Ventilation Equipment Co., Inc., Long Island City, NY.
- H. Turbine ventilators: Turbine ventilator, fabricated of mill finish aluminum, furnished with #8 aluminum insect screen, 1/2 inch aluminum bird screen and factory fabricated curb mount bases, as manufactured by Empire Ventilation Equipment Co., Inc., Long Island City, NY.
- I. Glass Cloth: open mesh glass fabric coated on each side with plasticized asphalt as manufactured by Karnak Corporation or equal.
- J. Asphalt cement: Federal Specification SS-C-153B, Type 1, asbestos free grade.
- K. Sealant: High performance, solvent free, formulated and moisture curing silyl-terminated polyether sealant, ASTM C-920, Type S, Grade NS, Class 25, NovaLink construction sealant by ChemLink, color as selected.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Accurately reproduce the details and design shown, and form profiles, bends and intersections, sharp, true and even. Fabricate sheet metal in the shop whenever possible, and form joints, laps, splices and connections to shed water and condensation in the direction of flow.
- B. Provide any miscellaneous flashing and sheet metal work not shown on the drawings but otherwise needed to leave the project complete and entirely watertight, neatly and carefully executed in a thorough and workmanlike manner.

### 3.2 INSPECTION

- A. Examine surfaces to receive work of this section and report any defects to the Owner. Commencement of work will be construed as complete acceptance of surfaces.

### 3.3 INSTALLATION

- A. Fabricate and install copper work in accordance with the current edition of "Copper and Common Sense" as published by the Revere Copper and Brass Company, unless otherwise indicated.
  - 1. Form all joints, except loose locked sealant filled expansion joints, to overlap 2 inches.
  - 2. Secure the joints with rivets spaced 1 inch on center positioned about 1/2 inch from the top edge of the joint, then sweat solder the joint.
  - 3. Use solder only to fill and seal the joint, not for mechanical strength. Form soldered joints continuous, strong and free from defects, with well heated soldering irons. Do not use open flame torches for soldering.
  - 4. Clean soldered joints daily, immediately after soldering, by washing them with soap and water applied with a soft bristle brush, then rinsing with clear water.
- B. Securely fasten and anchor all work, and make provisions for thermal expansion. Submit details of expansion joints for approval. Install fasteners through one edge of metal only, use a hook strip on the other edge.
- C. Use stainless steel pin Zamac type nail-in fasteners, or stainless steel screws and washers with neoprene inserts where fasteners will be exposed.

### 3.4 CAP FLASHINGS

- A. Install new copper cap flashings above all roof and roof flashing components, including copings, wall penetrating ducts and gravel stops. Install cap flashings built into masonry walls; as they are demolished as shown, and as they are constructed - properly joined to all related materials in a watertight manner.
  - 1. Solder all joints in the new cap flashing, except form 2 inch wide flat locked sealant filled expansion joints about 20 feet on center.
  - 2. Secure the joints with rivets spaced 1 inch on center positioned about 1/2 inch from the top edge of the joint, then sweat solder the joint.
  - 3. Form the flashing to turn up 2 inches inside the wall and finish with a hem on the bottom exposed edge.
  - 4. Fasten the top edge of the cap flashing to the back up masonry 12 inches on center.
  - 5. Install the new cap flashing under flexible type wall flashings where possible. Where it is not possible to lap the new cap flashing under an existing wall flashing, install a ply of glass cloth set in and coated with

asphalt cement to connect the new cap flashing to the existing wall flashing.

6. In the absence of an existing wall flashing, or at a solid masonry wall, turn up the new cap flashing 2 inches behind the first wythe of masonry.
  7. Install new cap flashings where shown on the drawings, and at a height of 10 to 12 inches above the roof surface.
  8. Install new cap flashings above parapet wall flashings and above eave metal at transitions with higher walls.
- B. Install new aluminum cap flashings on equipment curbs.
1. Form the cap flashing to extend at least 2 inches under the equipment, 4 inches over the base flashing, and finish with a 1/2 inch hem on the bottom edge.
  2. Install a 1/2 inch thick by 2 inch wide continuous foam gasket between the cap flashing and mechanical equipment or skylight. Do not set the equipment in sealant.
  3. Secure the equipment to the curb with stainless steel screws spaced 12 inches on center.

### 3.5 COPINGS

- A. Fabricate new copings to engage a continuous 3/4 inch wide hook strip under the outside face, and fasten the copings with Zamac type nail-in fasteners spaced 8 inches apart.
1. Install 6 inch wide under plates set into a solid bed of sealant at all joints. Overlap, rivet and install sealant at all miters and special conditions. Form the coping to turn up 6 inches at all rising walls, and cover the turned up flange with a cap flashing.

### 3.6 HOOK STRIPS

- A. Form continuous hook strips with locks that engage the superimposed trim piece a minimum of 3/4 inch, and to cover the entire underside edge of the wood blocking and neatly extend to the building wall.
- B. Fasten hook strips along their bottom edge, just above the 45 degree bend, with nails spaced 4 inches on center into underlying wood blocking; Zamac type nail-in type fasteners spaced 8 inches on center into masonry surfaces, or screws spaced 8 inches on-center into sheet metal surfaces.

### 3.7 CLEANING, PROTECTION AND WATERTIGHTNESS

- A. Inspect the interior and exterior of the building and grounds, and submit a written report with photos to document any leaks or damage, prior to performing any work.
- B. The Owner will conduct a similar inspection at the completion of the work, and the Contractor will be charged for all leaks and damage that weren't documented in the Contractor's report, or repaired to the Owners satisfaction at the Contractor's expense.
- C. Provide any equipment, material and labor necessary to protect the site, the building, its contents and occupants, pedestrians, and surrounding landscaped and paved areas from damage due to the construction work or from inclement weather during construction.
- D. Do not perform work during inclement weather. Protect incomplete work and the building from damage by inclement weather - which may occur unexpectedly. Make all work areas watertight at the end of each day's work.
- E. Clean up all litter, refuse, rubbish, scrap materials and debris at least twice a day; at noon and at the end of the work day, so the roof and site presents a neat, orderly and workmanlike appearance. Place the debris in a dumpster, and remove the dumpster from the site as soon as it is full or no longer being used.
- F. Carefully and thoroughly clean the entire roof to remove all residual debris when all work is complete. After cleaning the roof, thoroughly clean all drain sumps, drain lines, leader heads and leaders. Do not allow debris to enter the drainage system.

END OF SECTION 07 62 00



## **SECTION 07 72 00**

### **ROOF ACCESSORIES**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. All plant, labor, materials, equipment, testing and services necessary to complete the work shown on the drawings schedules and keynotes, as specified herein, and as may be required by conditions and authorities having jurisdiction, including, but not limited to, the following:

- 1. Roof specialties that are compatible with the roofing systems specified, including:
  - a. Louvered penthouse ventilators.
  - b. Pre-fabricated curbs and equipment supports.
  - c. Factory fabricate pipe curb portals
  - d. Drains, drain pipes and couplings.
  - e. Pipe insulation and fitting covers.
  - f. Galvanized steel roof access ladders.
  - g. Roof walkway pads and concrete pavers.
  - h. Snow guard assemblies.
- 2. Prepare, prime and paint all roof top equipment in areas being replaced.
  - a. Do not paint over the manufacturer's name-plates and labels.

- B. Related Requirements

- |                                       |                    |
|---------------------------------------|--------------------|
| 1. Masonry Maintenance                | - Section 04 01 00 |
| 2. Carpentry                          | - Section 06 10 00 |
| 3. EPDM Roofing                       | - Section 07 53 23 |
| 4. Sheet Metal Flashing & Specialties | - Section 07 62 00 |

##### **1.3 CODE APPROVAL REQUIREMENTS**

- A. Fabricate and install roof accessories that comply with the NY State Uniform Fire Prevention and Building Code.

##### **1.4 QUALITY ASSURANCE**

A. Installer Qualifications:

1. A firm (Installer) with at least 5 continuous years experience performing work similar to that required for this project, employing personnel skilled in the work specified.
    - a. The Installer shall directly employ the personnel performing the work of this section.
    - b. The Installer shall have a full time supervisor on the roof when work is in progress. The Supervisor shall have a minimum of 5 years experience with work similar in nature and scope to this project, and speak fluent English.
      - i. Submit the supervisor's resume upon request.
  2. The Installer shall provide a reference list of at least three previously completed projects of comparable size and similar design, within a fifty mile radius of this project, which may be observed by representatives of the Owner:
    - a. The reference list shall include at a minimum, the completion date, a description of the work performed, the Owner's name - contact person - phone number and address and the Architect's name - contact person and phone number, and the Contractor's Supervisor's name.
    - b. Submit the reference list upon request.
- B. Material Quality: Obtain each product from a single Manufacturer which has manufactured the same product in the United States of America for not less than 5 continuous years.
- C. Pre-Construction Conference: Meet at the project site between one and two weeks prior to starting work, with the Architect, Owner and other representatives concerned about the work, to discuss the following:
1. How the building will be kept watertight as work progresses.
  2. How roof accessory work will be coordinated with the installation of the vapor barrier, insulation, cover board, roofing, flashings, and other items to provide a watertight installation.
  3. Generally accepted industry practice and the Manufacturer's instructions for handling and installing his products.
  4. The condition of the substrate, curbs, penetrations and other preparatory work needed.



5. Incomplete submittals; note that progress payments will not be processed until all submittals are received and approved.
6. The construction schedule, forecast weather, availability of materials, personnel, equipment and facilities needed to proceed and complete the work on schedule.
7. A schedule for Manufacturer and Architect inspections.

## 1.5 SUBMITTALS

- A. Submit the following items far enough in advance to obtain approval prior to performing any work:
  1. A pre-work site and building inspection report with photos to document conditions before work starts.
  2. Manufacturer's installation instructions and technical data sheets for each item. Material sample submittals are not needed unless requested to show color and texture.
  3. Samples of the Contractor's and Manufacturer's guarantee/warranty forms.
  4. Test reports and certifications substantiating compliance with specification requirements if requested by the Architect.
- B. Simultaneously provide all technical submittals needed for this project, for all technical sections, collated by section. Incomplete submittals will not be reviewed.
  1. Submittals shall be prepared and made by the firm that will perform the actual work.
  2. Provide electronic submittals via an on-line submittal exchange program if one is established for this project; if an on-line program isn't established, provide the submittals on portable USB drives in pdf format, organized in folders by Section.
- C. Safety Data Sheets: Simultaneously provide all Safety Data Sheets needed for this project, for all specification sections - collated by section, in three ring binders. Provide two binders.
- D. Payment requisitions will not be processed until all submittals are received and approved.

## 1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver material to the site in the Manufacturer's original and unopened packaging, with intact and legible labels which identify the products and Manufacturers,

- B. Cover all stored materials with watertight tarpaulins installed immediately upon delivery.
- C. Do not overload the structure when storing materials on the roof.
- D. Protect roof surfaces where material and equipment is placed on them, and where construction traffic occurs, with 6 mil fire retardant polyethylene, covered with 1-1/2 inch thick foam insulation, overlaid with 2 by 10 wooden planks.

## 1.7 GUARANTEE

- A. Provide a written Contractor's Guarantee which guarantees that all work will remain free of material and workmanship defects and in a watertight condition for a five year period beginning upon Final Completion:
  - 1. Defects include but are not limited to the following: peeling paint, leakage, adhesive separation, delamination, lifting, loosening, splitting, cracking, movement and undue expansion.
  - 2. The Contractor shall make the repairs and modifications necessary to enable the work to perform as warranted at his own expense.
  - 3. Guarantee coverage shall include removing and replacing materials installed as part of the original work, if removal is needed to affect repairs.
  - 4. Guarantee coverage shall have no dollar limit.
- B. Provide one Contractor's Guarantee that covers "all work performed" when a single contractor is awarded work specified in multiple Sections.
- C. The Guarantee shall take effect no more than 30 days before the satisfactory completion of all punch list work.
- D. The Contractor's Surety Company may add a rider to the Performance Bond which clarifies that Performance Bond Coverage expires two years after Final Completion; i.e., Performance Bond Coverage does not run for the entire five year term of the Contractor's Guarantee.
- E. Provide a Manufacturer's written warranty, which warrants the skylights will remain watertight for a minimum 5 year term beginning upon final completion.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. Provide Manufacturer's standard units, modified as necessary to comply with the specified requirements. Fabricate each unit in a shop to the greatest extent possible, using the following components:

1. Aluminum Sheet: ASTM B 209 alloy 3003, tempered for forming and performance; mill finish, except as otherwise noted.
2. Extruded Aluminum: Standard extrusions alloy 6063-T52; 0.078 inch minimum thicknesses for primary framing and curb member legs, 0.062 inch thickness for secondary framing and covers; mill finish, except as otherwise indicated.
3. Insulation: Rigid fiber glass boards where encapsulated inside metal skirts, rigid isocyanurate where covered with roof flashings on the exterior of curbs.
4. Wood Nailers: Dimension grade Douglas Fir, not less than 1-1/2 inches thick.
5. Fasteners: Nonmagnetic stainless steel or hot dipped galvanized steel, to match the finish of the material being fastened.
6. Gaskets: Tubular neoprene or polyvinyl chloride, or block sponge neoprene.
7. Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

## 2.2 LOUVERED PENTHOUSE VENTILATORS

- A. Factory fabricated penthouse assemblies for mounting on field constructed curbs, incorporating .081 inch thick extruded aluminum louver blades, hidden mullions, 1-1/2 by 1-1/2 by 1/8 inch aluminum angle framing, 18-14 aluminum mesh insect screens, and .050 inch thick aluminum covers, manufactured by United Enertech: Model PEL-4-SN Harsh Weather Penthouse, height sized to provide a net free louvered opening equal to the size of the deck opening.

## 2.3 PRE-FABRICATED CURBS AND EQUIPMENT SUPPORTS

- A. Factory fabricated of welded 14 gauge galvanized steel, insulated with minimum 1-1/2 inch thick 3 pound density rigid insulation, with nominal 2 by 2 inch wood nailers and T bar reinforcing on sides longer than 36 inches; height 24 inches, Model ES-2 by Pate Inc.
- B. Where the roof deck slopes more than 1/4 inch per foot, provide tapered curbs to match the slope, and install the equipment level.

## 2.4 FACTORY FABRICATED PIPE CURB PORTALS

- A. Factory fabricated curb flashing systems, consisting of 9 inch high internally insulated galvanized steel curbs with 1-1/2 inch square wood nailers at the top edges, and 5 hole EPDM boots, with nipples that will accommodate pipes and conduits from 1/2 to 2-1/2 inches in diameter, with stainless steel hose clamps on each nipple - 5-Hole Pipe Portal Flashing System: C-555, by Portals Plus or equal.

## 2.5 DRAINS, DRAIN PIPES, AND COUPLINGS

- A. Conventional cast iron bottom and side outlet roof drains, installed with drain receivers, under deck clamps, cast iron strainers, cast iron clamping rings and factory installed stainless steel gravel screens Series 1011 as manufactured by Jay R. Smith Manufacturing Company.
- B. Match the drain outlet size and style to the building drain line, except if the drain line is a copper pipe, then furnish the drain body with a threaded outlet and use a male adapter to connect the drain body to the drain line.
- C. Drain pipe: cast iron pipe with no hub fittings, minimum 3 inch diameter, and larger to match the existing building drain lines.
- D. No-hub couplings: heavy duty rubber neoprene sleeve couplings with full length Type 304 stainless steel shields and at least 4 worm drive clamps, conforming to ASTM A564.

## 2.6 PIPE INSULATION AND FITTING COVERS

- A. Insulation: minimum 1 inch thick pre-molded 3.5 lb. heavy density fiberglass pipe insulation with UL rated non-combustible service jackets.
- B. .030 inch thick factory fabricated white PVC "Smoke Safe" fitting and drain bowl covers as manufactured by the Speedline Corporation, with a maximum Flame Spread Value of 25 and a maximum Smoke Developed Value of 50 in accordance with ASTM E8450.

## 2.7 GALVANIZED STEEL ROOF ACCESS LADDERS

- A. Fabricate ladder from 1-1/4 inch inside diameter steel pipe rails, spaced 22 inches apart, and 3/4 inch solid steel rebar rungs spaced 12 inches on center. Fit the rungs into drilled holes in the centerline of the rails, weld and grind the welds smooth. Extend the ladder rails and form goose-neck returns to finish 42 inches above the roof surface.
  - 1. Hot dip galvanize coat the ladder and mounting brackets after fabrication. Install with Type 316 stainless steel hardware.

## 2.8 ROOF WALKWAY PADS AND CONCRETE PAVERS

- A. 2 inches thick, 24 inches by 24 inches precast concrete pavers, natural buff color and finish, minimum 7500 psi compressive strength as manufactured by Hanover Architectural Products.
- B. 30 inches by 30 inches hard rubber black walkway pads manufactured by Firestone.

## 2.9 PAINT AND PRIMER

- A. Alkyd base rust inhibiting exterior primer and high gloss finish paint for ferrous metal surfaces as manufactured by Benjamin Moore or equal.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General: Field measure existing openings. Comply with manufacturer's instructions and recommendations. Coordinate with the installation of roof deck, other substrates to receive specialty units, vapor barriers, roof insulation, roofing and flashing to ensure that each element of the work performs and fits properly, and that combined elements are waterproof and weathertight. Anchor units securely to supporting structural substrates, adequate to withstand lateral and thermal stresses as well as inward and outward loading pressures.

### 3.2 LOUVERED PENTHOUSE VENTILATORS

- A. Construct a wood curb to extend 10 inches above the roof surface. Install new base and cap flashings, restore the curb liner to match the original construction, and install the penthouse assembly on top of a 1/2 inch by 2 inch foam gasket.

### 3.3 PRE-FABRICATED CURB AND EQUIPMENT SUPPORTS

- A. Install curb assemblies directly on the structural deck.
- B. Install new base and cap flashings prior to installing the mechanical equipment. Set mechanical equipment on 1/2 inch thick anti vibration pads.

### 3.4 FACTORY FABRICATED PIPE CURB PORTALS

- A. Install factory fabricated pipe portal flashing systems at all HVAC units, and where more than one pipe or conduit penetrates the roof.
  - 1. Install the portal curbs on wood blocking that matches the thickness of the roof insulation.
  - 2. Disconnect and reconnect refrigerant, power, control and condensate lines and pipes as needed to install the pipes through the flashing nipples.
    - a. Install water cut off sealant between the lines / pipes and EPDM nipples, and then install a hose clamp on each nipple.
    - b. Remove and replace nipples that are incorrectly cut too large.

### 3.5 DRAINS, DRAIN PIPES AND COUPLINGS

- A. Remove and replace the existing drains where roof removal and replacement work is indicated:
  - 1. Remove the existing drains and flashings; use care not to break or disturb the drain pipes within the building.
  - 2. Modify the existing drain lines to properly connect to the new drain assemblies.
  - 3. Enlarge the hole in the deck and reinforce the deck to accommodate the new drain, and install the drain recessed below the roof surface to achieve maximum drainage.
  - 4. Support the drain with a stamped sump drain receiver, secure it with an under deck clamp and patch the deck around the new drain.
  - 5. Connect the new drain to the existing drain line to conform to all applicable codes, and insulate the underside of the drain body and drain line.
- B. Connect the fittings and sections of cast iron pipe using heavy duty no-hub couplings; solvent weld PVC fittings and pipe, and use threaded connections to join steel fittings and pipe.
- C. Install new drain pipes to slope 1/4 inch per foot, and support each section of pipe with a hanger, supported on a structural member or strut, on each side of every coupling. Do not rely on the couplings to support any weight. Do not hang the drain pipes from the roof deck.

### 3.6 PIPE INSULATION AND FITTING COVERS

- A. Install insulation on all horizontal drain piping, and on new vertical pipes installed to connect the new drains to the existing lines.
- B. Install insulation on the undersides of the new drains.
- C. Install white PVC fitting and drain bowl covers, and wrap the joints between fitting covers and pipe insulation jackets with 3 inch wide white PVC tape.

### 3.7 GALVANIZED STEEL ROOF ACCESS LADDERS

- A. Install ladder at exterior location shown. Support and secure each ladder at the top and bottom and at intermediate points spaced a maximum of 5 feet on center. Use bolted steel brackets, anchored with 1/2 inch diameter stainless steel epoxy set bolts. Space the ladders to provide 7 inches of toe clearance. Extend the rails 42 inches and goose-neck form them to provide additional support at the top of the ladder.

### 3.8 ROOF WALKWAY PADS AND CONCRETE PAVERS

- A. Install concrete pavers spaced 5 feet on center for conduit and pipe supports, and under condensing units.

- 1. Install pavers over a piece of hard rubber walkway pad.

- B. Install hard rubber walkway pads to provide a path 2-1/2 feet wide where shown, and at all roof access points, i.e., doors, ladders and hatches, under concrete pavers used for conduit and pipe supports, and around all HVAC equipment.

- 1. **Adhere each pad with five self adhesive strips - do not install the pads using three strips of tape as supplied by the manufacturer.**

### 3.9 PAINTING

- A. Scrape and wire brush roof top equipment, and vent pipes to remove loose and peeling paint and surface rust.
- B. Install one coat of primer and two finish coats of paint using a brush or roller. Wait 24 hours for each coat of paint to dry before applying the next coat.
- C. Do not paint over the manufacturer's name-plates or labels.

### 3.10 MISCELLANEOUS

- A. Provide and install any sealants needed, where shown or required.
- B. Perform mechanical and electrical work using skilled and licensed tradesmen.
- C. Provide new material, couplings, transition pieces, blocking, fasteners and the similar accessories needed to complete the work.

### 3.11 CLEANING, PROTECTION AND WATERTIGHTNESS

- A. Inspect the interior and exterior of the building and grounds, and submit a written report with photos to document any leaks or damage, prior to performing any work.
- B. The Owner will conduct a similar inspection at the completion of the work, and the Contractor will be charged for all leaks and damage that weren't documented in the Contractor's report, or repaired to the Owners satisfaction at the Contractor's expense.
- C. Provide any equipment, material and labor necessary to protect the site, the building, its contents and occupants, pedestrians, and surrounding landscaped and paved areas from damage due to the construction work or from inclement weather during construction.

- D. Do not perform work during inclement weather. Protect incomplete work and the building from damage by inclement weather - which may occur unexpectedly. Make all work areas watertight at the end of each day's work.
- E. Clean up all litter, refuse, rubbish, scrap materials and debris at least twice a day; at noon and at the end of the work day, so the roof and site presents a neat, orderly and workmanlike appearance. Place the debris in a dumpster, and remove the dumpster from the site as soon as it is full or no longer being used.
- F. Carefully and thoroughly clean the entire roof to remove all residual debris when all work is complete. After cleaning the roof, thoroughly clean all drain sumps, drain lines, leader heads and leaders. Do not allow debris to enter the drainage system.

END OF SECTION 07 72 00



## **SECTION 07 84 00**

### **FIRESTOPPING**

#### **PART 1 GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

##### **1.2 DESCRIPTION OF WORK**

- A. Provide firestopping systems to prevent the passage of flame and the products of combustion through concealed spaces and openings as required by code including, but is not limited to, the following:
  - 1. Above wall or partitions indicated to extend to underside of structure above.
  - 2. Concealed furring spaces behind finished surfaces.
  - 3. Locations at pipes, conduits, ducts and other construction which passes through fire-rated assemblies.
  - 4. Openings related to systems that penetrate or interrupt fire-rated assemblies.

##### **1.3 RELATED WORK**

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that relate directly to work of this Section include, but are not limited to:
  - 1. Section 07 92 00, Joint Sealants.

##### **1.4 SUBMITTALS**

- A. Product Data: Submit manufacturer's product data, installation instructions, use limitations and recommendations for each material used. Provide certifications stating that materials comply with requirements.
- B. Test Reports: Submit manufacturer's certified test reports and general certification that products meet requirements.
- C. Mock-Up: Prior to installation of firestopping, provide a mock-up of each type of firestopping system proposed for use for approval. Accepted mock-ups may be incorporated in the work.

##### **1.5 QUALITY ASSURANCE**

- A. Source: For each type of material required for the work of this section, provide primary materials which are the products of one manufacturer. Provide secondary materials which are acceptable to the manufacturers of the primary materials.
- B. Installer: Engage an experienced installer with three years documented experience acceptable to firestopping manufacturer.
- C. Asbestos-Free Products: Provide firestopping products containing no detectable asbestos as determined by method specified in 40CFR Part 763, Subpart F, Appendix A, Section 1, "Polarized Light Microscopy."

## 1.6 TESTS

- A. Fire-Resistance: Provide materials and construction which are identical to assemblies whose fire-resistance rating has been tested in compliance with ASTM E119-07a, UL 263, ANSI A2.1, or NFPA 251 by independent agencies acceptable to the Architect and authorities having jurisdiction. Provide - Perimeter Fire Barrier Systems for firesafing at curtainwalls tested per UL2079 utilizing UL's Intermediate Scale Multistory Apparatus (ISMA).
- B. Burning Characteristics: Provide materials whose surface burning characteristics, when tested in compliance with ASTM E84-08 are as follows:
  - 1. Flame Spread: Not more than 25.
  - 2. Smoke Developed: Not more than 25.

## 1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and products in unopened factory labeled packages. Store and handle in strict compliance with manufacturers' instructions and recommendations. Protect from damage.
- B. Sequence deliveries to avoid delays, but minimize on-site storage.

## 1.8 SEQUENCING AND SCHEDULING

- A. Conference: Convene a pre-installation conference to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.
- B. Perform work of this section and other sections in proper sequence so that this work will not be damaged and will be installed prior to installation of enclosing or concealing work.

## PART 2 - PRODUCTS

### 2.1 FIRESTOPPING, GENERAL

- A. Compatibility: Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by firestopping manufacturer based on testing and field experience.
- B. Accessories: Provide components for each firestopping system that are needed to install fill materials and to comply with "System Performance Requirements" article in Part 1. Use only components specified by the firestopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire-resistance-rated systems. Accessories include but are not limited to the following items:
  - 1. Permanent forming/damming/backing materials including the following:
    - a. Semirefractory fiber (mineral wool) insulation.
    - b. Ceramic fiber.
    - c. Sealants used in combination with other forming/damming materials to prevent leakage of fill materials in liquid state.
    - d. Fire-rated formboard.
    - e. Joint fillers for joint sealants.
  - 2. Temporary forming materials.
  - 3. Substrate primers.
  - 4. Collars.
  - 5. Steel sleeves.
- C. Applications: Provide firestopping systems composed of materials specified in this Section that comply with system performance and other requirements.

### 2.2 FIRE-SAFING BOARD INSULATION

- A. Provide material tested, listed and labeled by UL and listed by UL in designs similar to applications indicated. Provide semi-rigid, non-asbestos mineral fiber board, rated noncombustible when tested according to ASTM E 136-04:
  - 1. k-Value: 0.25 at 75°F.
  - 2. Thickness: 4 in., unless otherwise indicated, and not less than thickness necessary to obtain required fire-rating.
  - 3. Density: Nominal 4 pcf.
  - 4. Product: U. S. Gypsum Co., Thermafiber Safing Insulation; Partek Insulation, Inc. Paroc Safing Insulation; Fibrex, Inc. FBX Safing Insulation; or approved equal.

### 2.3 MINERAL WOOL

- A. Provide loose mineral wool, rated noncombustible when tested in accordance with ASTM E 136-04, free of asbestos and glass fiber, and suitable for in-place density of 6 pcf to 12 pcf.

## 2.4 CAULK AND PUTTY

- A. Provide one of the following products, or Architect approved equal, that meet or exceed specified requirements:
  - 1. Bio Therm; Bio Fireshield.
  - 2. Fire-Barrier Series; 3M Fire Protection Products.
  - 3. Flamesafe; International Protective Coatings Corp.
  - 4. Flame Stop V Putty and Caulking; Flame Stop, Inc.
  - 5. Fyre Putty; Standard Oil Engineered Materials Company.
  - 6. Silicone Firestop Foam 2001, and Sealant 2000; Dow Corning Corp.
  - 7. CLK Adhesive Firestop; Nelson Firestop.
  - 8. STI SpecSeal S100.
  - 9. STI Spec Seal AS 200.

## 2.5 FIRESTOP MORTAR

- A. Prepackaged dry mix composed of a blend of inorganic binders, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogenous mortar.
- B. Provide one of the following products, or Architect approved equal, that meet or exceed specified requirements:
  - 1. Novasit K-10; Bio Fireshield
  - 2. KBS Mortar Seal; International Protective Coatings Corp.
  - 3. CMP Firestop Compound; Nelson Firestop.
  - 4. STI SpecSeal Mortar.

## 2.6 WRAP STRIPS

- A. Single-component, elastomeric sheet with aluminum foil on one side. Provide one of the following products, or Architect approved equal, that meet or exceed specified requirements:
  - 1. SpecSeal Wrap Strip; STI.
  - 2. Fire Barrier FS195 Wrap Strip; 3M.
  - 3. CS2420 Intumescent Wrap, Hilti Construction Chemicals, Inc.

## 2.7 COMPOSITE BOARDS

- A. Provide one of the following products, or Architect approved equal, that meet or exceed specified requirements:

1. Barrier Sheet Material; 3M.

## 2.8 MIXING

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

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. The Installer shall examine substrates, supports, and conditions under which this work is to be performed and notify Contractor, in writing, of conditions detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected. Beginning work means Installer accepts substrates and conditions.

### 3.2 PREPARATION

- A. Review extent and types of required firestopping with governing authorities before beginning work. Obtain approval of thicknesses and installation methods, including non-typical locations.

### 3.3 INSTALLATION

- A. Strictly comply with manufacturers' instructions and recommendations, except where more restrictive requirements are specified in this section.
- B. Provide firestopping material and thickness as required to provide indicated ratings. Where not otherwise indicated, comply with UL standard designs. In multiple layer work, offset joints by at least 6". Anchor firestopping using manufacturers' recommended system and in compliance with UL standard designs.
- C. Install firestopping without gaps and voids of any kind. Do not use damaged materials. Remove and replace nonfitting or disturbed work.
- D. All sleeves installed to accommodate future work are to be sealed with properly supported safety insulation. Oversized boxouts, sleeves, and cores are to be filled with grout full depth of concrete with reinforcing, and other support as necessary to secure grout.

### 3.4 FIELD QUALITY CONTROL

- A. Coordinate installation of firestopping work with other work to minimize cutting and removal of installed fireproofing. As work of other trades is completed, review firestopping work and repair or replace work which has been damaged or removed.

### 3.5 PROTECTION

- A. Provide temporary protection to ensure work being without damage or deterioration at time of final acceptance. Remove protections and rework as necessary immediately before final acceptance.

END OF SECTION

**SECTION 078413**  
**PENETRATION FIRESTOPPING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

**A. Section Includes:**

1. Penetrations in fire-resistance-rated walls.
2. Penetrations in horizontal assemblies.
3. Penetrations in smoke barriers.

**1.2 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference:** Conduct conference at Project site.

**1.3 ACTION SUBMITTALS**

- A. Product Data:** For each type of product.

- B. Product Schedule:** For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

1. **Engineering Judgments:** Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Product test reports.**

## 1.5 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
  - 1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
  - 2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:
    - a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.
      - 1) UL in its "Fire Resistance Directory."
      - 2) FM Global in its "Building Materials Approval Guide."

### 2.2 PENETRATION FIRESTOPPING SYSTEMS

- A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. 3M Fire Protection Products.
    - b. Hilti, Inc.
    - c. Tremco, Inc.



- B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
  - 1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
  - 1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
  - 2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
  - 3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.
- D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg (74.7 Pa).
  - 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at and no more than 50-cfm (0.024-cu. m/s) cumulative total for any 100 sq. ft. (9.3 sq. m) at both ambient and elevated temperatures.
- E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.
- F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

- B. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.
- C. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.
  - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.
- D. Install fill materials by proven techniques to produce the following results:
  - 1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
  - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
  - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

### 3.2 IDENTIFICATION

- A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches (76 mm) high and with minimum 0.375-inch (9.5-mm) strokes.
  - 1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet (4.57 m) from end of wall and at intervals not exceeding 30 feet (9.14 m).
- B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
  - 1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
  - 2. Contractor's name, address, and phone number.
  - 3. Designation of applicable testing and inspecting agency.
  - 4. Date of installation.
  - 5. Manufacturer's name.
  - 6. Installer's name.

### 3.3 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2174.
- B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.
- C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

END OF SECTION 078413



**SECTION 078443**  
**JOINT FIRESTOPPING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

**A. Section Includes:**

1. Joints in or between fire-resistance-rated constructions.
2. Joints in smoke barriers.

**1.2 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference:** Conduct conference at Project site.

**1.3 ACTION SUBMITTALS**

- A. Product Data:** For each type of product.

- B. Product Schedule:** For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.

1. **Engineering Judgments:** Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Product test reports.**

**1.5 CLOSEOUT SUBMITTALS**

- A. Installer Certificates:** From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
  - 1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
  - 2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
    - a. Joint firestopping systems shall bear classification marking of a qualified testing agency.
      - 1) UL in its "Fire Resistance Directory."

### 2.2 JOINT FIRESTOPPING SYSTEMS

- A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
- B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E 1966 or UL 2079.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. 3M Fire Protection Products.
    - b. Hilti, Inc.
    - c. Roxul Inc.
    - d. Tremco, Inc.
  - 2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.

- C. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079 based on testing at a positive pressure differential of 0.30-inch wg (74.7 Pa).
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. 3M Fire Protection Products.
    - b. Hilti, Inc.
    - c. Roxul Inc.
    - d. Tremco, Inc.
  - 2. L-Rating: Not exceeding 5.0 cfm/ft. (0.00775 cu. m/s x m) of joint at both ambient and elevated temperatures.
- D. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- E. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.
- B. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- C. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
  - 1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.
- D. Install elastomeric fill materials for fire-resistive joint systems by proven techniques to produce the following results:

1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

### 3.2 IDENTIFICATION

- A. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
  1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
  2. Contractor's name, address, and phone number.
  3. Designation of applicable testing agency.
  4. Date of installation.
  5. Manufacturer's name.
  6. Installer's name.

### 3.3 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2393.
- B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.
- C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

END OF SECTION 078443



## **SECTION 079200**

### **JOINT SEALANTS**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Non-staining Silicone joint sealants.
  - 2. Acoustical joint sealants
  - 3. Urethane joint sealants.
  - 4. Mildew-resistant joint sealants.

##### **1.2 PREINSTALLATION MEETINGS**

- A. Pre-installation Conference: Conduct conference at Project site.

##### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each joint-sealant product.
- B. Samples: for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Joint-Sealant Schedule: Include the following information:
  - 1. Joint-sealant application, joint location, and designation.
  - 2. Joint-sealant manufacturer and product name.
  - 3. Joint-sealant formulation.
  - 4. Joint-sealant color.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Product test reports. For each kind of joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency.
- B. Preconstruction laboratory test reports.
- C. Preconstruction field-adhesion-test reports. Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
- D. Field-adhesion-test reports. For each sealant application tested.
- E. Sample warranties. For special warranties.

#### 1.5 INTENT

- A. Performance and Design Requirements for Sealants: Provide sealants to maintain long term 20 year minimum air tight and water tight seals. No cohesive or adhesive failures, nor cracking or bubbling of sealant surfaces are permitted. Provide sealants certified by sealant manufacturer to be capable of accommodating the full range of manufacturing tolerances, field erection tolerances, building deflections, and all other movements.
  - 1. Interior Work: Interior work is intended to seal and fill all cracks, voids and gaps in the work, usually, but not always, located between dissimilar materials.

#### 1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C1021 to conduct the testing indicated.
- B. Source: For each type of sealant and filler material required for the work of this section, provide primary materials which are the products of one manufacturer. Provide secondary materials which are acceptable to the manufacturers of the primary materials. Provide sealants which are recommended by the manufacturer for each application indicated. Where exposed to pedestrian or vehicular traffic, provide sealants which are non-tracking and able to withstand the traffic without damage.
- C. Mock-Ups: Before beginning primary work of this section, provide 10 linear feet mock-ups of each type of sealing and filler work at locations acceptable to Architect and obtain Architect's acceptance of visual qualities. Protect and maintain acceptable mock-ups throughout the work of this section to serve as criteria for acceptance of this work. Acceptable mock-ups may be incorporated into the finished work.

## 1.6 PRECONSTRUCTION TESTING

- A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
  - 1. Adhesion Testing: Use ASTM C794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
  - 2. Compatibility Testing: Use ASTM C1087 to determine sealant compatibility when in contact with glazing and gasket materials.
  - 3. Stain Testing: Use ASTM C1248 to determine stain potential of sealant when in contact with stone masonry substrates.
- B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates. Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
- C. Conduct field tests for each kind of sealant and joint substrate, as directed by Architect.
- D. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
- E. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

## 1.7 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: twenty years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: 20 years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

#### 1.8 DELIVERY, STORAGE AND HANDLING

D. Deliver materials and products in unopened factory labeled packages. Store and handle in strict compliance with manufacturers' instructions and recommendations. Protect from damage. Sequence deliveries to avoid delays, but minimize on-site storage.

#### 1.9 PROJECT CONDITIONS

A. Substrates: Proceed with work only when substrate construction and penetrating work is complete.

B. Temperature and Humidity: Comply with manufacturer's requirements and recommendations. Joints to be sealed should not be near their fully closed nor fully open extremes.

C. Conference: Convene a pre-installation conference to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.

1. Advise other trades to ensure that no other work adversely affects sealant bonding surfaces.

## PART 2 - PRODUCTS

### 2.1 JOINT SEALANTS, GENERAL

- A. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.
- B. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

### 2.2 SILICONE JOINT SEALANTS

- A. Silicone, S, NS, 100/50, NT: Single-component, non-staining, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT.
  - 1. Products: Subject to compliance with requirements.
    - a. Dow Corning Corporation 790
    - b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
    - c. Pecora Corporation; 301 NS.
    - d. Sika Corporation, Construction Products Division; SikaSil-C990.
    - e. Tremco Incorporated; Spectrem 1.

### 2.3 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Pecora Corporation; AC-20 FTR
    - b. USG Corporation; SHEETROCK Acoustical Sealant.
    - c. Dow Corning Corporation

2.4 URETHANE JOINT SEALANTS refer to drawings for location of Urethane types.

- A. Self Leveling Polyurethane Sealant: Provide two or more part, self-leveling, polyurethane based elastomeric sealant, complying with ASTM C920-05 Type M, Grade P, Class 25, having Shore A hardness of not less than 55 when tested according to ASTM D2240-05, cured modulus of elasticity at 100% elongation of not more than 150 psi when tested according to ASTM D412-06a, and tear resistance of not less than 50 lbs./inch when tested according to ASTM D 624-00(2007). Provide one of the following products if they meet or exceed the requirements of these specifications:

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Pecora Urepan NR-200
  - b. Tremco TAC 900
  - c. Tremco 901
  - d. Sika 1A, SL

- B. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Products: Subject to compliance with requirements.
  - a. Pecora Corporation;
  - b. Sika Corporation, Construction Products Division;
  - c. Tremco Incorporated;

2.5 MILDEW-RESISTANT JOINT SEALANTS (For Sink and Counter Areas)

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. GE Construction Sealants; Momentive Performance Materials Inc. #1702
  - b. Pecora Corporation #863
  - c. The Dow Chemical Company. #786

- d. Tremco Incorporated. Tremsil 200

## 2.6 JOINT-SEALANT BACKING

- A. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer, for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

## 2.7 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

# PART 3 - EXECUTION

## 3.1 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
  - 1. Remove laitance and form-release agents from concrete.
  - 2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion.
    - a. Metal.
    - b. Glass.
    - c. Porcelain enamel.
    - d. Glazed surfaces of ceramic tile.

3. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, and surface dirt.
  4. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
    - a. Concrete.
    - b. Tile
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces. Remove tape immediately after tooling without disturbing joint seal.

### 3.2 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with ASTM C1193 and joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
1. Do not leave gaps between ends of sealant backings.
  2. Do not stretch, twist, puncture, or tear sealant backings.
  3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.



- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.
  2. Completely fill recesses in each joint configuration.
  3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
  4. Sealant Depth and Joint Size: Refer to Drawings for joint sizes. Provide width to depth ratio as follows  $1/4 \square$  wide:  $1/4 \square$  deep;  $1/2 \square$  wide:  $1/2 \square$  deep;  $1/2 \square$  1  $\square$  wide:  $1/2 \times$  width.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
1. Provide concave joint profile per Figure 8A in ASTM C1193 unless otherwise indicated.
    - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.
- G. .Acoustical Sealing: Seal tightly and completely around all penetrations into (such as outlet boxes) or through walls and floors, at the entire perimeter of walls, and between dissimilar materials.
1. At penetrations through drywall construction, provide a thin sheet metal sleeve approximately  $3/4$ " larger on each side than the penetration. Fit and seal the sleeve tightly to the surrounding drywall on both sides of the wall. Pack the  $3/4$ " space between the sleeve and the penetrating object solidly with fibrous acoustical insulation. Provide resilient, non-hardening acoustical sealant to seal both sides of wall between penetration and sleeve.
  2. At penetrations through solid walls and where opening is irregular and greater than 1" larger on each side than the penetration, wrap penetrating object with 1" thick fibrous material and solidly grout space between fibrous material and opening with grout. Pack all voids with fibrous filler and seal both sides with resilient, non-hardening acoustical sealant.
  3. Where fire-stopping sealant is used at penetrations through fire-rated assemblies, additional acoustical sealing is not required.
- H. Cure sealants in strict compliance with manufacturers' instructions and recommendations to obtain highest quality surface and maximum adhesion. Make every effort to minimize accelerated aging effects and increase in modulus of elasticity.

### 3.3 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
  - 1. Extent of Testing: Test completed and cured sealant joints as follows:
    - a. Perform 4 tests for the first for each area of sealant application.
  - 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
    - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
  - 3. Inspect tested joints and report on the following:
    - a. Whether sealants filled joint cavities and are free of voids.
    - b. Whether sealant dimensions and configurations comply with specified requirements.
    - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
  - 4. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

### 3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

### 3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

### 3.6 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
  - 1. Joint Locations:
    - a. Control and expansion joints on exposed interior surfaces of exterior walls.
    - b. Tile control and expansion joints.
    - c. Vertical joints on exposed surfaces of unit masonry, concrete walls and partitions.
    - d. Aluminum thresholds, under.
    - e. Sill plates, under.
    - f. Other joints as indicated on Drawings.
  - 2. Joint Sealant: Urethane, S, NS, 25, NT.
  - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.
  - 1. Joint Locations:
    - a. Control joints on exposed interior surfaces of exterior walls.
    - b. Perimeter joints between interior wall surfaces and frames of interior doors windows.
    - c. Other joints as indicated on Drawings.
  - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
  - 1. Joint Locations:

- a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
    - b. Tile control and expansion joints where indicated.
    - c. Other joints as indicated on Drawings.
  - 2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
  - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. Provide joint sealants as scheduled in this section and as indicated on the drawings. Before beginning work, obtain Architect's clarification if the extent of each type of sealant and filler is uncertain.

END OF SECTION 079200

## **SECTION 079201**

### **JOINT SEALERS**

#### **PART 1 – GENERAL**

##### **1.1 SUBMITTALS**

- A. Product Data: Catalog sheets, specifications, and installation instructions for each product specified except miscellaneous materials.
- B. Samples:
  - 1. Sealants: One pint or standard tube.
  - 2. Joint Fillers: 24 inch long full section.
  - 3. Gaskets: 24 inch long full section.
  - 4. Joint Primer/Sealer/Conditioners: One pint.
  - 5. Backer Rods: 24 inch long full section.
  - 6. Bond Breaker Tape: 24 inch long full section.
- C. Quality Control Submittals:
  - 1. Installer's Qualifications Data: Affidavit required under Quality Assurance Article.
  - 2. Company Field Advisor Data: Name, business address, and telephone number of Company Field Advisor.

##### **1.2 QUALITY ASSURANCE**

- A. Installer's Qualifications: The persons installing the sealants and their supervisor shall be personally experienced in the installation of sealants and shall have been regularly employed by a company engaged in the installation of sealants for a minimum of two years.
  - 1. Furnish to the Owner the names and addresses of five similar projects which the foregoing people have worked on during the past two years.
  - 2. Furnish a letter from the sealant manufacturer, stating that the foregoing people are authorized to install the manufacturer's sealant materials and that the manufacturer's specifications are applicable to the requirements of this Project.
- B. Container Labels: Include manufacturer's name, trade name of product, kind of material, federal specification number (if applicable), expiration date (if applicable), and packaging date or batch number.
- C. Test and validate sealants used for exterior weather sealing per the Sealant Waterproofing Restoration Institute (SWRI).
- D. Warranties:
  - 1. Silicone sealants: 20 years Weatherseal Warranty.

2. Polyurethane or Silicone: 5 year Weatherseal Warranty.
3. Sealants for Granite, Marble and Limestone: 20 year Non-Stain Warranty.

### 1.3 PROJECT CONDITIONS

#### A. Environmental Requirements:

1. Temperature: Unless otherwise approved or recommended in writing by the sealant manufacturer, do not install sealants at temperatures below 40 degrees F or above 85 degrees F for non silicone sealants and below minus 20 degrees F or above 125 degrees F for silicone sealants.
2. Humidity and Moisture: Do not install the Work of this section under conditions that are detrimental to the application, curing, and performance of the materials.

#### B. Protection:

1. Protect all surfaces adjacent to sealants with non-staining removable tape or other approved covering to prevent soiling or staining.
2. Protect all other surfaces in the Work area with tarps, plastic sheets, or other approved coverings to prevent defacement from droppings.

## PART 2 - PRODUCTS

### 2.1 SEALANTS

#### A. Type 1 Sealant, any of the following generic types:

1. One-part, low-modulus silicone sealant: Dow Corning 790, Dow Corning 791, Dow Corning 795, General Electric Silpruf, Pecora 864, Pecora 890, Pecora 890FTS.
2. One-part, non-sag silicone or polyurethane sealant: Bostik Chem-Calk 900, Bostik Chem-Calk 915, Bostik Chem-Calk 916 Textured, Bostik Chem-Calk 2020, Pecora Dynatrol I, Sika Sikaflex 1a, Sonneborn Sonolastic NP I, or Tremco DyMonic (not SWRI), Dow Corning Contractors Weatherproofing Sealant (CWS), Dow Corning Concrete Sealant (CCS), Pecora 895.
3. Two-part, non-sag silicone or polyurethane sealant: Bostik Chem-Calk 500 (not SRWI), Pecora Dynatrol II, Dow Corning CWS or CCS.

#### B. Type 1B Sealant:

1. For Horizontal Joints: One-part, silicone or polyurethane sealant for traffic bearing construction; Bostik 915, Tremco Spectrum 800, Pecora 310-SL, Sika Sikaflex-1a, Dow Corning CWS.
2. For Vertical Joints: One-part, non-sag silicone or polyurethane sealant; Tremco Vulkem 116, Pecora Dynatrol I, Sika Sikaflex Textured Sealant, Dow Corning CCS or CWS, Pecora 301-NS, Pecora 311-NS.

- C. Type 2 Sealant: One-part acrylic polymer sealant; Pecora AVW-920, PTI 738, or Tremco Mono.
- D. Pre-formed Sealant: Preformed paintable sealant strips of open cell, compressible urethane foam, saturated with non-drying, non-staining, and non-migrating butylene compound.
- E. Sealant Colors: For exposed materials provide color to match existing sealant as indicated or, if not indicated, as selected by the Owner from manufacturer's standard colors. For concealed materials, provide the natural color which has the best overall performance characteristics.

## 2.2 JOINT FILLERS

- A. Expanded Polyethylene Joint Filler: Flexible, compressible, closed-cell polyethylene of not less than 10 psi compression deflection (25 percent).
- B. Closed Cell Polyurethane Joint Filler: Resilient, compressible, semi-rigid; W.R. Meadows Ceramar or A.C. Horn Closed Cell Plastic Foam Filler, Code 5401.

## 2.3 MISCELLANEOUS MATERIALS

- A. Backer Rod: Compressible rod stock of expanded, extruded polyethylene.
- B. Bond Breaker Tape: Polyethylene or other plastic tape as recommended by the sealant manufacturer; non-bonding to sealant; self-adhesive where applicable.
- C. Cleaning Solvents: Oil free solvents as recommended by the sealant manufacturer. Do not use re-claimed solvents.
- D. Masking Tape: Removable paper or fiber tape, self-adhesive, non-staining.

# PART 3 EXECUTION

## 3.1 EXAMINATION

- A. Examine all joint surfaces for conditions that may be detrimental to the performance of the completed Work. Do not proceed until satisfactory corrections have been made.

## 3.2 PREPARATION

- A. Clean joint surfaces immediately before installation of sealant and other materials specified in this Section.
  - 1. Remove all loose materials, dirt, dust, rust, oils and other foreign matter that will impair the performance of materials installed under this Section.
  - 2. Remove lacquers, protective coatings and similar materials from joint faces with manufacturer's recommended solvents.
  - 3. Do not limit cleaning of joint surfaces to solvent wiping. Use methods such as grinding, acid etching or other approved and manufacturer's

recommended means, if required, to clean the joint surfaces, assuring that the sealant materials will obtain positive and permanent adhesion.

- B. Set joint fillers at proper depth and position as required for installation of bond breakers, backer rods, and sealants. Do not leave voids or gaps between the ends of joint filler units.
  - 1. Smooth Edged Joints: For joints between two concrete slabs or where new concrete abuts smooth edged materials use either cork joint filler or closed cell polyurethane joint filler.
  - 2. Irregular Edged Joints: For joints where new concrete abuts granite curbs or other irregular edges use closed cell polyurethane joint filler.
- C. Priming Joint Surfaces:
  - 1. Prime joints which are to receive Type 1A and 1B Sealants.
  - 2. Prime joints of friable (crumbly, chalky) masonry surfaces which are to receive Type 1 Sealant.
  - 3. Prime joints other than those above if so recommended by the manufacturer's printed instructions.
  - 4. Do not allow the primer/sealer to spill or migrate onto adjoining surfaces.

### 3.3 JOINT BACKING INSTALLATION

- A. Install bond breaker tape in relaxed condition as it comes off the roll. Do not stretch the tape. Lap individual lengths.
- B. Install backer rod of sufficient size to fill the joint width at all points in a compressed state. Compress backer rod at the widest part of the joint by a minimum of 25 percent. Do not cut or puncture the surface skin of the rod.

### 3.4 SEALANT INSTALLATION

- A. Except as shown or specified otherwise, install sealants in accordance with the manufacturer's printed instructions.
- B. Install sealants with ratchet hand gun or other approved mechanical gun. Where gun application is impractical, install sealant by knife or by pouring as applicable.
- C. Finishing: Tool all vertical, non-sag sealants so as to compress the sealant, eliminating all air voids and providing a neat smoothly finished joint. Provide slightly concave joint surface, unless otherwise indicated or recommended by the manufacturer.
  - 1. Use tool wetting agents as recommended by the sealant manufacturer.

### 3.5 FIELD QUALITY CONTROL

- A. Test Samples:



1. Where directed, for each 1000 linear feet of joint installed, cut out and carefully remove a 6 inch long sample of the undisturbed sealant and joint backer material from the newly installed Work. Remove the samples in the presence of the Director's Representative who will retain them for evaluating and testing.
2. Reseal cut out areas with the same materials.

### 3.6 CLEANING

- A. Immediately remove misapplied sealant and droppings from metal surfaces with solvents and wiping cloths. On other materials, remove misapplied sealant and droppings by methods and materials recommended in writing by the manufacturer of the sealant material.
- B. After sealants are applied and before skin begins to form on sealant, remove all masking and other protection and clean up remaining defacement caused by the Work.

END OF SECTION 079201



**SECTION 081100**  
**STEEL WINDOW FRAMES**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Steel Window Frames.

**1.2 RELATED SECTIONS**

- A. Section 088853 - Glazing.
- B. Section 099123 - Paints and Coatings.

**1.3 REFERENCES**

- A. ANSI/NFPA 80 - Standard for Fire Doors and Windows.
- B. ANSI A 250.4 □ Physical performance: 1 million cycles minimum
- B. ANSI/SDI A 250.8 - SDI-100 Recommended Specifications for Standard Frames.
- C. ANSI A 250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
- D. ANSI A 250.11 - Recommended Erection Instructions for Steel Frames.
- E. ASTM A 924 - Specification for General Requirements for Steel Sheet, Metallic Coated by the Hot Dip Process.
- F. ASTM A 1008/1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
- G. SDI-111 - Recommended Standard Details for Steel Doors & Frames.
- H. NAAMM/HHMA-820 TN01 - Grouting Hollow Metal Frames
- I. NAAMM/HHMA-820 TN03 - Guidelines for Glazing of Hollow Metal Transom, Sidelight and Windows
- J. NFPA 252 - Standard Method of Fire Tests of Door Assembly
- K. UL - Building Materials Directory; Underwriters Laboratories Inc.

#### 1.4 SUBMITTAL

- A. Product Data: Manufacturer's standard details and catalog data indicating compliance with referenced standards, and manufacturer's installation instructions.
- B. Certificates:
  - 1. Manufacturer's certification that products comply with referenced standards.
- C. Shop Drawings: Steel frame, in accordance with SDI 111D. Show types, quantities, dimensions, specified performance, and design criteria, materials and similar data for each opening required.
  - 1. Indicate frame configuration, anchor types and spacing reinforcement, to ensure frames are properly prepared.
  - 2. Indicate elevations, internal reinforcement, closure method, and cutouts for glass light.

#### 1.5 QUALITY ASSURANCE

- A. Supplier: A documented Quality Assurance Program for continuous quality monitoring and inspections.
- B. Fire Rated Doors and Frames: Underwriters Laboratories and Warnock Hersey, labeled fire doors and frames:
  - 1. Label fire frames in accordance with Underwriters Laboratories standard UL10C, and Positive Pressure Fire Tests of Assemblies.
  - 2. Construct and install doors and frames to comply with current issue of ANSI/NFPA 80.
  - 3. Manufacture Underwriters Laboratories labeled frames under the UL factory inspection program and in strict compliance to UL procedures, and provide the degree of fire protection, heat transmission.
  - 4. Manufacture Intertek Testing Services / Warnock Hersey labeled doors and frames under the ITS/WH factory inspection program and in strict compliance to ITS/WH procedures, and provide the degree of fire protection capability indicated by the opening class.
  - 5. Affix a physical label or approved marking to each fire window frame, at an authorized facility as evidence of compliance with procedures of the labeling agency. Alternate labeling with embossment permitted
  - 6. Conform to applicable codes for fire ratings. It is the intent of this specification that hardware and its application comply or exceed the standards for labeled openings. In case of conflict between types required for fire protection, furnish type required by NFPA and UL.
- C. Installer: Minimum five years documented experience installing products specified in this Section.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Handle, store and protect products in accordance with the manufacturers printed instructions and ANSI/SDI A250.10 and NAAMM/HMMA 840.
- B. Store frames in an upright position with heads uppermost under cover. Place on 4 inch (102 mm) high wood sills to prevent rust and damage. Store assembled frames five units maximum in a stack with 2 inch (51 mm) space between frames to promote air circulation.
- C. Do not use non-vented plastic or canvas shelters to prevent rust or damage.
- D. Should wrappers become wet, remove immediately.

## 1.7 COORDINATION

- A. Sequence of installation to accommodate required wall construction and finishes.
- B. Verify field dimensions for factory assembled frames prior to fabrication.
- C. Coordinate Glass type / rating in rated steel frame.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Bases of Design -Pioneer Industries,. Carlstadt, NJ. Tel: Kamal Sheikh; (201) 933 1900  
[skamal@pioneerindustries.com](mailto:skamal@pioneerindustries.com); [www.pioneerindustries.com](http://www.pioneerindustries.com)  
Pioneer's (F Series)
- B. Substitutions: Refer to Division One for Substitution.  
Manufacturers must be recognized as ☐SDI CERTIFIED☐

### 2.2 HOLLOW METAL FRAMING SYSTEMS:

- 1. Components: Construct architectural frame assemblies of standard frame components, fabricated as specified.
  - a. Interior Frames in stud wall construction: 16 gage (1.3 mm) cold rolled steel, ASTM A 1008/A 1008M steel.
  - b. Interior Frames in Masonry: Zinc-Iron Alloy-Coated galvanized steel, ASTM A 653, Class A60, 16 gage 0.053 inch (1.3 mm) galvanized steel.
- 2. Frame component requirements:
  - a. Fabricate frame assemblies for shipment to the jobsite completely welded.
    - 1) Provide frames with joint reinforcements 14 gage (1.7 mm), 8 inches (203 mm) long.
  - b. Pierced and dimpled glazing beads for use with

- manufacturers' standard fasteners.
  - c. Provide necessary anchors for jambs, heads, and sills of assemblies.
  - d. Verify field dimensions as required. Do not begin fabrication until these dimensions have been verified, and approved.
- 3. Accessories:
  - a. Glazing Bead: Formed steel sheet; screw-attached.
- 4. Fire Rating: Provide factory assembled welded units bearing Labels for fire ratings indicated on the Drawings.
- 5. Finish: Factory prime finish in accordance with ANSI A 250.10.

## 2.5 ACCESSORIES

- A. Anchors: Manufacturer's standard framing anchors, specified in manufacturer's printed installation instructions for project conditions.
- B. Glazing: Specified in Section 088853.

## 2.6 FABRICATION

- G. Steel Frames:
  - 1. Factory-welded frames: Head and jamb intersecting corners mitered at 45 degrees, with back welded joints ground smooth.
    - a. Continuous face weld the joint between the head and jamb faces along their length either internally or externally. Grind, prime paint, and finish smooth face joints with no visible face seams.

## 2.7 FINISHES

- H. Factory Prime Finish: Meet requirements of ANSI A

## 250.10. PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that project conditions are acceptable before beginning installation of frames.
  - 1. Verify that completed openings to receive knock-down wrap-around frames are of correct size and thickness.
  - 2. Verify that completed concrete or masonry openings to receive butt type frames are of correct size.
- B. Do not begin installation until conditions have been properly prepared.
- C. Confirm that the frames are intended for the exact locations.

### 3.2 INSTALLATION

- A. Install frames in accordance with manufacturer's printed installation instructions and with recommended erection instructions for steel frames ANSI A250.11 and NAAMM/HMMA 840.
- B. Fire Frames: Install in accordance with ANSI/NFPA 80.
- C. Set frames accurately in position; plumb, align and brace until permanent anchors are set. After wall construction is complete.
- D. Provide full height 3/8 inch (9.5 mm) to 1-1/2 inch (38 mm) thick strip of Fire Rated Wool blocking at frames.
- E. Glaze and seal exterior transom, sidelight and window frames in accordance with HMMA-820 TN03.

### 3.3 ADJUST AND CLEAN

- A. Clean and restore unclean surfaces. Remove scraps and debris and leave site in a clean condition.
- B. Prime Coat damages: Touch-Up Immediately after erection, sand smooth rusted or damaged areas of prime coat, and apply touch-up of compatible DTM air-drying primer.

### 3.4 PROTECTION

- A. Protect installed products and finished surfaces from damage during construction.

END OF SECTION





## **SECTION 081113**

### **HOLLOW METAL DOORS AND FRAMES**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. Section includes hollow-metal work.

##### **1.3 DEFINITIONS**

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

##### **1.4 COORDINATION**

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

##### **1.5 PREINSTALLATION MEETINGS**

- A. Pre-installation Conference: Conduct conference at Project site

##### **1.6 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, core descriptions, finishes.
- B. Shop Drawings: Include the following:
  - 1. Elevations of each door type.

2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
  3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
  4. Locations of reinforcement and preparations for hardware.
  5. Details of each different wall opening condition.
  6. Details of anchorages, joints, field splices, and connections.
  7. Details of accessories.
  8. Details of moldings, removable stops, and glazing.
  9. Details of conduit and preparations for power, signal, and control systems.
- C. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

### 2.2 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3.
  1. Physical Performance: Level A according to SDI A250.4.
  2. Doors:

- a. Type: As indicated in the Door and Frame Schedule.
- b. Thickness: 1-3/4 inches (44.5 mm.)
- c. Face: Metallic-coated steel sheet, minimum thickness of 14 gauge with minimum A40 (ZF120) coating.
- d. Edge Construction: Model 1, Full Flush
- e. Core: Mineral board with Vertical steel stiffener].

- 1) Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.1 deg F x h x sq. ft./Btu (0.370 K x sq. m/W when tested according to ASTM C 1363.

### 3. Frames:

- a. Materials: Metallic-coated steel sheet, minimum thickness of 12 gauge with minimum A40 (ZF120) coating.
- b. Construction: Full profile welded

### 4. Exposed Finish: Prime

## 2.3 FRAME ANCHORS

### A. Jamb Anchors:

- 1. Type: Adjustable anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick.

## 2.4 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

- F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- G. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.
- H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- I. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

## 2.5 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
  - 1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch (0.66 mm), steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches (152 mm) apart. Spot weld to face sheets no more than 5 inches (127 mm) o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
  - 2. Vertical Edges for Single-Acting Doors: Provide beveled or square edges at manufacturer's discretion.
  - 3. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets.
  - 4. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.
  - 5. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
  - 6. Astragals: Provide overlapping astragal on one leaf of pairs of doors. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

- C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
  - 1. Jamb Anchors: Provide number and spacing of anchors as follows:
    - a. Type: Locate anchors not more than 16 inches (406 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c.
  - 2. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
    - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
- E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
  - 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
  - 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
- F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted hairline joints.
  - 1. Provide fixed frame moldings on outside of exterior.
  - 2. Provide loose stops and moldings on inside of hollow-metal work.
  - 3. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

## 2.6 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
  - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

### 3.3 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames for doors, lites, and other openings, of size and profile indicated. Comply with SDI A250.11 or
  - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, NAAMM-HMMA 840 as required by standards specified remove temporary braces, leaving surfaces smooth and undamaged.
    - a. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    - b. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
  - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.

- a. Floor anchors may be set with power-actuated fasteners instead of post-installed expansion anchors if so indicated and approved on Shop Drawings.
- 3. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
  - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
  - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
  - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
  - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
- C. Doors: Fit doors accurately in frames, within clearances specified below. Shim as necessary.
  - 1. Non-Fire-Rated Doors:
    - a. Between Door and Frame Jambs and Head: 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).
    - b. Between Edges of Pairs of Doors: 1/8 inch (3.2 mm) to 1/4 inch (6.3 mm) plus or minus 1/32 inch (0.8 mm).
    - c. At Bottom of Door: 5/8 inch (15.8 mm) plus or minus 1/32 inch (0.8 mm).
    - d. Between Door Face and Stop: 1/16 inch (1.6 mm) to 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).
- D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.
  - 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

### 3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow-metal work immediately after installation.

- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- E. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.
- F. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113



**SECTION 081416**  
**FLUSH WOOD DOORS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

**A. Section Includes:**

- 1. Solid-core doors with Veneer
- 2. Factory fitting flush wood doors to frames and factory machining for hardware.
- 3. Factory installed glazing

**B. Related Requirements:**

- 1. Section 081100 Hollow Metal Doors & Frames
- 2. Section 087100 Door Hardware
- 3. Section 099300 Staining and Transparent Finishing for field finishing doors.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of door. Include details of core and edge construction, vision kits for openings and factory finishing.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
  - 1. Use same unit designations used in Contract Documents.
  - 2. Hardware and [wiring chase] preparation.
  - 3. Glazed openings
  - 4. Blocking dimensions and locations
  - 5. Fire-protection ratings for fire-rated doors.

- C. Samples for Initial Selection: Available standard [Stain] [Paint] [Plastic laminate].
- D. Samples for Verification:
  - 1. Factory finish applied to actual door face material, approximately 8 x 10 inches, for each material and finish.
  - 2. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.
  - 3. Plastic Laminate, 5 square, for each color, texture and pattern selected.
  - 4. Frames for light openings, 6 inches long, for each material, type, and finish when required.

#### 1.4 QUALITY ASSURANCE

- A. Quality Standard: WDMA I.S.1-A, latest edition, "Industry Standard for Architectural Wood Flush Doors"
- B. Security Standard: Filti Testing and Development (FTD), "Shooter Attack Test Method (SA)"

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in plastic bags and wrap bundles of doors in plastic sheeting.
- C. Mark each door on top rail with opening number used on Shop Drawings.

#### 1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

## 1.7 WARRANTY

- A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
    - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
  - 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
  - 3. Warranty Period for Solid-Core Interior Doors: Life of installation.

## PART 2 - PRODUCTS

- A. Masonite Architectural, Aspiro Series
  - 1. A component of the Attack Resistant System
  - 2. No Substitutions Allowed, unless approved by Architect.
- B. Source Limitations: Obtain flush wood doors from single manufacturer.

## 2.2 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: Provide WDMA I.S.1-A
  - 1. Performance Grade: Extra Heavy Duty.
  - 2. Aesthetic Grade: Custom (A grade faces)
- B. Security Standard: FTD-SA
  - 1. Performance Class:
    - a. Non-rated-Class 6
    - b. 20-Minute rated ☐ Class 3
    - c. 45- Minute rated ☐ Class 6
- C. Fire-Rated Wood Doors: Conforming to NFPA 80; listed and labeled for required ratings based on testing at pressure NFPA 252 OR UL 10C by UL or other testing agency acceptable to authorities having jurisdiction.
  - 1. Ratings; Category A positive pressure
  - 2. Cores:

- a. 20-minute rated: Structural composite lumber
    - b. 45-minute fire rated: Fire-resistant wood-based particleboard
  - 3. Vertical Edges:
    - a. Category A Positive Pressure: Integral intumescent seals concealed by outer stile where required.
    - b. Category B Positive Pressure: Intumescent seals applied to door frame per requirements of section 08 71 00 where required.
  - 4. Blocking: Provide blocking with improved screw holding capability approved for use in doors of fire protection ratings indicated as follows:
    - a. 5-inch in doors indicated to have closers and overhead stops
    - b. Blocking is not required in structural composite lumber core doors
- D. Smoke and Draft Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784 for I occupancy projects.

Specifier Note: Please Select the paragraph or paragraphs below that pertain to the door requirements on your project.

## 2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

### A. Interior Solid-Core Doors:

- 1. Aesthetic Grade: Custom, with Grade A faces
- 2. Species: Veneer: Match Existing Wood Species and Veneers Patterns, or if stated in Door Schedule on Drawings.
- 3. Match between Veneer Leaves: Book match.
- 4. Assembly of Veneer Leaves on Door Faces: Book & Running match.
- 5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
- 6. Vertical Edges: Matching / Compatible Hardwood Lumber over structural composite lumber
- 7. Horizontal Edges: Structural Composite Lumber Clean edge band bonded to the SCL top rail.
- 8. Core: Structural Composite Lumber
- 9. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering

## 2.4 LIGHT FRAMES

- A. Metal Vision Frames for Light Openings:
  - 1. 18 gauge cold-rolled steel
  - 2. Through-bolted through the door
  - 3. Bite: Minimum 3/8" overlap
  - 4. Finish Powder-coated finish; and approved for use in doors of fire-protection rating indicated.
- B. MVF Manufacturer's: Subject to compliance, meeting Filti Testing and Development (FTD), Shooter Attack Test Method (SA)
  - 1. Activar-VLFIG
  - 2. Anemostat-FGS-IS
  - 3. All Metal Stamping-118D or 118

## 2.5 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
  - 1. Comply with NFPA 80 requirements for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
  - 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
- C. Openings:
  - 1. Light Openings: Factory cut and install with vision kits indicated above.
  - 1. Glass: Factory install glass in doors per manufacturer's instructions.
    - a. Non-rated glass to be Armoured One AOTSG516
    - b. 20-minute glass to be Armoured One AOSTG1016FR-45
    - c. 45-minute glass to be Armoured One AOSTG1016FR-45

## 2.6 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
- B. Transparent Finish:
  - 1. Grade: Premium
  - 2. Finish: WDMA TR-8 UV Cured Acrylated Polyester/Urethane.
  - 3. Staining: Match Architect's sample] [As selected by Architect from manufacturer's full range.
  - 4. Sheen: Satin
- C. Factory Painted:
  - 1. Grade: Premium
  - 2. Finish: WDMA I.S. 1-A System OP-8
  - 3. Color: Matching Architect's paint sample] [As selected by Architect from manufacturers full range.
  - 4. Sheen: Satin

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
  - 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
  - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Hardware: For installation, see Section 087100 Door Hardware.
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
  - 1. Install fire-rated doors according to NFPA 80.

2. Install smoke- and draft-control doors according to NFPA 105.
- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
    - a. Comply with NFPA 80 for fire-rated doors.
    - b. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
  2. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.
- D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

### 3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416





## **SECTION 08 14 17**

### **WOOD ENTRANCE DOORS**

#### **PART 1 GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

##### **1.2 DESCRIPTION OF WORK**

- A. The work of this section includes, but is not limited to, the following:

- 1. Wood clad historic profile bulletproof doors at High School entry.
- 2. Prefitting and premachining of wood doors.
- 3. Factory finishing of wood doors.

##### **1.3 RELATED WORK**

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that relate directly to work of this Section include, but are not limited to:

- 1. Section 08 71 00, Door Hardware
- 2. Section 08 88 53, Security Glazing

##### **1.4 SUBMITTALS**

- A. Product Data: Submit manufacturer's product data, specifications, installation instructions, use limitations and recommendations for each door type used. Provide certifications stating that doors comply with requirements.
- B. Shop Drawings: Provide large scale shop drawings for fabrication and installation of all doors. Provide schedules, sizes, elevations, and details of construction, hardware blocking, information on prefitting and premachining work, and accessory items.
- C. Finishing Specifications: Provide detailed specifications for all factory applied coatings and finishes.
- D. Verification Samples: Submit representative samples of each door and finish that is to be exposed in the finished work, showing the full range of color and finish variations expected. Provide samples having minimum area of 144 square inches.
- E. Test Reports: Submit certified reports for fire-tests. Submit ballistic reports for

bullet resistant doors.

## 1.5 QUALITY ASSURANCE

- A. Source: For each type of door required for the work of this section, provide products of one manufacturer to ensure uniformity in quality of appearance and construction.
- B. Architectural Woodwork Institute: Provide doors complying with applicable requirements of AWI *Architectural Woodwork Quality Standards*, Section 1300, for grade, core construction and finish.

## 1.6 TESTS

- A. Fire-Resistance: Where fire-resistance ratings are indicated or required by authorities having jurisdiction, provide doors which are identical to doors whose fire-resistance rating has been tested in compliance with ASTM E2074 by independent agencies acceptable to the Architect and authorities having jurisdiction.
- B. Ballistics: Underwriters Laboratory, UL 752, Current Edition, Standard for Bullet-Resisting Equipment
- B. Provide doors that are labeled and listed by an agency acceptable to authorities having jurisdiction.
- C. When acceptable to authorities having jurisdiction, provide 1-3/4" thick solid core doors without fire-rating labels for "C-Labeled" doors.

## 1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver doors in manufacturer's standard package. Store and handle in strict compliance with manufacturer's instructions and recommendations. Comply with the requirements of on-site care recommendations of WDMA *Care and Finishing of Wood Doors*. Protect from damage.
- B. Sequence deliveries to avoid delays, but minimize on-site storage.

## 1.8 PROJECT CONDITIONS

- A. Weather: Unwrap and install doors only when existing and forecasted weather conditions are within the limits established by manufacturers.
- B. Proceed with work only when wet-work and other potentially damaging construction work is complete.
- C. Ventilation: Comply with manufacturer's requirements and recommendations.

## 1.9 ON-SITE CONFERENCE

- A. Conference: Convene a pre-installation conference to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.

## 1.10 WARRANTY

- A. Provide written warranty signed by manufacturer agreeing to repair or replace work which exhibits defects in materials or workmanship for the following periods from date of Substantial Completion. "Defects" is defined to include, but is not limited to, warping, bowing, cupping, twisting, telegraphing of core construction, exceeding tolerance limitations of NWMA and AWI, abnormal aging or deterioration, and failure to perform as required.
  - 1. Interior Doors: Life of Installation
  - 2. Exterior Doors: 10 years
- B. Include requirement for refinishing and reinstalling doors repaired or replaced under warranty. Manufacturer or fabricator shall not defer action on any claim; claims shall be satisfied immediately.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with requirements, provide products of one of the following manufacturers or approved equal:
  - 1. North American Bulletproof

### 2.2 MATERIALS AND PRODUCTS

- A. General: Provide AWI PC-5 construction as specified in AWI Quality Standards Section 1300-S. Core, stiles, and rails shall be glued together before sanding. Wood for stiles and rails shall be thoroughly seasoned, kiln-dried stock with 5% to 8% moisture content.
- B. Provide same exposed surface on both sides of door, unless indicated otherwise.
- C. Cut and trim openings (if shown), comply with applicable requirements of referenced standards.
- D. All factory-finished doors shall be shipped in individual protective packaging to jobsite.

## 2.3 DOORS AND COMPONENTS

- A. Stile and Rail Doors: AWI Premium Grade, veneered laminated-strand lumber core with face and edges of maple specified. Glass panels shall be laminated glass as specified in Section 08800, Glass and Glazing.
- B. Bullet Resistant Doors: Model WDR-PP-HL-CF Bullet-Resistant Wood Clad Door with custom stops and profiles matching existing historic entry door and frame.
  - 1. Frames, doors, and glazing shall be supplied to provide a complete assembly.
  - 2. Ballistic Resistance Performance Level: U.L. 752 Level 5
  - 3. WDR integral door/frame system to provide ballistic overlap protection.
  - 4. WDR wood door to be constructed of 1/8" (species)-veneered plywood door skins, matching door edges, solid hardwood trim profiles and stops. Core to be Shotgard fiberglass core with honeycomb filler panels and medium-density fiberboard panels for hardware reinforcement. Appearance to match existing historic entry door.
  - 6. WDR Primed-Finish Steel Doorframe to be constructed of 12-gauge steel with mitered, continuously welded corners. Frame to be clad with solid hardwood trim profiles and stops.
  - 7. Frame Profile: 2" clamp-style frame (depth of frame determined by wall thickness), lined with steel as required for ballistic protection level.
  - 8. Viewlite to be as shown on Drawings. Performance level of the glazing to match the performance level of the door.
  - 9. Door to be pre-hung with 1100-lb. rated continuous-gear hinge with security pins.
  - 10. Door and frame to be prepped for mortise lock and standard strike.
  - 11. Testing: Independently tested to U.L. 752 to level specified.

## 2.4 PREFITTING AND PREMACHINING

- A. At factory, prefit doors to frames and premachine doors for hardware listed on final schedules.
- B. Comply with tolerance requirements of AWI for non-rated doors and NFPA for fire-rated doors.
- C. Bevel non-rated doors 1/8" in 2" at lock and hinge stiles. Bevel rated doors 1/8" in 2" at lock edge only.

## 2.5 FINISHES

- A. General: Comply with referenced quality standard's requirements for factory finishing.
  - 1. Quality Standard: Provide AWI Premium Grade for finishing, complying with AWI Quality Standards, Section 1500.
  - 2. Preparation for Finishing: Comply with AWI Quality Standards for sanding,

filling, countersinking, sealing of concealed surfaces, and similar preparation requirements for finishing of work of this Section.

- C. Transparent Finish: Provide multi-coat tinted transparent polyurethane finish to match Architect's samples.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. The Installer shall examine frames and conditions under which this work is to be installed and notify Contractor, in writing, of conditions detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected. Beginning work means Installer accepts substrates and conditions.

### 3.2 PREPARATION

- A. Strictly comply with manufacturers' instructions and recommendations, except where more restrictive requirements are specified in this section.
- B. Condition doors to prevailing conditions before installing.

### 3.3 INSTALLATION

- A. Strictly comply with manufacturer's instructions and recommendations, except where more restrictive requirements are specified in this section.
- B. Prefit and premachine doors to the extent not done at factory. Restore factory finishes before installing.
- C. For non-rated doors, provide 1/8" clearances at head, jambs and meeting stiles (of pairs of doors). Provide 1/2" clearance at bottom and as required to clear flooring, except at thresholds provide 1/4" clearance. Coordinate with gasketing requirements.
- D. For fire-rated doors, provide clearances complying with NFPA 80.

### 3.4 ADJUSTING, CLEANING, PROTECTION

- A. Adjust doors to work easily, smoothly, and correctly.
- B. Touch-up damaged coatings and finishes to eliminate evidence of repair.
- C. Repair minor damage to eliminate all evidence of repair. Remove and replace work which cannot be satisfactorily repaired.
- D. Clean exposed surfaces using materials and methods recommended by manufacturer of material or product being cleaned. Remove and replace work

that cannot be successfully cleaned.

- E. Provide temporary protection to ensure work being without damage or deterioration at time of final acceptance. Remove protections and reclean as necessary immediately before final acceptance.

END OF SECTION

**SECTION 083113**  
**ACCESS DOORS AND FRAMES**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section includes access doors and frames for walls and ceilings.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, fire ratings, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Product Schedule: For access doors and frames.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For testing and inspecting agency.
  - 1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, section 5.2.3.1.

**1.5 CLOSEOUT SUBMITTALS**

- A. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

**1.6 QUALITY ASSURANCE**

- A. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies shall meet the qualifications set forth in NFPA 80, section 5.2.3.1

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection and temperature-rise limit ratings indicated, according to NFPA 252 or UL 10B.

### 2.2 ACCESS DOORS AND FRAMES

#### A. Flush Access Doors with Concealed Flanges

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Babcock-Davis.
  - b. Cendrex Inc.
  - c. Nystrom, Inc.
2. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
3. Locations: Wall and ceiling,
4. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch (1.63 mm), 16 gage factory primed.
5. Frame Material: Same material and thickness as door.
6. Latch and Lock: Cam latch, key operated.

### 2.3 FIRE-RATED ACCESS DOORS AND FRAMES

#### A. Fire-Rated, Flush Access Doors with Concealed Flanges

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Babcock-Davis.
  - b. Cendrex Inc.
  - c. Nystrom, Inc.
2. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal with concealed flange for gypsum board installation, self-closing door, and concealed hinge.
3. Locations: Wall and ceiling.
4. Door Size: <Insert door size>.
5. Fire-Resistance Rating: Not less than that of adjacent construction
6. Temperature-Rise Rating: 450 deg F (250 deg C) at the end of 30 minutes.



7. Metallic-Coated Steel Sheet for Door: Nominal 0.040 inch (1.02 mm), 20 gage factory primed.
8. Frame Material: Same material, thickness, and finish as door
9. Latch and Lock: Self-closing, self-latching door hardware, operated by key.

## 2.4 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.
- C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- D. Frame Anchors: Same material as door face.
- E. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

## 2.5 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
  1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
  2. For concealed flanges with plaster bead for full-bed plaster applications, provide zinc-coated expanded-metal lath and exposed casing bead welded to perimeter of frames.
- D. Latch and Lock Hardware:
  1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.

2. Keys: Furnish two keys per lock and key all locks alike.

## 2.6 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
  1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.

### 3.3 FIELD QUALITY CONTROL

- A. Inspections:
  1. Fire-Rated Door Inspections: Inspect each fire-rated access door in accordance with NFPA 80, section 5.2.

- B. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- C. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- D. Prepare and submit separate inspection report for each fire-rated access door indicating compliance with each item listed in NFPA 80 and NFPA 101.

#### 3.4 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 083113



**SECTION 083300**  
**ROLLING COUNTER FIRE SHUTTERS**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section Includes: electric operated automatic closing rolling counter fire doors with SmokeShield®UL leakage rated assembly label.
- B. Related Sections:
  - 1. 05 50 00 Metal Fabrications. Door opening jamb and head members.
  - 2. 06 10 00 Rough Carpentry. Door opening jamb and head members.
  - 3. 08 31 00 Access Doors and Panels. Access doors.
  - 4. Division 26. Electrical wiring and conduit, fuses, disconnect switches, connection of operator to power supply, installation of control station and wiring, and connection to alarm system.
- C. Products That May Be Supplied, But Are Not Installed Under This Section:
  - 1. Control station
  - 2. Electrical disconnect
  - 3. Primary and control wiring
  - 4. Conduit and fittings

**1.2 SYSTEM DESCRIPTION**

- A. Performance Requirements:
  - 1. Provide doors with Underwriters Laboratories, Inc. label for the fire rating classification, 3/4 hr
  - 2. Provide doors with Underwriters Laboratories, Inc. label for Leakage Rated Assembly or S label demonstrating product tested to UL 1784.
    - a. Comply with NFPA 105 air leakage requirements
  - 3. Custom Layout
    - a. Product has been reconfigured for a custom layout, refer to drawings by CornellCookson.
  - 4. Customized Product
    - a. This product has custom modifications designed by CornellCookson. Contact Manufacturer for details.

### 1.3 SUBMITTALS

- A. Reference Section 01 33 00 Submittal Procedures; submit the following items:
  - 1. Product Data
  - 2. Shop Drawings: Include special conditions not detailed in Product Data. Show interface with adjacent work.
  - 3. Quality Assurance/Control Submittals:
    - a. Provide proof of manufacturer ISO 9001:2015 registration
    - b. Provide proof of manufacturer and installer qualifications - see 1.4 below
    - c. Provide manufacturer's installation instructions
  - 4. Closeout Submittals:
    - a. Operation and Maintenance Manual
    - b. Certificate stating that installed materials comply with this specification

### 1.4 QUALITY ASSURANCE

- A. Qualifications:
  - 1. Manufacturer Qualifications: ISO 9001:2015 registered and a minimum of five years experience in producing counter fire doors and smoke control units of the type specified
  - 2. Installer Qualifications: Manufacturer's approval

### 1.5 DELIVERY STORAGE AND HANDLING

- A. Reference Section 01 66 00 - Product Storage and Handling Requirements
- B. Follow manufacturer's instructions

### 1.6 WARRANTY

- A. Standard Warranty: Two years from date of shipment against defects in material and workmanship
- B. Maintenance: Submit for owner's consideration and acceptance of a maintenance service agreement for installed products

## PART 2 PRODUCTS

### 2.1 MANUFACTURER

- A. Manufacturer:
  - 1. Cornell: 24 Elmwood Avenue Mountain Top, PA 18707.  
Telephone: (800) 233-8366.
    - a. Model: ERC11
  - 2. Cookson
  - 3. Clopay Building Products

Substitutions: Not permitted.

## 2.2 MATERIALS

- A. Curtain:
  - 1. Slat Configuration:
    - a. Stainless Steel: No. 1F, interlocked flat-faced slats, 1-1/2 inches (38 mm) high by 1/2 inch (13 mm) deep, minimum 22 gauge AISI type 304 #4 finish stainless steel with stainless steel bottom bar and vinyl astragal
  - 2. Finish:
    - a. Stainless Steel: type 304 #4 finish
- B. Endlocks:

Fabricate continuous interlocking slat sections with high strength galvanized steel endlocks riveted to slats per UL requirements
- C. Guides:
  - 1. Configuration & Finish:
    - a. Stainless Steel: minimum 12 gauge formed shapes
      - 1) type 304 #4 finish
- D. Counterbalance Shaft Assembly:
  - 1. Barrel: Steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot (2.5 mm per meter) of width
  - 2. Spring Balance: Oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of door to ensure that maximum effort to operate will not exceed 25 lbs (110 N). Provide wheel for applying and adjusting spring torque.
- E. Brackets:

Fabricate from reinforced steel plate with permanently lubricated ball or roller bearings at rotating support points to support counterbalance shaft assembly and form end closures

  - 1. Finish:
    - a. Stainless Steel
      - 1) type 304 #4 finish
- F. Hood and Mechanism Covers:

24 gauge stainless steel with reinforced top and bottom edges. Provide minimum 1/4 inch (6.35 mm) steel intermediate support brackets as required to prevent excessive sag.

  - 1. Finish:
    - a. Stainless steel: type 304 #4 finish
- G. Smoke Seals & UL Smoke Label:

1. Bottom Bar (Motor Operated Units): Combination smoke seal/sensing edge
2. Guides and Head: Replaceable, UL Listed, brush seals sealing against fascia side of curtain

## 2.3 OPERATION

### A. Motor Operation:

1. AlarmGard Advanced Fire Shutter Motor Operation: UL, cUL listed NEMA 1 enclosure, horsepower as recommended by manufacturer, Refer to Electrical Drawings for power / phase service. Provide a totally enclosed non ventilated motor, removable without affecting the setting of limit switches; thermal overload protection, planetary gear reduction, adjustable rotary limit switch mechanism and a transformer with 24v secondary output. All internal electrical components are to be prewired to terminal blocks.
  - a. Provide a failsafe motor operated door assembly requiring no ancillary or externally mounted release devices, cables, chains, pulleys, reset handles or mechanisms
  - b. Provide an internal electrical failsafe release device that requires no additional wiring, external cables or mounting locations
  - c. Provide an internal solenoid brake mechanism to hold the door at any position during normal door operation
  - d. Provide logic for fully monitored safety reversing devices such that the failure of any single monitored device will cause the motor operator to automatically revert to constant pressure to close
  - e. Electrically activate door system automatic closure by notification from central alarm system or power outage
  - f. Provide an automatic alarm closure selectable time delay of zero or ten seconds
  - g. Control automatic closure speed with an internal, totally enclosed, variable rate centrifugal governor without the use of electrical pulsation, constant rate viscosity, oscillation type or other exposed governing devices
  - h. Maintain automatic closure speed at not more than 9"(229 mm) per second
  - i. Electrically reset internal failsafe release device and door operating system upon restoration of electrical power and upon clearing of the alarm signal without requiring human supervision
  - j. Provide selectable ability for the door system to automatically self-cycle to the fully open position following automatic reset without requiring human supervision
  - k. Provide an integral, non-resettable cycle counter
  - l. Ensure that manual resetting of spring tension, release devices, linkages or mechanical dropouts will not be required
  - m. Provide minimum #50 roller chain for drive connection from motor drive assembly to the door drive shaft



- n. Install system only with manufacturer supplied or specified fasteners.
  - o. Notify electrical contractor to mount control station(s) and supply the appropriate disconnect switch, all conduit and wiring per the door system wiring instructions
  - p. Drop test and reset door system twice by all means of activation and comply fully with NFPA 80 Section 5
  
- B. Control Station:
  - 1. Flush mounted: "Open/Close/Stop" push buttons; NEMA 1B
  
- C. Control Operation:
  - 1. Constant pressure to close:
  
  - 1. Momentary contact to close:
    - Fail-safe, UL325-2010 Compliant Entrapment Protection for Motor Operation.
    - a. Continuously monitored, wireless sensing seal extending full width of door bottom bar. Contact before door fully closes shall cause door to immediately stop downward travel and reverse direction to the fully opened position
    - a. 2-wire, E.L.R. (E.L.R. meets fail-safe/monitored device specifications) electric sensing edge extending full width of door bottom bar. Contact before door fully closes shall cause door to immediately stop downward travel and reverse direction to the fully opened position. Provide a self-coiling cable connection to control circuit.

## 2.4 ACCESSORIES

- A. Locking:
  - 1. None
  
- B. Battery Backup:
  - 1. Model R-BBU Battery Back-Up System: For FireGard Motor Operator with a failsafe release device to provide a minimum of six hours door hold-open time in the event of a power failure
  
- C. Operator and Full Bracket Mechanism Cover:
  - 24 gauge stainless steel sheet metal cover to enclose exposed moving operating components at coil area of unit. Finish to match door hood.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates upon which work will be installed and verify conditions are in accordance with approved shop drawings
- B. Coordinate with responsible entity to perform corrective work on unsatisfactory substrates
- C. Commencement of work by installer is acceptance of substrate

### 3.2 INSTALLATION

- A. Install door and operating equipment with necessary hardware, anchors, inserts, hangers and supports
- B. Comply with NFPA 80 and NFPA 105 and follow manufacturer's installation instructions

### 3.3 ADJUSTING

- A. Following completion of installation, including related work by others, lubricate, test, and adjust doors for ease of operation, free from warp, twist, or distortion

### 3.4 FIELD QUALITY CONTROL

- A. Site Test: Test doors for normal operation and automatic closing. Coordinate with authorities having jurisdiction to witness test and sign Drop Test Form

### 3.5 CLEANING

- A. Clean surfaces soiled by work as recommended by manufacturer
- B. Remove surplus materials and debris from the site

### 3.6 DEMONSTRATION

- A. Demonstrate proper operation to Owner's Representative
- B. Instruct Owner's Representative in maintenance procedures

END OF SECTION

**SECTION 084113**  
**ALUMINUM-FRAMED ENTRANCES & STOREFRONTS**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Section Includes: Aluminum Entrance Doors, including:
- B. Related Sections:
  - 1. Glass and Glazing: Refer to Division 8 Glass and Glazing Section for glass and glazing requirements.
  - 2. Single Source Requirement: All products listed below shall be by the same manufacturer.
    - b. Section 084413.1, 084413.2, Glazed Aluminum Curtain Wall.

**1.02 SYSTEM PERFORMANCE DESCRIPTION**

- A. Performance Requirements: Provide aluminum swing doors that comply with performance requirements indicated, as demonstrated by testing manufacturer's assemblies in accordance with test methods indicated.
  - 1. Air Infiltration (Single Acting Butt Hinges, Continuous Hinges, or Offset Pivots): Air infiltration shall be tested in accordance with ASTM E 283 at static pressure of 1.57 PSF (75 Pa). Infiltration shall not exceed 0.50 CFM/FT<sup>2</sup> for single door or 1.00 CFM/FT<sup>2</sup> for pair doors.
  - 2. Structural: Door corner structural strength shall be tested per YKK AP's dual moment test procedure and certified by an independent testing laboratory to ensure corner integrity and weld compliance. Certified test procedures and results are available upon request.
  - 3. Structural Uniform Load Test:
    - a. Single Doors: ± 50 psf.
    - b. Pair of Doors: ± 33 psf.
  - 4a. Thermal Performance:
    - a. When tested in accordance with AAMA 1503 and AAMA 507 based on Standard 1" insulating unit:
    - b. Condensation Resistance Factor (CRF<sub>f</sub>): A minimum of 58.
    - c. Thermal Transmittance U-Value: 0.52 BTU/HR/FT<sup>2</sup>/°F.
  - 4b. Thermal Performance:
    - a. When tested in accordance with AAMA 1503 and NFRC 102 based on 1-1/2" clear high performance insulating glass, 1/4" Cardinal E366 Low-E (e=0.022\*, #2) Annealed, 0.47" Gap, Stainless Steel Spacer (SS-D), 90% Argon-Filled\*, 0.050" HM88 SWT Film (e=0.110, #3/0.105\*, #4), 0.47" Gap, Stainless Steel Spacer (SS-D), 90% Argon-Filled\*, 1/4" Clear Annealed having a center of glass U-factor of 0.14 BTU/hr/SF/°F:
    - b. Condensation Resistance Factor (CRF<sub>f</sub>): A minimum of 58.
    - c. Thermal Transmittance U-Value: 0.52 BTU/HR/FT<sup>2</sup>/°F.
  - 5. Acoustical Performance: Acoustical Performance: When tested in accordance with ASTM E 90, AAMA 1801:
    - a. Sound Transmission Class (STC) shall not be less than: 1" IGU; 33, laminated; 36.
    - b. Outdoor-Indoor Transmission Class (OITC) shall not be less than: 1" IGU; 29, 1" laminated; 32.
  - 6. Forced Entry Resistance: 300 lbs. satisfactory.

**1.03 PROJECT CONDITIONS / SITE CONDITIONS**

- A. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

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## 1.04 SUBMITTALS

- A. General: Prepare, review, approve, and submit specified submittals in accordance with "Conditions of the Contract" and Division 1 Submittals Sections. Product data, shop drawings, samples, and similar submittals are defined in "Conditions of the Contract."
- B. Product Data: Submit product data for each entrance series specified.
- C. Substitutions: Whenever substitute products are to be considered, supporting technical data, samples, and test reports must be submitted ten (10) working days prior to bid date in order to make a valid comparison.
- D. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including anchorage, accessories, and finish colors.
- E. Samples: Submit verification samples for colors. Minimum 2-1/2 inch by 3 inch (61 mm by 73 mm) samples on actual aluminum substrates indicating full color range expected in installed system.
- F. Quality Assurance / Control Submittals:
  - 1. Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties.
  - 2. Installer Qualification Data: Submit installer qualification data.
- G. Closeout Submittals:
  - 1. Warranty: Submit executed warranty documents specified herein, endorsed by YKK AP authorized official and installer.
  - 2. Project Record Documents: Submit project record documents, including operation and maintenance data for installed materials in accordance with Division 1 Project Closeout (Project Record Documents) Section.
    - a. Maintenance Data: Maintenance procedures for care and cleaning of entrance systems.

## 1.05 QUALITY ASSURANCE

- A. Qualifications:
  - 1. Installer Qualifications: Installer experienced (as determined by contractor) to perform work of this section who has specialized in the installation of work similar to that required for this project. If requested by Owner, submit reference list of completed projects.
  - 2. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction process.
- B. Mock-Ups (Field Constructed): Install at project site a job mock-up using acceptable products and manufacturer approved installation methods. Obtain Owner's and Architect's acceptance of finish color, and workmanship standard.
  - 1. Mock-Up Size:
  - 2. Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
  - 3. Incorporation: Mock-up may be incorporated into final construction upon Owner's approval.
- C. Pre-Installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements.

## 1.06 WARRANTY

- A. Project Warranty: Refer to "Conditions of the Contract" for project warranty provisions.

- B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by an authorized company official.
1. Warranty Period: Manufacturer's one (1) year standard warranty commencing on the substantial date of completion for the project provided that the warranty, in no event, shall start later than six (6) months from the date of shipment.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS (Acceptable Manufacturers)

- A. Bases of Design: YKK AP America Inc. Telephone: (678) 838-6000
1. Wausau Metals
  2. Kawneer
1. MegaTherm® XT Entrance Doors:
  2. Medium Stile Swing Doors: YKK AP Series 35XT Medium Stile Entrance.
    - a. Description: 2-3/8" (60.3 mm) thick by 3-1/2" (88.9 mm) wide Door Stile
  3. Corner Construction: Fabricate door corners joined by concealed reinforcement secured with screws, and sigma deep penetration welding.
  4. Glazing Stops: Manufacturer's standard snap-in glazing stops with EPDM glazing gaskets to prevent water infiltration.
  5. Weather-stripping: Manufacturer's standard pile type in replaceable rabbets for stiles; manufacturer's standard EPDM bulb type for door frames.
  6. Hardware: Manufacturer's standard as selected by Architect.

### 2.02 MATERIALS

- A. Extrusions: ASTM B 221 (ASTM B 221M), 6063-T5 Aluminum Alloy.
- B. Aluminum Sheet:
1. Anodized Finish: ASTM B 209 (ASTM B 209M), 5005-H14 Aluminum Alloy, 0.050" (1.27 mm) minimum thickness.
  2. Painted Finish: ASTM B 209 (ASTM B 209M), 3003-H14 Aluminum Alloy, 0.080" (1.95 mm) minimum thickness.

### 2.03 ACCESSORIES

- A. Manufacturer's Standard Accessories:
1. Fasteners: Zinc plated steel concealed fasteners; Hardened aluminum alloys or AISI 300 series stainless steel exposed fasteners, countersunk, finish to match aluminum color.
  2. Sealant: Non-skinning type, AAMA 803.3.
  3. Glazing: Setting blocks, edge blocks, and spacers in accordance with ASTM C 864, shore durometer hardness as recommended by manufacturer; Glazing gaskets in accordance with ASTM C 864.

### 2.04 RELATED MATERIALS (Specified In Other Sections)

- A. Glass: Refer to Division 8 Glass and Glazing Section for glass materials.

### 2.05 FABRICATION

- A. Shop Assembly: Fabricate and assemble units with joints only at intersection of aluminum members with uniform hairline joints; rigidly secure, and sealed in accordance with manufacturer's recommendations.
  - 1. Hardware: Drill and cut to template for hardware. Reinforce frames and door stiles to receive hardware in accordance with manufacturer's recommendations.
  - 2. Welding: Conceal welds on aluminum members in accordance with AWS recommendations or methods recommended by manufacturer. Members showing welding bloom or discoloration on finish or material distortion will be rejected.

## 2.06 FINISHES AND COLORS

- A. High Performance Organic Coating Finish:
  - 1. Fluoropolymer Type: Factory applied two-coat 70% Kynar resin by Arkema or 70% Hylar resin by Solvay Solexis, fluoropolymer based coating system, Polyvinylidene Fluoride (PVF-2), applied in accordance with procedures and meeting AAMA 2605 specifications.
  - 2. Colors: Selected by Architect from the following:
    - a. Standard coating color charts.
- D. Finishes Testing:
  - 1. Apply 0.5% solution NaOH, sodium hydroxide, to small area of finished sample area; leave in place for sixty minutes; lightly wipe off NaOH; Do not clean area further.
  - 2. Submit samples with test area noted on each sample.

## PART 3 EXECUTION

### 3.01 MANUFACTURER'S INSTRUCTIONS / RECOMMENDATIONS

- A. Compliance: Comply with manufacturer's product data, including product technical bulletins, installation instructions and approved shop drawings.

### 3.02 EXAMINATION

- A. Site Verification of Conditions: Verify conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions.
  - 1. Verify location of preset anchors, perimeter fasteners, and block-outs are in accordance with shop drawings.

### 3.03 PREPARATION

- A. Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage during product installation.
  - 1. Aluminum Surface Protection: Protect aluminum surfaces from contact with lime, mortar, cement, acids, and other harmful contaminants.

### 3.04 INSTALLATION

- A. General: Install manufacturer's system in accordance with shop drawings, and within specified tolerances.
  - 1. Protect aluminum members in contact with masonry, steel, concrete, or dissimilar materials using nylon pads or bituminous coating.
  - 2. Shim and brace aluminum system before anchoring to structure.

### 3.05 FIELD QUALITY CONTROL

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- A. Manufacturer's Field Services: Upon request, provide manufacturer's field service consisting of site visit for inspection of product installation in accordance with manufacturer's instructions.

### 3.06 ADJUSTING AND CLEANING

- A. Adjusting: Adjust swing doors for operation in accordance with manufacturer's recommendations.
- B. Cleaning: The General Contractor shall clean installed products in accordance with manufacturer's instructions prior to owner's acceptance, and remove construction debris from project site. Legally dispose of debris.
- C. Protection: The General Contractor shall protect the installed product's finish surfaces from damage during construction.

END OF SECTION





**084413.1**  
**GLAZED ALUMINUM CURTAIN WALLS**

**PART 1 GENERAL**

**1.01 SUMMARY**

A. Section Includes: Glazed Aluminum Curtain Walls:

B. Related Sections:

1. Sealants: Refer to Division 7 Joint Treatment Section for sealant requirements.
2. Glass and Glazing: Refer to Division 8 Glass and Glazing Section for glass and glazing requirements.
3. Single Source Requirement: All products listed below shall be by the same manufacturer.
  - a. Section 08 41 13 Aluminum-Framed Entrances and Storefronts.

**1.02 SYSTEM PERFORMANCE DESCRIPTION**

A. Performance Requirements: Provide aluminum curtain wall systems that comply with performance requirements indicated, as demonstrated by testing manufacturer's assemblies in accordance with test method indicated.

1. Risk Category IV

2.. Air Infiltration: Completed curtain wall systems shall have 0.06 CFM/FT<sup>2</sup> (1.10 m<sup>3</sup>/h·m<sup>2</sup>) maximum allowable infiltration when tested in accordance with ASTM E 283 at differential static pressure of 6.24 PSF (299 Pa).

3.. Water Infiltration:

- a. No uncontrolled water on indoor face of any component when tested in accordance with ASTM E 331 at a static pressure of 15 PSF (718 Pa).
- b. No uncontrolled water on indoor face of any component when tested in accordance with AAMA 501.1 at a dynamic pressure of 15 PSF (718 Pa).

4. Optional Incidental Water Management: Head member shall be capable of directing condensation from the wall  
Cavity above the curtain wall to the exterior of the system.

5. Wind Loads: Completed curtain wall system shall withstand wind pressure loads per local code requirements. Submit Sealed Structural Calculations from a NY licensed Engineer for review.

6. Deflection: Maximum allowable deflection in any member when tested in accordance with ASTM E 330 with allowable stress in accordance with AA Specifications for Aluminum Structures.

- a. For spans less than 13'-6" (4.1m): L/175 or 3/4" (19.1mm) maximum. .
- b. For spans greater than 13'-6" (4.1m) but less than 40'-0" (12.2m): L/175 or L/240 + 1/4" (6.4mm).

7. Thermal Movement: Provide for thermal movement caused by 180 degrees F. (82.2 degrees C.) surface temperature, without causing buckling stresses on glass, joint seal failure, undue stress on structural elements, damaging loads on fasteners, reduction of performance, or detrimental effects.

8a. Thermal Performance:

- a. Tested in accordance with AAMA 1503.1, AAMA 507, and NFRC 100 based on 1" clear high performance insulating glass, 1/4" Clear (E=0.040 #2), 1/2" Air Space, 1/4" Clear, having a center of glass  
U-factor of 0.29 BTU/HR/FT<sup>2</sup>/°F with an NFRC U-factor of 0.37 BTU/HR/ FT<sup>2</sup>/°F.
- b. Condensation Resistance Factor (CRF<sub>f</sub>): 78, with a CRF<sub>g</sub> of 67.
- c. Thermal Transmittance U-Factor: 0.37 BTU/HR/FT<sup>2</sup>/°F or less.

8b. Thermal Performance:

- a. When tested in accordance with AAMA 1503.1, AAMA 507, and NFRC 100 based on 1-1/2" clear high performance insulating glass, 1/4" Cardinal E272 (e=0.042\*, #2) Heat Strengthened, 0.28" Gap, Aluminum Spacer (A1-D), 95% Krypton-Filled, 0.002 SMIONE, 0.35" Gap, Aluminum Spacer (A1-D), 95% Krypton-Filled, 0.003" Southwall Technologies, Inc. HM88 (e=0.110\*, #5), 0.28" Gap, Aluminum Spacer (A1-D), 95% Krypton-Filled, 1/4" Clear Heat-Strengthened having a center of glass U-factor of 0.10 BTU/HR/FT<sup>2</sup>/°F.
- b. Condensation Resistance Factor (CRF<sub>f</sub>): 82
- c. Thermal Transmittance U-Factor: 0.20 BTU/HR/FT<sup>2</sup>/°F or less.

8c. Thermal Performance:

- a. When tested in accordance with AAMA 1503., AAMA 507, and NFRC 100 based on 2" clear high performance glass, 1/4" Viracon VE1-85 (e=0.02040\*, #2) Heat-Strengthened, 0.69" Gap, Aluminum Spacer (A1-D), Air-Filled\*, 1/4" Viracon VE1-85 (e=0.088\*, #4) Heat-Strengthened, 0.69" Gap, Aluminum Spacer (A1-D), Air-Filled\*, 1/4" Clear Heat-Strengthened, having a center of glass U-factor of 0.16 BTU/HR/FT<sup>2</sup>/°F.
- b. Condensation Resistance Factor (CRF<sub>f</sub>): 82
- c. Thermal Transmittance U-Factor: 0.24 BTU/HR/FT<sup>2</sup>/°F or less.

9. Acoustical Performance: When tested in accordance with AAMA 1801:

- a. Sound Transmission Class (STC) shall not be less than 32 for heat strengthened; 35 for laminated glazing.
- b. Outdoor-Indoor Transmission Class (OITC) shall not be less than 27 for heat strengthened; 30 for laminated glazing.

1.03 SUBMITTALS

- A. General: Prepare, review, approve, and submit specified submittals in accordance with Conditions of the Contract and Division 1 Submittals Sections. Product data, shop drawings, samples, and similar submittals are defined in Conditions of the Contract.
- B. Product Data: Submit product data for each type curtain wall series specified.
- C. Substitutions: Whenever substitute products are to be considered, supporting technical data, samples and test reports must be submitted ten (10) working days prior to bid date in order to make a valid comparison.
- D. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including anchorage, accessories, finish colors and textures.
- E. Samples: Submit verification samples for colors on actual aluminum substrates indicating full color range expected in installed system.
- F. Quality Assurance / Control Submittals:
  1. Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties.
  2. Installer Qualification Data: Submit installer qualification data.
- G. Closeout Submittals:
  1. Warranty: Submit warranty documents specified herein.
  2. Project Record Documents: Submit project record documents for installed materials in accordance with Division 1 Project Closeout (Project Record Documents) Section.

1.04 QUALITY ASSURANCE

- A. Qualifications:

1. Installer Qualifications: Installer experienced (as determined by contractor) to perform work of this section who has specialized in the installation of work similar to that required for this project. If requested by Owner, submit reference list of completed projects.
2. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction process.
- B. Mock-Ups (Field Constructed): Install at project site a job mock-up using acceptable products and manufacturer approved installation methods. Obtain Owner's and Architect's acceptance of finish color, and workmanship standard.
  1. Mock-Up Size:
  2. Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
  3. Incorporation: Mock-up may be incorporated into final construction upon Owner's approval..
- C. Pre-Installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements.

#### 1.05 PROJECT CONDITIONS / SITE CONDITIONS

- A. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

#### 1.06 WARRANTY

- A. Project Warranty: Refer to "Conditions of the Contract" for project warranty provisions.
- B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by an authorized company official.
  1. Warranty Period: Manufacturer's one (1) year standard warranty commencing on the substantial date of completion for the project provided that the warranty, in no event, shall start later than six (6) months from the date of shipment

### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS (Acceptable Manufacturers)

- A. Bases of Design: YKK AP America Inc. Telephone: (678) 838-6000
  1. Wausau Metals
  2. Kawneer
  1. Curtain Wall System: YKK AP YCW 750 XT Aluminum Curtain Wall System.
- B. Curtain Wall Framing System:
  1. Description: Framing shall be thermally broken. Horizontal and vertical framing members shall have a nominal face dimension of 2-1/2 inches. Depth as indicated on drawings. Framing system shall provide a flush glazed appearance on all sides with no protruding glass stops.
  2. Thermal Barrier: Provide continuous thermal barrier by means of 6/6 nylon polyamide glass fiber reinforced pressure extruded bars. Systems employing non-structural thermal barriers are not acceptable.

## 2.02 MATERIALS

- A. Extrusions: ASTM B 221 (ASTM B 221M), 6063-T5 and 6063-T6 Aluminum Alloys.
- B. Aluminum Sheet:
  - 1. Painted Finish: ASTM B 209 (ASTM B 209M), 3003-H14 Aluminum Alloy, 0.080" (1.95 mm) minimum thickness.
  - 2. Thermal Barrier: Provide YKK AP MegaTherm® continuous thermal barrier by means of 6/6 nylon polyamide glass fiber reinforced pressure extruded bars. Systems employing non-structural thermal barriers are not acceptable.

## 2.03 ACCESSORIES

- A. Manufacturer's Standard Accessories:
  - 1. Fasteners: Zinc plated steel concealed fasteners; Hardened aluminum alloys or AISI 300 series stainless steel exposed fasteners, countersunk, finish to match aluminum color.
  - 2. Sealant: Non-skinning type, AAMA 803.3
  - 3. Glazing: Setting blocks, edge blocks, and spacers in accordance with ASTM C 864, shore durometer hardness as recommended by manufacturer; Glazing gaskets in accordance with ASTM C 864.

## 2.04 RELATED MATERIALS (Specified In Other Sections)

- A. Glass: Refer to Division 8 Glass and Glazing Section for glass materials.

## 2.05 FABRICATION

- A. Shop Assembly: Fabricate and assemble units with joints only at intersection of aluminum members with hairline joints; rigidly secure, and sealed in accordance with manufacturer's recommendations.

## 2.06 FINISHES AND COLORS

- A. High Performance Organic Coating Finish:
  - 1. Fluoropolymer Type: Factory applied two-coat 70% Kynar resin by Arkema or 70% Hylar resin by Solvay Solexis, fluoropolymer based coating system, Polyvinylidene Fluoride (PVF-2), applied in accordance with procedures and meeting AAMA 2605 specifications.
  - 2. Colors: Selected by Architect from the following:
    - a. Standard coating color charts.
- B. Finishes Testing:
  - 1. Apply 0.5% solution NaOH, sodium hydroxide, to small area of finished sample area; leave in place for sixty minutes; lightly wipe off NaOH; Do not clean area further.
  - 2. Submit samples with test area noted on each sample.

## PART 3 EXECUTION

### 3.01 MANUFACTURER'S INSTRUCTIONS / RECOMMENDATIONS

- A. Compliance: Comply with manufacturer's product data, including product technical bulletins, installation instructions, and product carton instructions. The latest Installation Manual can be found at [www.ykkap.com](http://www.ykkap.com).

### 3.02 EXAMINATION

- A. Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions.

### 3.03 PREPARATION

- A. Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage during

product installation.

### 3.04 INSTALLATION

- A. General: Install manufacturer's system in accordance with shop drawings, and within specified tolerances.
  - 1. Protect aluminum members in contact with masonry, steel, concrete, or dissimilar materials using nylon pads or bituminous coating.
  - 2. Shim and brace aluminum system before anchoring to structure.
  - 3. Verify curtain wall system allows water entering system to be collected in gutters and wept to the exterior. Verify weep holes are open, and metal joints are sealed in accordance with manufacturers installation instructions.
  - 4. Seal metal to metal curtain wall system joints using sealant recommended by system manufacturer.

### 3.05 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Upon request, provide manufacturer's field service consisting of site visit for inspection of product installation in accordance with manufacturer's instructions.
- B. Field Test: Conduct field test to determine watertightness of curtain wall system. Conduct test in accordance with AAMA 501.2.

### 3.06 ADJUSTING AND CLEANING

- A. Adjusting: Adjust operating items as recommended by manufacturer.
- B. Cleaning: The General Contractor shall clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance, and remove construction debris from project site. Legally dispose of debris.
- C. Protection: The General Contractor shall protect installed product's finish surfaces from damage during construction.

END OF SECTION 084413.1



## **SECTION 08 5667**

### **BULLET-RESISTANT STEEL TRANSACTION WINDOWS**

#### **PART 1 GENERAL**

##### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Bullet-resistant fixed steel transaction window assemblies.
- B. Related Sections:
  - 1. Division 01: Administrative, procedural, and temporary work requirements.

##### **1.2 REFERENCES**

- A. American Welding Society (AWS) D1.3/D1.3M - Structural Welding Code - Sheet Steel.
- B. ASTM International (ASTM) A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
- C. Underwriters Laboratories (UL) 752 - Bullet Resisting Equipment.

##### **1.3 SYSTEM DESCRIPTION**

- A. Design Requirements:
  - 1. Provide window frames of "non-ricochet type" intended to permit capture and retention of attacking projectile, lessening potential of random injury or lateral penetration.
  - 2. Two way "natural voice" communication permitted by design of vertical side frames and glazing technique.

##### **1.4 SUBMITTALS**

- A. Submittals for Review:
  - 1. Shop Drawings: Include window profiles and sizes, type and spacing of frame anchors, reinforcement size and locations, details of joints and connections, and welding details.
  - 2. Product Data: Include product description for window assemblies including bullet-resistant ratings
- B. Closeout Submittals:
  - 1. Maintenance Data: Include instructions for cleaning of glazed panels.

##### **1.5 QUALITY ASSURANCE**

- A. Transaction Window Assemblies: Ballistic Level 5, ( as noted on drawings) tested to UL 752.

## 1.6 DELIVERY, STORAGE AND HANDLING

- A. Store window assemblies upright in protected, dry area, off ground or floor, with at least 1/4 inch space between individual units.
- B. Do not cover with non vented coverings that create excessive humidity.
- C. Remove wet coverings immediately.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Contract Documents are based on products by ARMORTEX, 5926 Corridor Parkway, Schertz, Texas, 800-880-8306, [www.armortex.com](http://www.armortex.com).
- B. Substitutions: Under provisions of Division 01.

### 2.2 MATERIALS

- A. Steel Sheet:
  - 1. ASTM A1008/1008M, cold rolled, free from scale, pitting, coil breaks, and other surface defects.
- B. Bullet-Resistant Composite: UL Listed Bullet Resistant Composite by ARMORTEX, of UL Ballistic Level equal to specified frame ballistic protection level.
- C. Ballistic Steel: Hi-Hard Ballistic Steel, of UL Ballistic Level equal to specified frame ballistic protection level.
- D. Glazing:
  - 1. Bullet resistant Glass-clad polycarbonate
  - 2. Bottom edge of glazing panel provided with 18 gage stainless steel cap.

### 2.3 FABRICATION

- A. Frames:
  - 1. Fabricate from 16 gage steel lined with ballistic steel.
  - 2. Bullet-resistant rating equivalent to or greater than glazing.
  - 3. Weld frame corners; knock-down and mechanical joints not acceptable.
  - 4. Frame modules capable of being joined with other frame modules to form continuous line.
  - 5. Replacement of glazing from secure side of window, not requiring removal of frame from opening.



- B. Shelf: Minimum 2 inches thick with recessed dip tray, full width of window x minimum 12 inches deep, centered under glazing, 18 gage stainless steel.
- C. Dip Tray: Model RMDT1016, 16 gage stainless steel, 10 x 16 inches to outside edge of flanges, clear 1-5/8 inch open depth under glazing.
- D. Welding: In accordance with AWS D1.3/D1.3M. Grind exposed welds flush and smooth.
- E. Finish work neat and free from defects.
- F. Allowable Tolerances: Plus or minus 1/16 inch for frame opening width, height, diagonal dimensions, and overall width and height (outside to outside).

## 2.4 FINISHES

- A. Steel:
  - 1. Dress tool marks and surface imperfections to smooth surfaces.
  - 2. Clean and chemically treat steel surfaces.
  - 3. Apply manufacturer's standard rust inhibiting gray primer paint.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install window assemblies in accordance with manufacturer's instructions and approved Shop Drawings.
- B. Set plumb and level.
- C. Secure to adjacent construction using fastener type best suited to application.
- D. Field alterations to window assemblies not permitted unless approved in advance by manufacturer and Architect.

### 3.2 ADJUSTING

- A. Touch up minor scratches and abrasions primer paint to match factory finish.

END OF SECTION



## SECTION 087100

### DOOR HARDWARE

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

###### A. Section includes:

1. Mechanical door hardware for:
  - a. Swinging doors.
2. Field verification, preparation and modification of existing doors and frames to receive new door hardware.
3. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.
4. Card Lock System Components: **(Locksets will be purchased by Rye City School District and Installed by GC. All programming, wiring and access will be done by Rye City School District.)**
  - a. Battery operated access and security management system and software
  - b. Wireless electric battery operated access and security management system
  - c. Card Reader Units - with and without keypad
  - d. Door Locks - Salto Virtual Network and wireless versions
  - e. Control units - relay and expansion boards
  - f. UPS network for locks
  - g. Power reader switches
  - h. Portable programmer devices

###### B. Exclusions: Unless specifically listed in hardware sets, hardware is not specified in this section for:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors

###### C. Related Sections:

1. Division 01 Section "Alternates" for alternates affecting this section.
2. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
3. Division 09 sections for touchup, finishing or refinishing of existing openings modified by this section.

4. Division 13 Section "Radiation Protection" for requirements for lead-lining for door hardware at openings indicated to receive radiation protection.
5. Division 26 sections for connections to electrical power system and for low-voltage wiring.
6. Division 28 sections for coordination with other components of electronic access control system.

### 1.3 REFERENCES

#### A. UL - Underwriters Laboratories

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware
5. UN294 Access Control System Units

#### B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Key Systems and Nomenclature

#### C. ANSI - American National Standards Institute

1. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties

### 1.4 SUBMITTALS

#### A. General:

1. Submit in accordance with Conditions of Contract and Division 01 requirements.
2. Highlight, encircle, or otherwise specifically identify on submittals deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.
3. Prior to forwarding submittal, comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, "EXAMINATION" article, herein.

#### B. Action Submittals:

1. Product Data: Technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated, and tagged with full description for coordination with schedule.
  - a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.
3. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:

- a. Door Index; include door number, heading number, and Architects hardware set number.
  - b. Opening Lock Function Spreadsheet: List locking device and function for each opening.
  - c. Quantity, type, style, function, size, and finish of each hardware item.
  - d. Name and manufacturer of each item.
  - e. Fastenings and other pertinent information.
  - f. Location of each hardware set cross-referenced to indications on Drawings.
  - g. Explanation of all abbreviations, symbols, and codes contained in schedule.
  - h. Mounting locations for hardware.
  - i. Door and frame sizes and materials.
  - j. Name and phone number for local manufacturer's representative for each product.
  - k. Operational Description of openings with any electrified hardware (locks, exits, electromagnetic locks, electric strikes, automatic operators, door position switches, magnetic holders or closer/holder units, and access control components).  
Operational description should include operational descriptions for: egress, ingress (access), and fire/smoke alarm connections.
    - 1) Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work that is critical in Project construction schedule.
4. Card Lock System Components:
- a. Shop Drawings and Schematics: Shall depict the Physical Access Control System in final proposed "as built" configuration. The following shall be provided:
    - 1) Connection diagrams for interfacing equipment.
    - 2) Network IP and or MAC addresses of field device.
    - 3) List of connected equipment.
    - 4) Locations for all major equipment components to be installed under this specification.
    - 5) Product Data: The following shall be provided:
      - Technical data sheets for each piece of proposed equipment.
      - A complete set of user and maintenance manuals.
5. Key Schedule:
- a. After Keying Conference, provide keying schedule listing levels of keying as well as explanation of key system's function, key symbols used and door numbers controlled.
  - b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
  - c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
  - d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
  - e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion.
    - 1) Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
  - f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.
6. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory or shop prepared for door hardware

installation.

C. Informational Submittals:

1. Qualification Data: For Supplier, Installer and Architectural Hardware Consultant.
2. Product data for electrified door hardware:
  - a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
3. Warranty: Special warranty specified in this Section.

D. Closeout Submittals:

1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
  - a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
  - b. Catalog pages for each product.
  - c. Factory order acknowledgement numbers (for warranty and service)
  - d. Name, address, and phone number of local representative for each manufacturer.
  - e. Parts list for each product.
  - f. Final approved hardware schedule, edited to reflect conditions as-installed.
  - g. Final keying schedule
  - h. Copies of floor plans with keying nomenclature
  - i. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
  - j. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

## 1.5 QUALITY ASSURANCE

- A. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that provides certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
1. Warehousing Facilities: In Project's vicinity.
  2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
  3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
  4. Coordination Responsibility: Assist in coordinating installation of electronic security hardware with Architect and electrical engineers and provide installation and technical data to Architect and other related subcontractors.
    - a. Upon completion of electronic security hardware installation, inspect and verify that all components are working properly.
- B. Architectural Hardware Consultant Qualifications: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
1. For door hardware, DHI-certified, Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC).
  2. Can provide installation and technical data to Architect and other related subcontractors.

3. Can inspect and verify components are in working order upon completion of installation.
  4. Capable of producing wiring diagrams.
  5. Capable of coordinating installation of electrified hardware with Architect and electrical engineers.
- C. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.
- D. Fire-Rated Door Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
- E. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.
- F. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in "REFERENCES" article, herein.
- G. Keying Conference
1. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
    - a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
    - b. Preliminary key system schematic diagram.
    - c. Requirements for key control system.
    - d. Requirements for access control.
    - e. Address for delivery of keys.
- H. Pre-installation Conference
1. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  2. Inspect and discuss preparatory work performed by other trades.
  3. Inspect and discuss electrical roughing-in for electrified door hardware.
  4. Review sequence of operation for each type of electrified door hardware.
  5. Review required testing, inspecting, and certifying procedures.
- I. Coordination Conferences:
1. Installation Coordination Conference: Prior to hardware installation, schedule and hold meeting to review questions or concerns related to proper installation and adjustment of door hardware.
  2. Electrified Hardware Coordination Conference: Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
  - 1. Deliver each article of hardware in manufacturer's original packaging.
- C. Card Lock System Components:
  - 1. Ordering: The manufacturer's ordering instructions and lead-time requirements shall be followed to avoid installation delays.
  - 2. Delivery: The Physical Access Control System shall be delivered in the manufacturer's original, unopened, undamaged container with identification labels intact.
  - 3. Storage and Protection: The Physical Access Control System shall be stored and protected from exposure to harmful weather conditions and at the environmental conditions recommended by the manufacturer.
- D. Project Conditions:
  - 1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
  - 2. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.
- E. Protection and Damage:
  - 1. Promptly replace products damaged during shipping.
  - 2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
  - 3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.
- F. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.
- G. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

## 1.7 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.
- E. Existing Openings: Where existing doors, frames and/or hardware are to remain, field verify



existing functions, conditions and preparations and coordinate to suit opening conditions and to provide proper door operation.<sup>4</sup>

## 1.8 WARRANTY

- A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Beginning from date of Substantial Completion, for durations indicated.

a. Closers:

- 1) Mechanical: 25 years.
- 2) Electrified: 2 years.

b. Exit Devices:

- 1) Mechanical: 3 years.
- 2) Electrified: 1 year.

c. Locksets:

- 1) Mechanical: 10 years
- 2) Electrified: 1 year.

d. Key Blanks: Lifetime

e. Card Lock System Components:

- 1) Warranty Period will be a minimum of one (1) year from the date of purchase.
- 2) All equipment and systems will be warranted by the Contractor for a period of two (2) years commencing with the filing date of the Notice of Completion, provided the system has been inspected and signed off by the Manufacturer and at the conclusion of satisfactory acceptance of the entire system by the end user.
- 3) The warranty shall cover all costs for service, including parts.
- 4) The contract for service will cover the period starting with the first expected activation of each system for installation and test and will continue for an initial period of two (2) years. A partial-year extension will be acquired to cover the period to the end of the two year warranty and will be handled such that a smooth transition to a customer maintenance agreement can be achieved with no lapse in coverage.
- 5) Service response shall be within 2 hours of the initial request for service; the response may be by phone or remote VPN access into the system. This service should be provided during the warranty period at no added cost. This will be a 24 hour per day, 7 days per week, and inclusive of all holidays.
- 6) Service requests will be reported via phone call to a designated service number provided by Security Contractor, or via a service web site or e-mail account as designated by the security contractor.

2. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

3.

## 1.9 MAINTENANCE

- A. Maintenance Tools: Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Approval of manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturers" in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.
- B. Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.
- C. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.
- D. Card Lock System Components: **(Locksets will be purchased by Rye City School District and Installed by GC. All programming, wiring and access will be done by Rye City School District.)**
  - 1. Salto Systems  
1780 Corporate Drive Suite 400  
Norcross, GA 30093  
866-GO SALTO (866-467 2586)  
Email: info@Salto.us, Internet: www.Salto.us
  - 2. Substitutions: Not Permitted

### 2.2 MATERIALS

- A. Fasteners
  - 1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
  - 2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
  - 3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru-bolts are required.
  - 4. Install hardware with fasteners provided by hardware manufacturer.
- B. Modification and Preparation of Existing Doors: Where existing door hardware is indicated to be removed and reinstalled.
  - 1. Provide necessary fillers, Dutchmen, reinforcements, and fasteners, compatible with existing materials, as required for mounting new opening hardware and to cover existing door and frame preparations.
  - 2. Use materials which match materials of adjacent modified areas.
  - 3. When modifying existing fire-rated openings, provide materials permitted by NFPA 80 as required to maintain fire-rating.

- C. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.

- 1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

## 2.3 HINGES

### A. Manufacturers and Products:

- 1. Scheduled Manufacturer and Product: Ives 5BB series.
- 2. Acceptable Manufacturers and Products: Hager BB series, McKinney TA/T4A series, Stanley FBB Series.

### B. Requirements:

- 1. Provide hinges conforming to ANSI/BHMA A156.1.
- 2. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
  - a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
  - b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high
- 3. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
  - a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
  - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
- 4. 2 inches or thicker doors:
  - a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
  - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
- 5. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
- 6. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
- 7. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
  - a. Steel Hinges: Steel pins
  - b. Non-Ferrous Hinges: Stainless steel pins
  - c. Out-Swinging Exterior Doors: Non-removable pins
  - d. Out-Swinging Interior Lockable Doors: Non-removable pins
  - e. Interior Non-lockable Doors: Non-rising pins
- 8. Width of hinges: 4-1/2 inches (114 mm) at 1-3/4 inch (44 mm) thick doors, and 5 inches (127 mm) at 2 inches (51 mm) or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.
- 9. Provide hinges with electrified options as scheduled in the hardware sets. Provide with sufficient number and wire gage to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component.
- 10. Provide mortar guard for each electrified hinge specified.
- 11. Provide spring hinges where specified. Provide two spring hinges and one bearing hinge per door leaf for doors 90 inches (2286 mm) or less in height. Provide one additional bearing hinge for each 30 inches (762 mm) of additional door height.

## 2.4 FLUSH BOLTS

### A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

### B. Requirements:

1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless-steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.

## 2.5 CYLINDRICAL LOCKS – GRADE 1

### A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage ND series.
2. Acceptable Manufacturers and Products: Sargent 11-Line, Corbin-Russwin CL3100 series.

### B. Requirements:

1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1, and UL Listed for 3 hour fire doors.
2. Cylinders: Refer to "KEYING" article, herein.
3. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2 inch latch throw. Provide proper latch throw for UL listing at pairs.
4. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
5. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
7. Provide electrified options as scheduled in the hardware sets.
8. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.

- a. Lever Design: Schlage ATH Athens

## 2.6 ACCESS AND SECURITY MANAGEMENT SYSTEM

### A. All modules shall be supplied by SALTO inclusive of:

1. Card Readers Units with and without Keypad
2. Door Locks- SVN and Wireless Versions
3. Control Units- Relay and Expansion Boards
4. UPS Network for Locks
5. Power Reader Switches
6. Card Encoders or Enrollment Reader
7. Portable Programmer Devices

### B. The Physical Access Control System shall have two primary component areas: door control hardware and the management application software.

### C. The system shall provide for a combination of wireless (wire-free) and online (hardwired) wall readers to secure perimeter doors as well as battery powered electronic locks to secure all interior doors, manufactured in the and supported by the same manufacturer.

- D. The system shall be centrally managed by one single database/software and one single credential system for all doors in the System.
- E. Token, Credentials, and RFID Contact-less Smart Card Features and Technical Requirements:
  - 1. Secured Contactless smart card technology provides high-speed, reliable communications with data integrity.
  - 2. Read/write capability is mandatory; any system that does not use a two way encrypted Smart Card (RFID) communication format will be considered unacceptable.
  - 3. Multi-application cards have to be capable of storing information for future applications and integration.
  - 4. Card readers and electronic locks shall be compatible with a wide range of smart card (RFID) Technologies, operating on the industry standard frequency of 13.56MHz as listed below:
    - a. HID iClass: Memory capacity: 32K bit with 2 application area configurations. The HID-iClass credential shall have a minimum of 16 kb, 32kb preferred of available memory and allow the possibility for use with multiple vendors across multiple applications.
    - b. MIFARE: 4k Bytes
    - c. DESFire: 4k Bytes
    - d. Desfire EV1: 4K Bytes
    - e. Sony FeliCa: 4K Bytes
    - f. Legic: 4K Bytes
    - g. Pico Pass: 4k Bytes
    - h. BLE: Blue Tooth Low Energy
    - i. NFC: Near Field Communication at 13.56 MHz
  - 5. Access profile for the individual user, encoded on the card, shall be encrypted and in such a format as to negate the potential for cloning.
  - 6. Standard 16 kb or 32kb preferred memory on each credential shall be secured with a unique set of Keys- A&B for the Electronic Access Control (EAC) system and to enable, as and when required, the collection and transfer of information pertaining to audit trails, lost and stolen cards etc via a data on card functionality
  - 7. Tokens or credentials shall be available in multiple form factors. They include, but not limited to: standard ID card format, printable ID card format, key fob format, wrist watch format, rubber wrist band format, BLE mobile and NFC tokens.
- F. Online Control Unit and wall readers
  - 1. Shall be manufactured and supported by the same manufacturer of the electronic door locks and system software.
  - 2. Provide real time door access monitoring with on-line capability.
  - 3. Shall continue operating and store historical data (audit trail) in the event of a network or server failure. System door units shall buffer a minimum of 1000 transactions.
  - 4. Shall provide Ethernet connectivity of all on-line devices via IP4 or IP6 addressing, either hardwired or through a Salto ZigBee 16 Channel WiFi Connection (802.15.4).
  - 5. Shall provide the ability to use 1 IP address, and connect 4 additional controllers using RS485 (10 card readers per IP address)
  - 6. Shall provide automatic card updating to all contactless smart cards regardless of type.
  - 7. Shall provide the ability to support 2 readers and 2 locking devices with on board programmable relays.
  - 8. Shall provide a minimum of 4 on-board outputs (relays) available per controller, without the use of an auxiliary output board.
  - 9. Shall support a minimum of 400' in cable length for each card reader.
  - 10. Shall support Anti-Pass back on controller, in and out firing the same relay.
  - 11. Shall provide encryption between the controller and each supported card reader.
  - 12. Shall provide a minimum of 6 auxiliary inputs for use as door position, request to exit, or for any non-door purpose required. Must support a minimum of 60 inputs per IP address without the use of a auxiliary input board or device.
  - 13. Shall provide for up to 16 auxiliary output boards with a total of not less than 128 outputs available for end user programming.
  - 14. Shall provide the flexibility for either online wireless or offline battery operated locks,

- allowing for the two system types to be integrated into the same facility.
- 15. Shall provide 2 on board tamper option, input and switch.
- 16. Must be able to be powered by a standard 12vdc power supply.
- 17. Shall provide support for POE as an option.
- 18. Controller shall be certified to the following standards: CE, UL 294, FCC part 15.
- G. Battery Powered Wireless Networked locks
  - 1. RFID Keycard operated: unlocking by means of contact-less smart carriers, which most include the following formats; card, key-fob, wrist watch, RFID stickers and wrist band. All devices will perform at the same level.
  - 2. The EAC Locking Unit shall have typical access control features and be able to mimic traditional door hardware functions. The following is a minimum of the required door operational features:
    - a. Standard
    - b. Office
    - c. Automatic Changes
    - d. Automatic Opening
    - e. Automatic Opening Plus Office
    - f. Automatic Opening Plus Toggle
    - g. Key Card Plus Pin Number (Keypad)
    - h. Pin Number Only (Keypad)
    - i. Timed Key Card Plus Pin Number (Keypad)
    - j. Timed Pin Number (Keypad)
    - k. Timed Office
    - l. Timed Toggle
    - m. Toggle Only
    - n. Emergency Lockdown (AMOK Crisis)
    - o. Anti Passback – Soft/Timed
  - 3. Internal door lock audit trail memory shall be at minimum, 1,000 transactions. This shall include valid, invalid attempts, request to exit, door status, door ajar and mechanical override key used.
  - 4. Automatic Unlocking: all locks shall be able to be programmed to remain unlocked during certain hours and days, automatically changing to a locked down mode outside of these times i.e.- go into office, card only, card plus PIN mode, etc. Each lock shall have a minimum of 8 different automatic locking and unlock schedules. This feature shall be able to be manipulated by day of the week and by system holidays for each door lock.
  - 5. Automatic Locking (lockdown mode), all locks shall be able to lock down from the inside in an emergency. While the lock is in lockdown mode, one designated token will be able to enter the locked down door unit. Once the unit is returned to normal programming mode, it will operate as previously programmed. Activation and resetting of the lockdown mode (AMOK) shall be done with a card holders token. This privilege will be given to the desired card holder on a person by person basis. Blanket lockdown setting or lockdown by a lock thumb turn will be unacceptable.
  - 6. Lost cards shall be able to be deleted from the system without waiting for card expiration or having to visit the locks with a handheld programmer.
  - 7. Water resistance application lock units, must be an option for outdoor and wet environments.
  - 8. Battery life benchmarked to 48,000 Operations or 2.5 - 3.0 years.
  - 9. Shall be powered by standard off the shelf batteries (AAA).
  - 10. Proprietary batteries or proprietary battery packs are not acceptable.
  - 11. Low battery warning shall be at minimum via visual LEDs and shall also automatically report through the system software. This shall be accomplished without the need to visit the door lock with a programming device. For wireless lock units, they will also report via a link through the RFID Cards through a hotspot (on line reader) for direct communications to the software to report current battery status.
  - 12. Shall automatically adjust for daylight saving time. This feature will be flexible enough

to provide changeable dates from year to year. This feature shall not require a visit to the lock with a programming device.

13. A door lockset shall be deemed to include all of the components necessary for the EAC to function as per manufacturer's specification; namely UL approved and listed internal and external lock parts. The following locking hardware types shall be available:
    - a. UL Listed, ANSI Grade 1 American Mortise Lock
    - b. UL Listed, ANSI Grade 1 American Mortise Lock, with deadbolt
    - c. UL Listed, ANSI Grade 1 Glass Door Lock
    - d. UL Listed, ANSI Grade 1 American Cylindrical Lock
    - e. UL Listed, ANSI Grade 2 American Cylindrical Lock
    - f. UL Listed Locker Lock, Padlock
    - g. UL Listed, ANSI Grade 1 Exit Device
    - h. UL Listed, European Mortise Lock
    - i. Mortise Cylinder (Salto GEO)
    - j. Rim Cylinder (Salto GEO)
    - k. Pad Lock (Salto GEO)
    - l. Keypad and Card Lock- XS4
    - m. Salto Mini Card Lock- XS4 Mini
    - n. Salto Cabinet Lock
  14. External and internal lever handles shall comply with ADA requirements and specifications, and shall also be available with antibacterial Salto BioCote® finishes.
  15. The length of time that is allowed to open the door after a valid credential is presented shall be variable and managed by the software, allowing for users with physical disabilities additional time when needed to access their quarters.
  16. At all times the internal lever shall be free to operate and retract all latches and deadbolts, allowing free egress by way of a single action.
  17. A mechanical master key override shall be provided where necessary and shall operate in conjunction with the lever clutching mechanism, rather than directly on the door latch. Operation of the key override will be recorded in the lock unit audit trail memory to provide increased security and to track key usage. A standard American mortise cylinder shall provide the key override function.
- H. Off-line Reader and Battery Powered SVN Lock Operations
1. The smart card shall transfer data to/from both off-line locksets to the on-line hot-spots. Tokens may be card, wrist watch or band, key fob formats. All formats shall have the same system performance.
  2. A door lockset shall be deemed to include all of the components necessary for the EAC to function as per manufacturer's specification; namely UL approved and listed internal and external lock parts. The following locking hardware types shall be available:
    - a. UL Listed, ANSI Grade 1 American Mortise Lock
    - b. UL Listed, ANSI Grade 1 American Mortise Lock, with deadbolt
    - c. UL Listed, ANSI Grade 1 Glass Door Lock
    - d. UL Listed, ANSI Grade 1 American Cylindrical Lock
    - e. UL Listed, ANSI Grade 2 American Cylindrical Lock
    - f. UL Listed Locker Lock, Pad Lock
    - g. UL Listed, European Mortise Lock
    - h. UL Listed, ANSI Grade 1 Exit Device
    - i. Mortise Cylinder (Salto GEO)
    - j. Rim Cylinder (Salto GEO)
    - k. Keypad and Card Units (XS4)
    - l. Cam Lock- GxCL (Salto GEO)
    - m. Heavy Duty Deadbolt- GxB3 (Salto GEO)
    - n. Locker 9000 (XS4)
    - o. Salto Mini XS4 Lock
    - p. Salto Aelement minimalist ANSI mortise lock
    - q. Salto Aelement minimalist European mortise lock

3. Retrofit locks, wherever possible and as needed, the manufacturer shall have a option

to reuse existing locks that are in good working order and can support the new Salto trim and controls.

4. External & Internal Lever handles shall comply with ADA requirements and specifications. Lever and trim shall also be available with antibacterial finishes. Traditional door hardware finishes and a choice of lever styles to as closely as possible match existing door hardware.
5. At all times the internal lever shall be free to operate and retract all latches and deadbolts, allowing free egress by way of a single action.
6. A mechanical key override shall be provided where necessary and shall operate in conjunction with the lever clutching mechanism, rather than directly on the door latch. To provide increased security the key operation will leave an audit in the lock memory that the mechanical key was used to open the door. This shall be available on mortise or cylindrical type locks.
7. The unit shall initially be delivered with 3 standard alkaline AA batteries, sufficient for up to 48,000 transactions or approximately 2.5 – 3.0 years operational life. No proprietary or rechargeable battery packs shall be accepted.
8. Low battery status shall be, by default, recorded on the user's credential and transferred to the management system when the credential is used at an on-line wall reader or update point (Hotspot). No handheld Device will be needed to retrieve battery status.
9. In the event of a battery failure, the door shall be able to be opened with a small portable handheld device in conjunction with a valid credential (smart card or token).
10. Networked and non-networked locks of all hardware styles shall always allow free egress if the batteries fail.
11. An audit trail of the last 1,000 events (including failed attempts at access by unauthorized key holders) shall be stored on the networked lock's memory for collection using the portable handheld device at anytime and without requiring access to the inside component of the door lock.
12. The networked lock shall hold its designation, the zones that it belongs to, operational configuration, audit trail and the list of cancelled keys in non-volatile memory.
13. The current date and time shall be synchronized with the server on a time basis, and/or when collecting audit trails with the portable handheld device or replacing batteries.
14. The networked lock shall incorporate such measures as hardened high resistance steel drill plates, floating axes and steel ball bearings to prevent unauthorized access or tampering by physical means.
15. The external lever mechanism shall incorporate a clutching system to minimize the potential for vandal damage by allowing free travel up and down until a valid credential is presented for the door to be opened.
16. The length of time allowed to open the door after a valid credential is presented shall be variable and managed by the software, allowing for users with physical disabilities additional time when needed for access.
17. When the lever returns to the zero position, no matter how much time elapsed since the valid credential was presented, the clutch shall automatically disengage, limiting the potential for an unauthorized person to enter after the authorized entry.
18. Internal covers shall be secured with tamper resistant screws to restrict access to authorized personnel only.
19. Where appropriate the internal clock of the networked lock shall be programmed to allow for the start and finish of daylight saving time.
20. In an office, meeting room or services environment (where applicable) the networked lock shall be able to either automatically or manually be set into "free passage" mode by authorized users, reverting to standard operating mode at a prescribed time.
21. In the event a user key is lost, an authorized operator shall be able to cancel and re-issue a new key for the User. Information regarding cancelled keys shall be transmitted to all off line doors via the "black list", placed on credentials when passing through an on-line "hotspot" or by visiting the doors with the portable programming device.
22. When the system is being operated using the hotel functionality, if a room key is reported lost or stolen (or the user is missing), simply presenting a "Guest cancel key"



- shall cancel access for that key without providing access to the room.
23. The locking unit shall have typical access control features and be able to mimic traditional door hardware functions. The following is a minimum of the required door operational features:
    - a. Standard
    - b. Office
    - c. Automatic Changes
    - d. Automatic Opening
    - e. Automatic Opening Plus Office
    - f. Automatic Opening Plus Toggle
    - g. Key Card Plus Pin Number (Keypad)
    - h. Pin Number Only (Keypad)
    - i. Timed Key Card Plus Pin Number (Keypad)
    - j. Timed Pin Number (Keypad)
    - k. Timed Office
    - l. Timed Toggle
    - m. Toggle Only
    - n. Emergency Lockdown
    - o. Anti Passback – Soft/Timed
  - I. On Line Wall Reader Operations
    1. An XS4 wall reader device shall include support for one (1) or two (2) wall readers. These readers may be; Mifare, Mifare Plus, DESfire, DESfire EV1, Pico Pass, IClass and NFC, and BLE, Card Plus PIN will also be available if needed. The unit will control access and egress, where applicable, secured to the wall with a vandal resistant frame and tamper-proof fixings; plus a Control Unit (CU) housed with 12V DC power supply, ready for connection to 120V AC outlet. Additionally the power supply shall be prepared to interface with the local fire alarm system to cut power to the door locks, if required, and have connections for 12V DC battery back-up supply (provided by others). POE shall be available as an option.
    2. Shall be ISO 15.93 and FCC Part 15 compliant.
    3. The wall reader control unit set shall have the capability to operate both as an off-line stand-alone door controller or, be easily upgraded with additional (not replacement) hardware to function as an integrated part of the on-line EAC system.
    4. The XS4 wall reader shall have a keypad available as an option.
    5. Connection between the Wall Reader and Control Unit shall be via UTP CAT5e or better cable.
    6. If required for security or logistical reasons the CU shall be able to be placed up to 122 meters or 400 feet remotely from the wall reader(s).
    7. The C.U. shall hold its designation, the zones that it belongs to, operational configuration, audit trail and a list of cancelled keys in non-volatile memory.
    8. The on-line CU shall connect directly to the EAC application and be capable of making changes to the individual user access profile when a credential is presented. At the same time the CU shall pass the list of recent cancelled cards on to the key and upload any stored “on key” audits of attempts to access doors and any low battery warnings from the stand-alone locks.
    9. The current list of cancelled cards is placed onto every card when it is presented to an on-line reader (hot-spot), and the updated card shall then transfer that list to the off-line readers each time they are used, allowing for the upgraded list to be transmitted throughout the facilities by the users as they go about accessing doors.
    10. The EAC system shall synchronize the server clock with the on-line CU approximately every 30 seconds.
    11. The (off-line and on-line) CU shall be capable of integrating with the elevator management system to control access to individual floors for individual users. Connection to the CU shall be via a RS485 serial connection to Extension Relay Boards (ERB) consisting of 8 NO/NC 12VDC dry contact relays. The EAC system shall allow for up to 16 ERB to be connected in series to each control unit.

12. For the off-line reader the date and time shall synchronize with the hand held programming unit any time an audit is retrieved.

J. Basic System Performance Requirements

1. Shall provide central management of user rights, access policies, and credentialing.
2. The application shall be capable of implementing access policies through the assignment of entry permission based on door groupings and time schedules.
3. The system shall allow for schedules to be applied at doors, governing their remaining open or locked condition.
4. The application shall permit flexible assignment of user rights and privileges.
5. The application shall allow for creation and editing of cardholder credentials, including system wide card formats.
6. The application shall provide views of events and alarms throughout the installation and shall be capable of triggering hardware and communicative actions, based on system configuration.
7. The application shall be capable of generating standard and custom reports, and provide a detailed and complete log of all system events, as defined by the system operator.

K. System and Software

1. The system shall incorporate 128 bit AES encrypted data.
2. Supported operating systems shall be Microsoft Windows Vista, Windows 7, Windows 8, Windows 8.1, Windows Server 2008 R2, Server 2012
3. The system shall support a web based interface as part of the same software package. Loading or licenses for a separate application or having to download software will be unacceptable; acceptable browsers shall be Internet Explorer, Firefox, Chrome, and Safari.
4. The database engine shall be SQL 2008 R2, 2012, 2014 or SQL Express.
5. The system shall have an operating temperature of 0°C to 50°C, ambient, a storage temperature of -40°C to +85°C, ambient, a relative humidity ability of 0% to 95% (non-condensing) at 50°C, and a MTBF of > 100,000 hours.
6. The system-radiated emissions shall be compliant with FCC Part 15, Class A, and EN55022 specifications.
7. The system must be capable of managing 4 million users, 64,000 doors, 256 calendars, 1024 zones, and 256 time zones, 1024 time periods, both with 8 intervals each.
8. Shall support integration with other software systems through dynamic database synchronization.
9. Shall be able to store all historical data on the system server without having to individually use a handheld device to download audit trail data from individual locks.
10. Shall be capable of being expanded throughout the site. Shall support database partitioning such that each area (department) shall be able to manage their own doors and users without a chance of accidentally interfering with other areas (departments).
11. Capable of dynamic master-keying: each credential can change access privileges transparently "on the fly" without the need to visit the access control administrator to reprogram keycards and without the need to reprogram the electronic locks with a handheld programmer.
12. No predefined profiles shall be necessary to issue keycards. Each and every keycard can be individually enabled to access any combination of doors.
13. Lost keycard cancellation: Contactless smart cards shall be capable of conveying lists of cancelled keys to avoid having to reprogram locks with a handheld device any time a keycard is lost.
14. No third party WI-FI or Radio infrastructure shall be required for SVN Operation
15. The locks shall have built-in anti- passback functionality. The EAC locks shall have the ability to prevent card holders from reentering without presenting their token to the out reader. This feature shall be incorporated in both On Line/Wireless, or in the off-line EAC lock units.
16. The software shall be supplied ready to support any number and configuration of off-

- line and on-line stand-alone locks and wall readers, with the capacity to manage multiple or single sites.
17. A Portable Programming Device (PPD) for transferring information to and from the database for all off-line locks and wall readers shall also be included.
  18. Shall support 1024 time periods that determine the time intervals at which a lock shall operate in a special mode, timed office mode, automatic opening mode etc.
  19. Shall support 256 time zones, which determine the interval of time in which a user has access to a particular door or zone
  20. Shall support 256 Calendars, for user access or used by the electronic locks when they operate in a timed mode.
  21. Shall support 1024+ Zones to group doors into sets making programming user access simpler and more efficient.
  22. Incorporate user groups to enable the system administrator to group users according to their privileges of access.
  23. Operator Groups shall be defined hierarchically and be password protected to allow only authorized staff to make amendments to sections of the database for which they have responsibility.
  24. Shall allow multiple simultaneous access, which allows multiple authorized operators to make dynamic changes to the database at any one time.
  25. Shall have a proven API for interfacing with existing and well established traditional access control systems. [SHIP]
  26. Shall have a proven API for interfacing with third party access control panels. [SALLIS]
  27. Shall have a graphic map feature that will indicate to the operator where a system annunciated alarm is located.
  28. Shall support an "Out of Site" feature which shall work in conjunction with IN and OUT hot spot readers to disable user access when leaving a facility and enabling user access when entering it.
  29. Shall support a "Limited User Access" feature which can be set to allow a maximum number of users assigned to a door.
  30. Shall support a "Limited User Occupancy" monitor which can be set to disallow access after the desired number is reached in an area.
  31. Shall support setting encryption type for Desfire cards.
  32. Shall incorporate auto assignment when using Legic Prime cards.
  33. Shall incorporate an activation date and time setting for user cards.
  34. Shall allow multiple operator groups to be created with software features able to be individually allowed or denied to the group.
  35. Shall feature a Department tab, allowing departments to share users and also add external (users not in a group) access to the department.
  36. Shall permit specifying Wiegand codes in decimal, hexadecimal, or binary formats, and bit order.
  37. The system software shall support the following optional features:
    - a. Visitor Management
    - b. Badging
    - c. Partitions
    - d. JustIN mSVN (Mobile App)
    - e. Third party access system interface
    - f. Software to software API with other wired access control systems
    - g. Graphical mapping
  38. In the event of an emergency the System Administrator shall have the ability to either lock down or unlock all or some doors/locks connected via the Salto Wireless Network. These doors shall then remain locked or unlocked until the emergency is designated as over by the System Administrator.
  39. If an invalid card is presented to an on-line reader an entry is placed immediately in the audit trail and the control unit can trigger a CCTV camera or an alarm (local or remote). This operation can be modified at anytime by changing the dipswitch configuration in the control unit.
  40. As a standard feature in all software versions, database import and export utilizing "flat

files" shall be supported.

## 2.7 KEYING

- A. Provide cylinders/cores keyed into Owner's existing keying system managed by Owner's locksmith, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference. Contact:

1. Firm Name:
2. Contact Person:
3. Telephone:

## 2.8 DOOR CLOSERS

- A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: LCN 4050 series.
2. Acceptable Manufacturers and Products: Falcon SC70A series, Norton 7500 series, Sargent 351 series, Yale 4400 series.

- B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with cast aluminum cylinder.
3. Closer Body: 1-1/2 inch (38 mm) diameter with 11/16 inch (17 mm) diameter heat-treated pinion journal and full complement bearings.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and all weather requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and back check.
7. Pressure Relief Valve (PRV) Technology: Not permitted.
8. Provide stick on templates, special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

## 2.9 DOOR TRIM

- A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

- B. Requirements:

1. Provide push plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick and beveled 4 edges. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
2. Provide push bars of solid bar stock, diameter and length as scheduled. Provide push bars of sufficient length to span from center to center of each stile. Where required,

- mount back to back with pull.
- 3. Provide offset pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
- 4. Provide flush pulls as scheduled. Where required, provide back-to-back mounted model.
- 5. Provide pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
- 6. Provide pull plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick, beveled 4 edges, and prepped for pull. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
- 7. Provide wire pulls of solid bar stock, diameter and length as scheduled.
- 8. Provide decorative pulls as scheduled. Where required, mount back to back with pull.

## 2.10 PROTECTION PLATES

### A. Manufacturers:

- 1. Scheduled Manufacturer: Ives.
- 2. Acceptable Manufacturers: Burns, Rockwood.

### B. Requirements:

- 1. Provide kick plates, mop plates, and armor plates minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
- 2. Sizes of plates:
  - a. Kick Plates: 10 inches (254 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
  - b. Mop Plates: 4 inches (102 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
  - c. Armor Plates: 36 inches (914 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs

## 2.11 DOOR STOPS AND HOLDERS

### A. Manufacturers:

- 1. Scheduled Manufacturer: Ives.
- 2. Acceptable Manufacturers: Burns, Rockwood.

### B. Provide door stops at each door leaf:

- 1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
- 2. Where a wall stop cannot be used, provide universal floor stops for low or high rise options.
- 3. Where wall or floor stop cannot be used, provide medium duty surface mounted overhead stop.

## 2.12 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

### A. Manufacturers:

- 1. Scheduled Manufacturer: Zero International.

2. Acceptable Manufacturers: National Guard, Reese.

B. Requirements:

1. Provide thresholds, weather-stripping (including door sweeps, seals, and astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.
2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
3. Size of thresholds:
  - a. Saddle Thresholds: 1/2 inch (13 mm) high by jamb width by door width
  - b. Bumper Seal Thresholds: 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width
4. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

## 2.13 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

## 2.14 COAT HOOKS

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

B. Provide coat hooks as specified.

## 2.15 FINISHES

A. Finish: BHMA 626/652 (US26D); except:

1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Continuous Hinges: BHMA 630 (US32D)
3. Continuous Hinges: BHMA 628 (US28)
4. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
5. Protection Plates: BHMA 630 (US32D)
6. Overhead Stops and Holders: BHMA 630 (US32D)
7. Door Closers: Powder Coat to Match
8. Wall Stops: BHMA 630 (US32D)

9. Latch Protectors: BHMA 630 (US32D)
10. Weatherstripping: Clear Anodized Aluminum
11. Thresholds: Mill Finish Aluminum

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.
- C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.
- E. Card Lock System Components:
  1. Inspect units before installation to verify physical condition and inclusion of all peripheral materials.
  2. Modules shall be free of any cosmetic defects or damage.
  3. Shipping box shall include the module, power supply (surface mount units) and operations manual.

### 3.2 PREPARATION FOR CARD LOCK SYSTEM

- A. Unit shall be mounted on a properly prepared surface adequate for the size and weight of the module. The placement of the unit shall allow provision for installation and maintenance as indicated on the approved detail drawings and in accordance with the installation manual.

### 3.3 INSTALLATION

- A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
  1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
  2. Custom Steel Doors and Frames: HMMA 831.
  3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
- D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

- E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- H. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches (750 mm) of door height greater than 90 inches (2286 mm).
- I. Card Lock System Components:
  - 1. The Physical Access Control System shall be installed, configured, and tested in accordance with the manufacturer's instructions.
  - 2. Comply with Division 26 Section "Grounding and Bonding for Electrical Systems."
  - 3. Comply with IEEE 1100, "Power and Grounding Sensitive Electronic Equipment."
  - 4. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
  - 5. Bond shields and drain conductors to ground at only one point in each circuit.
  - 6. Signal Ground terminal:
    - a. Locate in each equipment room and wiring closet; isolate from power system and equipment grounding.
    - b. Bus: Mount on wall of main equipment room with standoff insulators.
    - c. Backbone Cable: Extend from signal ground bus to signal ground terminal in each equipment room and wiring closet.
  - 7. Cable installation shall comply with NECA 1, "Good Workmanship in Electrical Contracting" EIA/TIA-569, "Commercial Building Standard for Telecommunications Pathways and Spaces."
    - d. Install cables and wiring according to requirements in Division 28.
    - e. Access control system wiring color to be distinct and specific to the system. Contractor to coordinate cable colors with all other vendors to ensure color is not duplicated.
    - f. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Use NRTL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.
    - g. Install LAN cables using techniques, practices, and methods that are consistent with Category 5E rating of components and that ensure Category 5E performance of completed and linked signal paths, end to end.
    - h. Install cables without damaging conductors, shield, or jacket.
    - i. Cable application requirements are minimum requirements and will be exceeded if recommended or required by manufacturer of system hardware.
    - j. RS-232 Cabling: Install at a maximum distance of 50 feet.
    - k. RS-485 Cabling: Install at a maximum distance of 4000 feet.
  - 8. Boxes and enclosures containing security system components or cabling, and which are easily accessible to employees or to the public, shall be provided with a lock. Boxes above ceiling level in occupied areas of the building will not be considered to be accessible. Junction boxes and small device enclosures below ceiling level and easily accessible to employees or the public will be covered with a suitable cover



- plate and secured with tamperproof screws.
9. Install end-of-line supervision resistors at the field device location and not at the controller or panel location.
- J. Wiring: Coordinate with Division 26, ELECTRICAL sections for:
1. Conduit, junction boxes and wire pulls.
  2. Connections to and from power supplies to electrified hardware.
  3. Connections to fire/smoke alarm system and smoke evacuation system.
  4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
  5. Testing and labeling wires with Architect's opening number.
- K. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- L. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.
- M. Closer/Holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
- N. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.
- O. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- P. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.
- Q. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- R. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- S. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

### 3.4 FIELD QUALITY CONTROL

- A. Engage qualified manufacturer trained representative to perform inspections and to prepare inspection reports.
1. Representative will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

### 3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating

and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, Installer's Architectural Hardware Consultant must examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.
- C. Card Lock System Components:
  1. Testing Agency: Engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
    - a. LAN Cable Procedures: Inspect for physical damage and test each conductor signal path for continuity and shorts. Use Class 2, bidirectional, Category 6 tester. Test for faulty connectors, splices, and terminations. Test according to TIA/EIA-568-1, "Commercial Building Telecommunications Cabling Standards - Part 1 General Requirements." Link performance for UTP cables must comply with minimum criteria in TIA/EIA-568-B.
    - b. Test each circuit and component of each system. Tests will include, but are not limited to, measurements of power supply output under maximum load, signal loop resistance, and leakage to ground where applicable. System components with battery backup will be operated on battery power for a period of not less than 10 percent of the calculated battery operating time. Provide special equipment and software if testing requires special or dedicated equipment.
    - c. Operational Test: After installation of cables and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all pairs installed. Remove temporary connections when tests have been satisfactorily completed.

### 3.6 START-UP SERVICE FOR CARD LOCK SYSTEM COMPONENTS

- A. Engage a factory-authorized service representative to supervise and assist with startup service. Complete installation and startup checks according to approved procedures that were developed in the Preparation article and with manufacturer's written instructions.
- B. Enroll and prepare badges and access cards for Owner's operators, management, and security personnel.

### 3.7 TESTING TRAINING AND CERTIFICATION FOR CARD LOCK SYSTEM COMPONENTS

- A. The Contractor shall demonstrate the functionality of the Physical Access Control System upon completion of installation, documenting the result of all tests and providing these results to the Owner. The Physical Access Control System shall be tested in accordance with the following:
- B. The Contractor shall conduct a complete inspection and test of all installed Physical Access Control System equipment. This process includes testing and verifying operation with connected equipment and network infrastructure.
- C. The Contractor shall provide staff to test all devices and all operational features of the system for witness by the Owner's representative and the Authority having jurisdiction if need be.
- D. The Owner's representative, prior to acceptance, shall witness all testing.
- E. Develop separate training modules for the following:
  1. System Administration personnel to manage and repair the LAN and databases and to update and maintain system and database software.
  2. Computer Operators who prepare and input credentials/tokens to operate workstation on the system.(enrollment station)
  3. Security Personnel, Safety Staff

4. Hardware maintenance personnel.

### 3.8 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

### 3.9 DOOR HARDWARE SCHEDULE

- A. Hardware items are referenced in the following hardware. Refer to the above-specifications for special features, options, cylinders/keying, and other requirements.

- B. Hardware Sets:

#### HARDWARE SET NO. 01 - SINGLE SALTO

Provide each SGL door(s) with the following:

| QTY |    | DESCRIPTION                       | CATALOG NUMBER             | FINISH | MFR |
|-----|----|-----------------------------------|----------------------------|--------|-----|
| 3   | EA | HINGE                             | 5BB1 SERIES AS SPECIFIED   | 613    | IVE |
| 1   | EA | ELECTRICAL<br>CYLINDRICAL LOCKSET | CB250N70DBB3               | DB     | SAL |
| 1   | EA | CYLINDRICAL LATCH                 | LC1KC70IM                  |        | SAL |
| 1   | EA | LATCH ALIGNMENT<br>SPRING KIT     | 01848                      |        | SAL |
| 1   | EA | DOOR CONTACT SENSOR               | RFDTCTW30W01               |        | SAL |
| 1   | EA | SURFACE CLOSER                    | 4050 REG OR PA AS REQ MWMS | 689    | LCN |
| 1   | EA | KICK PLATE                        | 8400 16" X 1" LDW B-CS     | 613    | IVE |
| 1   | EA | WALL STOP                         | WS406/407CCV               | 613    | IVE |
| 3   | EA | SILENCER                          | SR64                       | GRY    | IVE |

#### HARDWARE SET NO. 02 - PAIR CORRIDOR

Provide each PR door(s) with the following:

| QTY |    | DESCRIPTION                    | CATALOG NUMBER  | FINISH | MFR |
|-----|----|--------------------------------|---|--------|-----|
| 6   | EA | HINGE                          | 5BB1 SERIES AS SPECIFIED  | 613    | IVE |
| 2   | EA | FIRE EXIT HARDWARE             | 9927-EO-F-LBR-499F  | US10B  | VON |
| 2   | EA | ELECTRONIC EXIT<br>DEVICE TRIM | XS4 HALF ESCHUTCHEON TO<br>USE WITH PANIC BAR-<br>AB650A00DBH8W | DB     | SAL |
| 1   | EA | PANIC BAR ADAPTER KIT          | KPB04DBW  | DB     | SAL |
| 2   | EA | SURFACE CLOSER                 | 4050 CUSH   |        | LCN |
| 2   | EA | KICK PLATE                     | 8400 16" X 1" LDW B-CS  | 613    | IVE |
| 2   | EA | FIRE/LIFE WALL MAG             | SEM7850 AS REQ (12/24/120V<br>AC/DC TRI-VOLT)                   | US10B  | LCN |
| 2   | EA | SILENCER                       | SR64  | GRY    | IVE |

HARDWARE SET NO. 03 - SINGLE SALTO - PRIVACY

Provide each SGL door(s) with the following:

| QTY |    | DESCRIPTION                                  | CATALOG NUMBER             | FINISH | MFR |
|-----|----|--|----------------------------|--------|-----|
| 3   | EA | HINGE  | 5BB1 SERIES AS SPECIFIED   | 613    | IVE |
| 1   | EA | ELECTRICAL<br>CYLINDRICAL PRIVACY<br>LOCKSET | AB656N00DB38W              | DB     | SAL |
| 1   | EA | CYLINDRICAL LATCH                            | LC1KC70IM                  |        | SAL |
| 1   | EA | LATCH ALIGNMENT<br>SPRING KIT                | 01848                      |        | SAL |
| 1   | EA | DOOR CONTACT SENSOR                          | RFDTCTW30W01               |        | SAL |
| 1   | EA | SURFACE CLOSER                               | 4050 REG OR PA AS REQ MWMS | US10B  | LCN |
| 2   | EA | KICK PLATE                                   | 8400 16" X 1" LDW B-CS     | 613    | IVE |
| 1   | EA | WALL STOP                                    | WS406/407CCV               | US10B  | IVE |
| 3   | EA | SILENCER                                     | SR64                       | GRY    | IVE |

HARDWARE SET NO. 03B - SINGLE SALTO

Provide each SGL door(s) with the following:

| QTY |    | DESCRIPTION                       | CATALOG NUMBER           | FINISH | MFR |
|-----|----|-----------------------------------|--------------------------|--------|-----|
| 3   | EA | HINGE                             | 5BB1 SERIES AS SPECIFIED | 613    | IVE |
| 1   | EA | ELECTRICAL<br>CYLINDRICAL LOCKSET | CB250N70DBB3             | DB     | SAL |
| 1   | EA | CYLINDRICAL LATCH                 | LC1KC70IM                |        | SAL |
| 1   | EA | LATCH ALIGNMENT<br>SPRING KIT     | 01848                    |        | SAL |
| 1   | EA | DOOR CONTACT SENSOR               | RFDTCTW30W01             |        | SAL |
| 1   | EA | SURFACE CLOSER                    | 4050A RW/PA              | US10B  | LCN |
| 2   | EA | KICK PLATE                        | 8400 16" X 1" LDW B-CS   | 613    | IVE |
| 1   | EA | WALL STOP                         | WS406/407CCV             | US10B  | IVE |
| 3   | EA | SILENCER                          | SR64                     | GRY    | IVE |

HARDWARE SET NO. 04 - PAIR SALTO

Provide each PR door(s) with the following:

| QTY |    | DESCRIPTION                       | CATALOG NUMBER           | FINISH | MFR |
|-----|----|-----------------------------------|--------------------------|--------|-----|
| 6   | EA | HINGE                             | 5BB1 SERIES AS SPECIFIED | 613    | IVE |
| 2   | EA | MANUAL FLUSH BOLT                 | FB458                    | 613    | IVE |
| 1   | EA | DUST PROOF STRIKE                 | DP2                      | 613    | IVE |
| 1   | EA | ELECTRICAL<br>CYLINDRICAL LOCKSET | CB250N70DBB3             | DB     | SAL |
| 1   | EA | CYLINDRICAL LATCH                 | LC1KC70IM                |        | SAL |
| 1   | EA | LATCH ALIGNMENT<br>SPRING KIT     | 01848                    |        | SAL |
| 1   | EA | DOOR CONTACT SENSOR               | RFDTCTW30W01             |        | SAL |
| 2   | EA | SURFACE CLOSER                    | 4050 CUSH                | US10B  | LCN |
| 2   | EA | SILENCER                          | SR64                     | GRY    | IVE |

HARDWARE SET NO. 04A - PAIR SALTO - Not Used

Provide each PR door(s) with the following:

| QTY |    | DESCRIPTION                       | CATALOG NUMBER           | FINISH | MFR |
|-----|----|-----------------------------------|--------------------------|--------|-----|
| 6   | EA | HINGE                             | 5BB1 SERIES AS SPECIFIED | 613    | IVE |
| 2   | EA | MANUAL FLUSH BOLT                 | FB458                    | 613    | IVE |
| 1   | EA | DUST PROOF STRIKE                 | DP2                      | 613    | IVE |
| 1   | EA | ELECTRICAL<br>CYLINDRICAL LOCKSET | CB250N70DBB3             | DB     | SAL |
| 1   | EA | CYLINDRICAL LATCH                 | LC1KC70IM                |        | SAL |
| 1   | EA | LATCH ALIGNMENT<br>SPRING KIT     | 01848                    |        | SAL |
| 1   | EA | DOOR CONTACT SENSOR               | RFDTCTW30W01             |        | SAL |
| 2   | EA | SURFACE CLOSER                    | 4050A RW/PA              | 613    | LCN |
| 2   | EA | SILENCER                          | SR64                     | GRY    | IVE |

HARDWARE SET NO. 05 - SINGLE EXIT SALTO

Provide each SGL door(s) with the following:

| QTY |    | DESCRIPTION                    | CATALOG NUMBER   | FINISH | MFR |
|-----|----|--------------------------------|--|--------|-----|
| 3   | EA | HINGE                          | 5BB1 SERIES AS SPECIFIED   | 613    | IVE |
| 1   | EA | FIRE EXIT HARDWARE             | 99-EO-F  | 613    | VON |
| 1   | EA | ELECTRONIC EXIT<br>DEVICE TRIM | XS4 HALF ESCHUTCHEON TO<br>USE WITH PANIC BAR -<br>AB650A00DBH8W | DB     | SAL |
| 1   | EA | PANIC BAR ADAPTER KIT          | KPB03DBW   | DB     | SAL |
| 1   | EA | SURFACE CLOSER                 | 4050 REG OR PA AS REQ MWMS                                       | 613    | LCN |
| 1   | EA | WALL STOP                      | WS406/407CCV   | US10B  | IVE |
| 3   | EA | SILENCER                       | SR64   | GRY    | IVE |

HARDWARE SET NO. 06 - UNEQUAL PAIR EXIT SALTO

Provide each PR door(s) with the following:

| QTY |     | DESCRIPTION                    | CATALOG NUMBER   | FINISH | MFR |
|-----|-----|--------------------------------|--|--------|-----|
| 6   | EA  | HINGE                          | 5BB1 SERIES AS SPECIFIED   | 613    | IVE |
| 1   | SET | AUTO FLUSH BOLT                | FB31P  | US10B  | IVE |
| 1   | EA  | DUST PROOF STRIKE              | DP2  | 613    | IVE |
| 1   | EA  | FIRE EXIT HARDWARE             | 9975-EO-F-576A   | 613    | VON |
| 1   | EA  | ELECTRONIC EXIT<br>DEVICE TRIM | XS4 HALF ESCHUTCHEON TO<br>USE WITH PANIC BAR -<br>AB650A00DBH8W | DB     | SAL |
| 1   | EA  | PANIC BAR ADAPTER KIT          | KPB03DBW   | DB     | SAL |
| 2   | EA  | SURFACE CLOSER                 | 4050A EDA  | 613    | LCN |
| 2   | EA  | KICK PLATE                     | 8400 16" X 1" LDW B-CS   | 613    | IVE |
| 2   | EA  | WALL STOP                      | WS406/407CCV   | US10B  | IVE |
| 2   | EA  | SILENCER                       | SR64   | GRY    | IVE |

HARDWARE SET NO. 06A - SINGLE SALTO

Provide each SGL door(s) with the following:

| QTY |    | DESCRIPTION                       | CATALOG NUMBER             | FINISH | MFR |
|-----|----|-----------------------------------|----------------------------|--------|-----|
| 3   | EA | HINGE                             | 5BB1 SERIES AS SPECIFIED   | 613    | IVE |
| 1   | EA | ELECTRICAL<br>CYLINDRICAL LOCKSET | CB250N70DBB3               | BD     | SAL |
| 1   | EA | CYLINDRICAL LATCH                 | LC1KC70IM                  |        | SAL |
| 1   | EA | LATCH ALIGNMENT<br>SPRING KIT     | 01848                      |        | SAL |
| 1   | EA | DOOR CONTACT SENSOR               | RFDTCTW30W01               |        | SAL |
| 1   | EA | SURFACE CLOSER                    | 4050 REG OR PA AS REQ MWMS | 613    | LCN |
| 1   | EA | KICK PLATE                        | 8400 16" X 1" LDW B-CS     | 613    | IVE |
| 3   | EA | SILENCER                          | SR64                       | GRY    | IVE |

HARDWARE SET NO. 07 - SINGLE EXIT SALTO

Provide each SGL door(s) with the following:

| QTY |    | DESCRIPTION                    | CATALOG NUMBER   | FINISH | MFR |
|-----|----|--------------------------------|--|--------|-----|
| 3   | EA | HINGE                          | 5BB1 SERIES AS SPECIFIED   | 613    | IVE |
| 1   | EA | FIRE EXIT HARDWARE             | 99-EO-F  | 613    | VON |
| 1   | EA | ELECTRONIC EXIT<br>DEVICE TRIM | XS4 HALF ESCHUTCHEON TO<br>USE WITH PANIC BAR -<br>AB650A00DBH8W | DB     | SAL |
| 1   | EA | PANIC BAR ADAPTER KIT          | KPB03DBW   | DB     | SAL |
| 1   | EA | SURFACE CLOSER                 | 4050 REG OR PA AS REQ MWMS                                       | 613    | LCN |
| 1   | EA | WALL STOP                      | WS406/407CCV   | US10B  | IVE |
| 3   | EA | SILENCER                       | SR64   | GRY    | IVE |

HARDWARE SET NO. 08 - SINGLE SALTO

Provide each SGL door(s) with the following:

| QTY |    | DESCRIPTION                       | CATALOG NUMBER           | FINISH | MFR |
|-----|----|-----------------------------------|--------------------------|--------|-----|
| 3   | EA | HINGE                             | 5BB1 SERIES AS SPECIFIED | 613    | IVE |
| 1   | EA | ELECTRICAL<br>CYLINDRICAL LOCKSET | CB250N70DBB3             | DB     | SAL |
| 1   | EA | CYLINDRICAL LATCH                 | LC1KC70IM                |        | SAL |
| 1   | EA | LATCH ALIGNMENT<br>SPRING KIT     | 01848                    |        | SAL |
| 1   | EA | DOOR CONTACT SENSOR               | RFDTCTW30W01             |        | SAL |
| 1   | EA | SURFACE CLOSER                    | 4050A EDA                | 613    | LCN |
| 1   | EA | KICK PLATE                        | 8400 16" X 1" LDW B-CS   | 631    | IVE |
| 1   | EA | WALL STOP                         | WS406/407CCV             | US10B  | IVE |
| 1   | EA | GASKETING                         | 188SBK PSA               | BK     | ZER |

HARDWARE SET NO. 09 - SINGLE SALTO

Provide each SGL door(s) with the following:

| QTY |    | DESCRIPTION                       | CATALOG NUMBER           | FINISH | MFR |
|-----|----|-----------------------------------|--------------------------|--------|-----|
| 3   | EA | HINGE                             | 5BB1 SERIES AS SPECIFIED | 613    | IVE |
| 1   | EA | ELECTRICAL<br>CYLINDRICAL LOCKSET | CB250N70DBB3             | DB     | SAL |
| 1   | EA | CYLINDRICAL LATCH                 | LC1KC70IM                |        | SAL |
| 1   | EA | LATCH ALIGNMENT<br>SPRING KIT     | 01848                    |        | SAL |
| 1   | EA | DOOR CONTACT SENSOR               | RFDTCTW30W01             |        | SAL |
| 1   | EA | SURFACE CLOSER                    | 4050A RW/PA              | 613    | LCN |
| 1   | EA | KICK PLATE                        | 8400 16" X 1" LDW B-CS   | 613    | IVE |
| 1   | EA | WALL STOP                         | WS406/407CCV             | US10B  | IVE |
| 1   | EA | GASKETING                         | 188SBK PSA               | BK     | ZER |

HARDWARE SET NO. 10 - PAIR EXTERIOR SALTO

Provide each PR door(s) with the following:

| QTY |    | DESCRIPTION                    | CATALOG NUMBER   | FINISH | MFR |
|-----|----|--------------------------------|--|--------|-----|
| 2   | EA | CONT. HINGE                    | 112XY  | 613    | IVE |
| 1   | EA | REMOVABLE MULLION              | 4954   | 613    | VON |
| 2   | EA | PANIC HARDWARE                 | 33A-EO   | 613    | VON |
| 1   | EA | ELECTRONIC EXIT<br>DEVICE TRIM | XS4 HALF ESCHUTCHEON TO<br>USE WITH PANIC BAR -<br>AB650A00DBH8W | DB     | SAL |
| 1   | EA | PANIC BAR ADAPTER KIT          | KPB03DBW   | DB     | SAL |
| 2   | EA | SURFACE CLOSER                 | 4050 HCUSH   | 613    | LCN |
| 1   | EA | PERIMETER GASKETING            | BY DOOR MANUFACTURER   |        |     |
| 1   | EA | THRESHOLD                      | 545A-223   | A      | ZER |

HARDWARE SET NO. 10A - PAIR MAIN ENTRY - EXIT ONLY

Provide each PR door(s) with the following:

| QTY |    | DESCRIPTION         | CATALOG NUMBER       | FINISH | MFR |
|-----|----|---------------------|----------------------|--------|-----|
| 2   | EA | CONT. HINGE         | 112XY                | 613    | IVE |
| 1   | EA | REMOVABLE MULLION   | 4954                 | 613    | VON |
| 2   | EA | PANIC HARDWARE      | 33A-EO               | 613    | VON |
| 2   | EA | SURFACE CLOSER      | 4050 HCUSH           | 613    | LCN |
| 1   | EA | PERIMETER GASKETING | BY DOOR MANUFACTURER |        |     |
| 1   | EA | THRESHOLD           | 545A-223             | A      | ZER |

HARDWARE SET NO. 10B - PAIR MAIN ENTRY - SALTO -

Provide each PR door(s) with the following:

| QTY |    | DESCRIPTION                    | CATALOG NUMBER   | FINISH | MFR |
|-----|----|--------------------------------|--|--------|-----|
| 2   | EA | CONT. HINGE                    | 112XY  | 613    | IVE |
| 1   | EA | REMOVABLE MULLION              | 4954   | 613    | VON |
| 2   | EA | PANIC HARDWARE                 | 33A-EO   | 613    | VON |
| 1   | EA | ELECTRONIC EXIT<br>DEVICE TRIM | XS4 HALF ESCHUTCHEON TO<br>USE WITH PANIC BAR -<br>AB650A00DBH8W | DB     | SAL |
| 1   | EA | PANIC BAR ADAPTER KIT          | KPB03DBW   | DB     | SAL |
| 2   | EA | SURFACE CLOSER                 | 4050 HCUSH   | 613    | LCN |
| 1   | EA | PERIMETER GASKETING            | BY DOOR MANUFACTURER   |        |     |
| 1   | EA | THRESHOLD                      | 545A-223   | A      | ZER |

HARDWARE SET NO. 11 - SINGLE EXTERIOR SALTO

Provide each SGL door(s) with the following:

| QTY |    | DESCRIPTION                    | CATALOG NUMBER   | FINISH | MFR |
|-----|----|--------------------------------|--|--------|-----|
| 1   | EA | CONT. HINGE                    | 112XY  | 613    | IVE |
| 1   | EA | PANIC HARDWARE                 | 33A-EO   | 613    | VON |
| 1   | EA | ELECTRONIC EXIT<br>DEVICE TRIM | XS4 HALF ESCHUTCHEON TO<br>USE WITH PANIC BAR -<br>AB650A00DBH8W | DB     | SAL |
| 1   | EA | PANIC BAR ADAPTER KIT          | KPB03DBW   | DB     | SAL |
| 1   | EA | SURFACE CLOSER                 | 4050 HCUSH   | 613    | LCN |
| 1   | EA | PERIMETER GASKETING            | BY DOOR MANUFACTURER   |        |     |
| 1   | EA | THRESHOLD                      | 545A-223   | A      | ZER |

HARDWARE SET NO. 11A - SINGLE MAIN ENTRY - EXIT ONLY

Provide each SGL door(s) with the following:

| QTY |    | DESCRIPTION                    | CATALOG NUMBER   | FINISH | MFR |
|-----|----|--------------------------------|--|--------|-----|
| 1   | EA | CONT. HINGE                    | 112XY  | 613    | IVE |
| 1   | EA | PANIC HARDWARE                 | 33A-EO   | 613    | VON |
| 1   | EA | ELECTRONIC EXIT<br>DEVICE TRIM | XS4 HALF ESCHUTCHEON TO<br>USE WITH PANIC BAR -<br>AB650A00DBH8W | DB     | SAL |
| 1   | EA | PANIC BAR ADAPTER KIT          | KPB03DBW   | DB     | SAL |
| 1   | EA | SURFACE CLOSER                 | 4050 HCUSH   | 613    | LCN |
| 1   | EA | PERIMETER GASKETING            | BY DOOR MANUFACTURER   |        |     |
| 1   | EA | THRESHOLD                      | 545A-223   | A      | ZER |

HARDWARE SET NO. 11B - SINGLE EXTERIOR SALTO

Provide each SGL door(s) with the following:

| QTY |    | DESCRIPTION                    | CATALOG NUMBER   | FINISH | MFR |
|-----|----|--------------------------------|--|--------|-----|
| 1   | EA | CONT. HINGE                    | 112XY  | 628    | IVE |
| 1   | EA | FIRE EXIT HARDWARE             | 99-EO-F  | 626    | VON |
| 1   | EA | ELECTRONIC EXIT<br>DEVICE TRIM | XS4 HALF ESCHUTCHEON TO<br>USE WITH PANIC BAR -<br>AB650A00DBH8W | DB     | SAL |
| 1   | EA | PANIC BAR ADAPTER KIT          | KPB03DBW   | DB     | SAL |
| 1   | EA | SURFACE CLOSER                 | 4050A SCUSH  | 689    | LCN |
| 1   | EA | GASKETING                      | 429AA-S  | AA     | ZER |
| 1   | EA | DOOR SWEEP                     | 39A  | A      | ZER |
| 1   | EA | THRESHOLD                      | 545A-223   | A      | ZER |



HARDWARE SET NO. 12 - SINGLE MAIN ENTRY - SALTO

Provide each SGL door(s) with the following:

| QTY |    | DESCRIPTION                    | CATALOG NUMBER   | FINISH | MFR |
|-----|----|--------------------------------|--|--------|-----|
| 1   | EA | CONT. HINGE                    | 112XY  | 613    | IVE |
| 1   | EA | PANIC HARDWARE                 | 33A-EO   | 613    | VON |
| 1   | EA | ELECTRONIC EXIT<br>DEVICE TRIM | XS4 HALF ESCHUTCHEON TO<br>USE WITH PANIC BAR -<br>AB650A00DBH8W | DB     | SAL |
| 1   | EA | PANIC BAR ADAPTER KIT          | KPB03DBW   | DB     | SAL |
| 1   | EA | CYLINDER                       | TO SUIT LOCKING DEVICE   |        |     |
| 1   | EA | SURFACE CLOSER                 | 4050 HCUSH   | 613    | LCN |
| 1   | EA | PERIMETER GASKETING            | BY DOOR MANUFACTURER   |        |     |
| 1   | EA | THRESHOLD                      | 545A-223   | A      | ZER |

HARDWARE SET NO. 13 - PAIR EXITS - MULLION - SALTO

Provide each PR door(s) with the following:

| QTY |    | DESCRIPTION                    | CATALOG NUMBER   | FINISH | MFR |
|-----|----|--------------------------------|--|--------|-----|
| 6   | EA | HINGE                          | 5BB1 SERIES AS SPECIFIED   | 613    | IVE |
| 2   | EA | FIRE EXIT HARDWARE             | 9827-EO-F-LBR-499F   | 613    | VON |
| 1   | EA | ELECTRONIC EXIT<br>DEVICE TRIM | XS4 HALF ESCHUTCHEON TO<br>USE WITH PANIC BAR -<br>AB650A00DBH8W | DB     | SAL |
| 1   | EA | PANIC BAR ADAPTER KIT          | KPB03DBW   | DB     | SAL |
| 2   | EA | SURFACE CLOSER                 | 4050A EDA  | 613    | LCN |
| 2   | EA | KICK PLATE                     | 8400 16" X 1" LDW B-CS   | 613    | IVE |
| 2   | EA | WALL STOP                      | WS406/407CCV   | US10B  | IVE |
| 2   | EA | SILENCER                       | SR64   | GRY    | IVE |

END OF SECTION 087100



## **SECTION 088100**

### **SOLAR CONTROL COATED INSULATING GLASS**

#### **PART 1 - GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Double-Glazed Solar Control Insulating Glass Units.

##### **1.2 RELATED SECTIONS**

- 1. Section 084113 "Aluminum Entrances and Storefronts."
- 2. Section 084413.1 & 084413.1 "Glazed Aluminum Curtain Walls"
- 3. Section 088853.3 "Fire-Rated Glazing."
- 4. Section 088853.1, & 088853.2 "Security Glazing."

##### **1.3 REFERENCES**

- A. ANSI Z 97.1 - Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test.
- B. ASTM C 1036 - Standard Specification for Flat Glass.
- C. ASTM C 1048 - Standard Specification for Heat-Treated Flat Glass--Kind HS, Kind FT Coated and Uncoated Glass.
- D. ASTM C 1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Glass.
- E. ASTM E 2188 □ Standard Test Method for Insulating Glass Unit Performance.
- F. ASTM E 2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.
- G. CPSC 16CFR-1201 - Safety Standard for Architectural Glazing Materials.
- H. Glass Association of North America (GANA) Glazing Manual.

##### **1.4 DEFINITIONS**

- A. Sealed Insulating Glass Unit Surfaces:
  - 1. Surface No. 1: Exterior surface of outer lite.
  - 2. Surface No. 2: Interior surface of outer lite.
  - 3. Surface No. 3: Exterior surface of inner lite.
  - 4. Surface No. 4: Interior surface of inner lite.

- B. Airspace: Space between lites of an insulating glass unit that contains dehydrated air or other inert specified gas.

## 1.5 SUBMITTALS

- A. Comply with Section 01330 - Submittal Procedures.
- B. Product Data: Submit manufacturer's product data, including performance characteristics and installation instructions.
- C. Shop Drawings: Submit manufacturer's or fabricator's shop drawings, including plans, elevations, sections, and details, indicating glass dimensions, tolerances, types, thicknesses, and coatings.
- D. Samples: Submit manufacturer's samples of each type, thickness, and coating.
- E. Fabricator's Certification: Submit fabricator's certification by manufacturer.
- F. Cleaning Instructions: Submit manufacturer's cleaning instructions.
- G. Warranty: Submit manufacturer's standard warranty for sealed insulating glass units.

## 1.6 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Minimum of 5 years experience manufacturing solar control coated glass.
- B. Fabricator's Qualifications:
  - 1. Minimum of 5 years experience manufacturing sealed insulating glass units meeting ASTM E 2190.
  - 2. Certified by coated glass manufacturer.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery:
  - 1. Deliver glass to site in accordance with manufacturer's instructions.
  - 2. Deliver glass in manufacturer's or fabricator's original containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage:
  - 1. Store glass in accordance with manufacturer's instructions.
  - 2. Store glass in clean, dry area indoors.
  - 3. Protect from exposure to direct sunlight and freezing temperatures.
  - 4. Apply temporary coverings loosely to allow adequate ventilation.
  - 5. Protect from contact with corrosive chemicals.
  - 6. Avoid placement of glass edge on concrete, metal, and other hard objects.
  - 7. Rest glass on clean, cushioned pads at 1/4-points.
- C. Handling:
  - 1. Handle glass in accordance with manufacturer's instructions.

2. Protect glass from damage during handling and installation.
3. Do not slide 1 lite of glass against another.
4. Do not use sharp objects near unprotected glass.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURER (Acceptable Manufacturers)

- A. Basis-of-Design Product:, Guardian Glass, LLC; SunGuard Advanced Architectural Glass - SN68
- B. Substitutions: Subject to compliance with requirements
  1. Vitro
  2. Oldcastle

### 2.2 FABRICATORS

- A. Sealed Insulating Glass Units, Heat-Strengthened Glass, Tempered Glass, and Spandrel Glass:
  1. Acceptable Fabricators:

### 2.3 SOLAR CONTROL INSULATING COATED GLASS

- A. Double-Glazed Sputter-Coated Insulating Glass Units:
  1. Conformance: ASTM E 2190.
  2. Outboard Lite: Sputter-coated clear float glass.
    - a. Annealed Clear Float Glass: ASTM C 1036, Type 1, Class 1, Quality q3.
    - b. Vacuum Deposition Sputtered Coating: ASTM C 1376.
    - c. Coating on Surface No. 2: SunGuard SuperNeutral 68 (SN 68).
    - d. Glass Thickness: 6 mm (1/4 inch).
    - e. Heat Treatment: None
  3. Air Space: 12 mm (1/2 inch) wide, hermetically sealed, dehydrated air space.
  4. Inboard Lite: Guardian Clear float glass.
    - a. Annealed Clear Float Glass: ASTM C 1036, Type 1, Class 1, Quality q3.
    - b. Glass Thickness: 6 mm (1/4 inch).
    - c. Heat-Treatment: Tempered; ASTM C 1048, Kind FT; CPSC 16CFR-1201; ANSI Z 97.1.
  5. Glass Unit Performance Characteristics:
    - a. Visible Light Transmittance: 68 percent
    - b. Visible Light Reflectance Outdoors: 11 percent
    - c. Direct Solar Energy Transmittance: 33 percent
    - d. Direct Solar Energy Reflectance Outdoors: 33 percent
    - e. Winter U-Value Nighttime: 0.29
    - f. Summer U-Value Daytime: 0.28
    - g. Solar Heat Gain Coefficient: 0.38
    - h. Summer Relative Heat Gain: 90
  6. Edge Seals: ASTM E 2188, with aluminum spacers, dual-sealed with a primary seal of polyisobutylene and a secondary seal of silicone sealant for glass-to-spacer seals.

7. Sealant: Approved by glass manufacturer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas to receive glass. Notify Architect of conditions that would adversely affect installation. Do not proceed with installation until unsatisfactory conditions are corrected.

### 3.2 PREPARATION

- A. Verify glazing openings are correct size and within tolerance.
- B. Verify glazing channels, recesses, and weeps are clean and free of obstructions.

### 3.3 GLAZING

- A. Install glass in accordance with manufacturer's instructions, except where local codes or GANA Glazing Manual indicate more stringent requirements.

### 3.4 FIELD QUALITY CONTROL

- A. Coated glass, when viewed from minimum of 10 feet, exhibiting slightly different hue or color not apparent in hand samples, will not be cause of rejection of glass units, as determined by Architect.
- B. Verify glass is free of chips, cracks, and other inclusions that could inhibit structural or aesthetic integrity.

### 3.5 CLEANING

- A. Clean glass promptly after installation in accordance with manufacturer's instructions.
- B. Remove labels from glass surface.
- C. Do not use harsh cleaning materials or methods that would damage glass.

### 3.6 PROTECTION

- A. Protect installed glass from damage during construction.
- B. Protect installed glass from contact with contaminating substances resulting from construction operations.

- C. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in other ways during construction period, including natural causes, accidents, and vandalism.

END OF SECTION





## **SECTION 08 81 01**

### **INTERIOR GLASS AND GLAZING**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. Provide interior glazing materials and installation components and accessories where scheduled, as shown on the drawings and specified in this section, not included in security glazing, curtain wall or storefront sections.
- B. Related Sections include the following:
  - 1. Section 08 14 00 Wood Doors

##### **1.3 PERFORMANCE REQUIREMENTS**

- A. General: Provide glazing systems capable of withstanding normal, and specified movement and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, and/or product imperfections, fabrication, and installation; failure of sealants or gaskets; and other defects in construction.
- B. Work shall conform to the most current edition of following standards and codes. Where contradictory requirements are found between standards and/or codes and/or this specification, the more stringent requirement shall govern unless otherwise stated by the Architect.
  - 1. New York State Building Code
  - 2. ANSI Z97.1 American National Standard for Safety Glazing Materials Used in Buildings
  - 3. GANA Glass Association of North America Glazing Manual
- C. Glass Thickness: Select minimum glass thickness to comply with ASTM E 1300.
- D. Minimum thickness of glass lites, whether annealed or heat treated, are to be selected so that the worst case probability of failure does not exceed the percentages listed in the State Building Code.

##### **1.4 SUBMITTALS**

- A. Product Data: For each glass product and glazing material indicated.

- B. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

## 1.5 QUALITY ASSURANCE

- A. Source Limitations for Clear Glass: Obtain clear float glass from one primary-glass manufacturer.
  - 1. Fabricator to have minimum 5 years experience.
- B. Source Limitations for Laminated Glass: Obtain laminated-glass units from one manufacturer using the same type of glass lites and interlayers for each type of unit indicated.
- C. Source Limitations for Glazing Accessories: Obtain glazing accessories from one source for each product and installation method indicated.
- D. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.
- E. Provide safety glass where required to satisfy structural requirements, resist human impact loads and as otherwise required by Codes and Standards. Glass panels subject to human impact loads include glass in doors, fixed panels in windows and doors that may be mistaken for means of egress or ingress, where lowest point of panel is less than 18" above finished floor and minimum panel dimension is larger than 18".
- F. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
  - 1. GANA Publications: GANA'S "Glazing Manual" and "Laminated Glass Design Guide."
  - 2. SIGMA Publications: SIGMA TM-3000, "Vertical Glazing Guidelines"

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

## 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers.

## 1.8 WARRANTY

- A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Manufacturer's Special Warranty on Laminated Glass: Written warranty, made out to Owner and signed by laminated-glass manufacturer agreeing to furnish replacements for laminated-glass units that deteriorate as defined in "Definitions" Article, delivered to a secure location on site, within specified warranty period indicated below.
  - 1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 GLAZING SYSTEMS, GENERAL

- A. Unless specific products are designated as proprietary, it is intended that each type of glazing system be selected by the fabricator for the individual systems for doors.

### 2.2 PRIMARY FLOAT GLASS

- A. Low Iron Float Glass: Starphire Ultra Clear or equal, ASTM C 1036, Type I (ultra clear transparent glass, flat), Quality q3 (glazing select); Class 1.

### 2.3 HEAT STRENGTHENED, AND FULLY TEMPERED GLASS

- A. General: Glass which has been heat treated horizontally; maintain roller marks running horizontally in the final installation whenever possible. For glass which has been heat treated vertically, locate tong marks along an edge, oriented in the same direction which will be concealed in the glazing system.
  - 1. Overall Bow and warp tolerances: Heat treated glass shall be examined by the glass manufacturer to detect and discard any lites which exceed 50% maximum bow in any direction, as listed ASTM C1048 Tables.
  - 2. Roll ripple tolerances: Where heat treatment process results in essentially parallel ripples of waves, the deviation from flatness at any peak shall not exceed 0.005 inches.
  - 3. Quench marks to shall be consistently oriented horizontally.
  - 4. Incorporate the heat soak process to control nickel sulfide inclusions and reduce risk of spontaneous breakage of installed glass. Heat soaking shall be performed per EN 14179-1:2005– European Heat Soaking Standard.
  - 5. Comply with ASTM C 1048; Type I (transparent glass, flat); Quality q3 (glazing select); class, kind, and condition as indicated in schedules at the end of Part 3.

### 2.4 LAMINATED GLASS

- A. Laminated Glass: Comply with ASTM C 1172 for kinds of laminated glass indicated and other requirements specified.
- B. Interlayer: Interlayer material as indicated below, clear or in colors, and of thickness indicated with a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after laminating glass lites and installation.
  - 1. Interlayer Material: Polyvinyl butyral sheets.
  - 2. Laminate material at edges, not to be exposed to UV light or deterioration
  - 3. Laminate lites with polyvinyl butyral interlayer in autoclave with heat plus pressure.
- C. Safety glass shall have permanent marking sandblasted or ceramic frit logo.

## 2.5 GLASS SCHEDULE

- A. General: the following descriptions include minimum thicknesses and strengths of glass required and interspace gas. Where thicker or stronger glass, or argon gas fill is required to meet the performance criteria herein, including acoustic performance, wind loads and thermal stress it shall be provided by the contractor at no additional cost. "Types" indicated below refer to acoustic performance requirements.
- B. Safety Glass: The glass types in this schedule shall be modified to include Fully Tempered (FT) safety glass where indicated and at doors and locations where edge of glass is within 18" of surface used by pedestrians.
- C. Glass Types:
  - 1. 3/8" LAMINATED SAFETY GLASS
    - a. Inner Lite: 3/16" Type I (transparent glass, flat) Class 1, clear, float glass. Kind HS (heat strengthened) or FT (fully tempered)
    - b. PVB innerlayer
    - c. Outer Lite: 1/8" Type I (transparent glass, flat) Class 1, clear, float glass. Kind HS (heat strengthened) or FT (fully tempered)
  - 2. 1/4" MONOLITHIC TEMPERED GLASS
    - a. Type I (transparent glass, flat) Class 1, clear, float glass. Kind FT (fully tempered)

## 2.6 GLAZING SEALANT

- A. Medium-Modulus Neutral-Curing Silicone Glazing Sealant: Provide products complying with the following:
  - 1. Products: Provide the following, or equal as approved by the architect:
    - a. Dow 795 Dow Corning.
    - b. GE Silpruf SCS2000
    - c. Pecora 895 NST

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Glazing Substrates: M, G, A, and, as applicable to glazing substrates indicated, O.
  - a. Use O Glazing Substrates: Coated glass, color anodic aluminum, aluminum coated with a high-performance coating.
6. Applications: General glazing applications, particularly those for large lights and similar applications where additional movement capability is required.

## 2.7 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tape: Preformed, butyl-based, (silicone sealant at all butyl tape exposed to UV light) elastomeric tape with a solids content of 100 percent; non-staining and non-migrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
  1. AAMA 804.3 tape, where interior use where indicated.
  2. AAMA 806.3 tape, for general glazing applications, all exterior and applications in which tape is subject to continuous pressure.
  3. Alternate: Silicone tape.

## 2.8 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealants: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Silicone with a Shore A durometer hardness of 85, plus or minus 5.
- D. Spacers: Silicone blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Silicone material of hardness needed to limit glass lateral movement (side walking), 50+/- Shore Durometer hardness.

## 2.9 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

- A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface

conditions, and bite complying with written instructions of product manufacturer and referenced glazing standard, to comply with system performance requirements.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

### 3.2 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Glazing channel dimensions, as indicated on drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thickness, with reasonable tolerances. Adjust and correct s required by project conditions during installation.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply cleaners and primers to joint surfaces where required application and for adhesion of sealants, as determined by pre-construction sealant-substrate testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead. Install at 1/4 points unless otherwise instructed by the glass manufacturer.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Stops: Install and secure as indicated, after glazing has been set in frame. Do not exert excess force no glazing and spacers.

### 3.3 GASKET GLAZING (DRY)

- A. Insert soft and hard compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners with joint seals and/or molded, welded corners.

- B. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weather tight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer. Seal horizontal and vertical metal extrusion to receive gasket at all corners.
- C. Install gaskets so they protrude past face of glazing stops.

### 3.4 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

### 3.5 PROTECTION AND CLEANING

- A. Remove and replace glass that is broken, chipped, cracked, or abraded.
- B. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer and GANA guidelines. Do not use razor blades, scrapers or other metal tools to clean glass.

END OF SECTION 08 81 13





## **SECTION 08 87 00**

### **DECORATIVE GLAZING FILMS**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. Provide decorative privacy film glazing materials and installation as shown on the drawings and specified in this section.
- B. Related Sections include the following:
  - 1. Section 08 81 00 Glass and Glazing

##### **1.3 REFERENCE REQUIREMENTS**

- A. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
- B. ASTM International (ASTM):
  - 1. ASTM D 882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
  - 2. ASTM D 624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
  - 3. ASTM D 1004 - Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting.
  - 4. ASTM D 1044 - Standard Method of Test for Resistance of Transparent Plastics to Surface Abrasion (Taber Abrader Test).
  - 5. ASTM D 2582 - Standard Test Method for Puncture-Propagation Tear Resistance of Plastic Film and Thin Sheeting.
  - 6. ASTM D 5895 - Standard Test Methods for Evaluating Drying or Curing During Film Formation of Organic Coatings Using Mechanical Recorders.
  - 7. ASTM E 84 - Standard Method of Test for Surface Burning Characteristics of Building Materials.
- C. Consumer Products Safety Commission 16 CFR, Part 1201 - Safety Standard for Architectural Glazing Materials.

##### **1.4 SUBMITTALS**

- A. Product Data: For each glass film product indicated.

- B. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

## 1.5 QUALITY ASSURANCE

### A. Performance Requirements:

1. Adhesion to Glass: Minimum 5 lbs/in peel strength per ASTM D3330 (Method A).
2. Flammability: Surface burning characteristics when tested in accordance ASTM E 84, demonstrating film applied to glass rated Class A for Interior Use:
  - a. Flame Spread Index: no greater than 25.
  - b. Smoke Developed Index: no greater than 55.
3. Abrasion Resistance: Film shall have a surface coating that is resistant to abrasion such that less than 5 percent increase of transmitted light haze will result when tested in accordance to ASTM D 1044 using 100 cycles, 500 grams weight, and the CS10F Calibrase Wheel.

- B. Source Limitations for Glazing Films: Fabricator to have minimum 5 years experience.

### C. Installer Qualifications: All products listed in this section are to be installed by a single installer with a minimum of five years demonstrated experience in installing products of the same type and scope as specified.

1. Provide documentation that the installer is authorized by the Manufacturer to perform Work specified in this section.
2. Provide a commercial building reference list of 5 properties where the installer has applied window film. This list will include the following information:
3. Name of building.
4. The name and telephone number of a management contact.
5. Type of glass.
6. Type of film and/or film attachment system.
7. Amount of film and/or film attachment system installed.
8. Date of completion.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing film materials according to manufacturer's written instructions and as needed to prevent damage from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Environmental Limitations: Do not proceed with application when ambient and substrate temperature conditions are outside limits permitted by glazing film material manufacturers.

## 1.7 WARRANTY

- A. Manufacturer's Special Warranty on Glazing Films:

1. Warranty Period: 5 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 DECORATIVE GLAZING FILM

- A. Basis of Design: Solyx SXJ-0594-71 Triangle Gradient or approved equal acceptable to the Architect.
  1. 4 mil polyester film with clear pressure sensitive adhesive and silicone release liner.
  2. Pattern: White and frost Triangle Fading Gradient providing semi privacy as the triangles disperse from the bottom upwards.
  3. Shading Coefficient 0.55
  4. Visible Light Reflection 22%
  5. Visible Light Transmission 100 -10%
  6. UV Transmission 1%
  7. Total Solar energy Rejected 38%
  8. Solar Energy Absorbed 25%

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Carefully measure the height and width of the glass surface. Cut the film to the dimensions, leaving an extra ½ inch to 1 inch around all sides.
- B. Thoroughly clean the surface of the glass to remove any trace of dust, grime and grease. Use low-lint towels or microfiber cloths to clean the surface, as lint left on the glass can stick under film.

### 3.2 APPLICATION

- A. Lay the film on a clean, flat surface with the liner facing up. Slowly peel back the liner, wetting the adhesive side of the film very thoroughly during peel down.
- B. After you remove the liner, rinse and dip fingers in water before handling the film. Use care to prevent fingerprints on the adhesive surface.
- C. Thoroughly spray and soak the glass surface and the adhesive side of the film with the water mixture.
- D. Pick up the film by the top corners, keeping it straight and level. Place the wet film onto the wet surface, keeping the top edge level but letting the film hang over the edges of the frame on all sides. Move, slide and reposition the film as needed. The water should allow it to float and flow easily.

- E. Wet the outside of the film with the spray, then slide a squeegee over the wet film to smooth out and press the film against the glass. Squeegee from the center moving out, pushing bubbles and wrinkles out.
- F. Double check that the film is flat and smooth. If any bubbles remain, use the hard card provided by the manufacturer to push them towards the edge. Trim the excess film from the edges in one smooth, continuous motion using the hard card and razor knife.
- G. Once the film is trimmed, wrap the hard card in a paper towel and use it to push any remaining bubbles and water to the outside edge.
- H. Protect the film until completely dry and fully adhered, typically within 3 days.

END OF SECTION 08 87 00

## **SECTION 088853.1**

### **IIGU - SECURITY GLAZING**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

Drawings and general provision of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

###### **A. Section Includes**

1. Shooter Attack Certified Insulating Security Glazing

##### **1.3 CODES AND REFERENCES:**

- B. FTD-SA IIGU Filti Testing and Development, Standard for Shooter Attack certification
- C. GSA IIGU General Services Administration Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings.
- D. ASTM F1642 IIGU Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings
- E. UL972 IIGU Standard for Burglary Resistant Glazing
- F. EN356 P4 IIGU Testing Classification of Resistance Against Manual Attack
- G. ASTM E330 IIGU Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- H. TAS 201, 202, 203 - FLORIDA BUILDING CODE (Dade County Small Missile Test) - Hurricane
- I. 16 CFR 1201 IIGU Safety Standard for Architectural Glazing Materials; Consumer Products Commission; current edition.

- J. ANSI Z97.1 □ American National Standard for Safety Glazing Materials Used in Building, Safety Performance Specifications and Methods of Test; 2010.
- K. ASTM C 1036-06 □ Standard Specification for Flat Glass
- L. ASTM C 1349-04 - Standard Specification for Architectural Flat Glass Polycarbonate
- M. ICC/BC □ International Building Code.
- N. State Building Codes, Local Amendments.

#### 1.4 QUALITY ASSURANCE

- O. Manufacturers Qualifications: Provide glazing systems produced by a manufacturer with not less than 5-years successful experience in the fabrication of assemblies of the type and quality required.
- P. Installer's Qualifications: Glazed systems shall be installed by a firm that has not less than 5-years successful experience in the installation of systems like those required.
- Q. Source Limitations for Glass: Obtain all glass products from a single manufacturer.
- R. Glass Product Testing: Obtain glass test results for product test reports in □ Submittals □ Article from a qualified independent agency.

#### 1.5 SUBMITTALS

- S. Submit under provisions of Division 1
- T. Product Data: Manufacturers data sheets of each product to be used, including:
  - 1. Preparation instructions and recommendation
  - 2. Storage and handling requirements and recommendations
  - 3. Installation methods.
- U. Glazing Schedule:
  - 1. Use same designations indicated on Drawings.

2. Listing types and thicknesses for each size, opening and location.
3. Samples:
  - a. Submit one 12"x 12" sample of each glass type specified
  - b. Submit one sample of each glazing sealant and/or glazing tape for color review.
4. Warranty: Warranty documents specified herein.

V. Certifications:

1. Certification that all sealants are fully compatible with the surfaces and finishes with which they are in applied.
2. Certification that all products comply with the test methods listed under Paragraph 1.3 Codes and References.

1.6 DELIVERY, STORAGE AND HANDLING

- W. Deliver materials in manufacturer's unopened and undamaged packaging, with manufacturer's labels intact.
- X. Protect glass and glazing materials from damage in ordinance with manufacturer's recommendations.

1.7 WARRANTIES

- Y. Non-Rated Glass Units: Warrant for 10 years from date of Delivery to be free from delamination and failure of seals and not to develop material obstruction of vision, as a result of dust, moisture or film formation on internal glass surfaces.
- Z. Low-E Glass: Warrant for 10 years from date of Delivery to be free of peeling or other deterioration of the Low-E coating.
- AA. Glazing Sealants: Warrant for 10 years per sealant manufacturer's standard warranty of merchantable quality. Warranty shall certify that cured sealants:
  1. Will perform as a watertight weather-seal.
  2. Will not become brittle or crack due to weathering or normal expansion and contraction of adjacent surfaces.

3. Will not harden beyond a Shore A durometer of 50, nor soften below a durometer of 10.
4. Will not change color when used with compatible back-up materials.
5. Will not bleed.

## PART 2 ☐ PRODUCTS

### 2.1 MANUFACTURER'S

- A. Acceptable Manufacturer: Armoured One, LLC., Which is located at: 386 North Midler Ave. Syracuse, NY 13206. Tel: 315-720-4186; Email: [info@armouredone.com](mailto:info@armouredone.com); Web: [www.armouredone.com](http://www.armouredone.com).
- B. Substitutions: Not Permitted
- C. Requests for substitutions will be considered in accordance with provisions in Division 1.

### 2.2 MATERIALS

- A. Shooter/Attack Resistant Security Glass, Non-Rated Insulated: AOTSG1-IGU
  1. Glass Type: Clear insulating panel
  2. Overall Thickness: 1 ☐
  3. Outdoor light: 1/4 ☐ Guardian SN68 Fully tempered
    - a. Coatings: Low-E coating applied to surface 2
  4. Interspace content: argon gas filled
  5. Indoor light: AOTSG516
  6. Winter nighttime U-factor: 0.25
  7. Summer daytime U-factor: 0.28
  8. Visible Light Transmittance (VLT): 68%



9. Solar heat gain: 0.27
10. Visible light reflectance (exterior): 11%
11. Visible light reflectance (interior): 12%
12. Light to Solar Gain (LSG): 1.80
13. FTD-SA □ Standard for Shooter Attack certification Class 6.
14. GSA-Level 2 □ General Services Administration Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings.
15. ASTM F1642 □ Standard Test Method for Glazing and Glazing Systems Subject to Air blast Loadings.
16. UL972 □ Standard for Burglary Resisting Glazing.
17. EN356 P4 □ European Standard for Testing and Classification of Resistance against manual attack.
18. ASTM E330 □ Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
19. TAS 201, 202, 203 - FLORIDA BUILDING CODE (Dade County Small Missile Test) - Hurricane
20. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Consumer Products Safety Commission; current edition.
21. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.

#### B. GLAZING MATERIAL

1. General: Comply with manufacturer's recommendations for applications and conditions at time of installation.

2. Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.
3. Setting Blocks: Neoprene, silicone or EPDM, 70-90 durometer hardness, with proven compatibility with glazing materials used.
4. Spacers: Neoprene, silicone or EPDM, 40-50 durometer hardness with proven compatibility with glazing materials used.
5. Compressible Fillers: Closed-cell or waterproof-jacketed rod stock of synthetic rubber or plastic foam, proven to be compatible with sealants used, flexible and resilient, with 5-10 psi compression strength for 25% deflection.

#### C. FABRICATION

1. Cut glass to full fit and play, consistent with glass and glazing material manufacturers' recommendations and the requirements of the Drawings and References, Codes and Standards Article.
2. Follow code requirements and glass manufacturer's recommendations for minimum bite and edge and face clearances.
3. Cut lights to smooth straight edges, clean, free of nicks and flares; nipping not permitted. Follow glass manufacturer's directions exactly for tinted and Low-E glass
4. Glass Identification:
  - a. Manufacturer's and UL identifications for glazing shall be permanently etched to be visible after glass has been set in place and glazed.

### PART 3- EXECUTION

#### 3.1 GENERAL

- BB. Each glazing installation must withstand normal temperature changes, and impact loading without failure of glass, failure of sealants or gaskets, deterioration of glazing materials and other defects in the work.

- CC. Protect glass from damage during handling and installation, and subsequent operation of glazed components of the work. Discard units with edge damage or other imperfections.
- DD. Glazing channel dimensions are intended to provide for necessary bite on glass, minimum edge clearance, and adequate tape or sealant thicknesses, with reasonable tolerances.
- EE. Comply with recommendations by manufacturers of glass and glazing products, except where more stringent requirements are indicated, including those of referenced glazing standards.

### 3.2 PREPARATION

- FF. Clean glazing channel and other framing members to receive glass, immediately before glazing. Remove coatings which are not firmly bonded to substrate.
- GG. Where sealants are used, apply primer or sealant to joint surfaces where recommended by sealant manufacturer.

### 3.3 INSTALLATION

- HH. Set units of glass in each series with uniformity of pattern, draw, bow and similar characteristics.
- II. Where sealants are used at butt joints, apply sealant in thin continuous clear bead. Tool sealant to a uniform, continuous, even profile.
- JJ. Apply glazing stops and clean up any excess structural sealants from finished surfaces.
- KK. Conform to recommendations of glass manufacturer where such covers points not shown on Drawings or specified herein.
- LL. Remove "loose" stops furnished with the units and reinstall as a part of the glazing operation.
- MM. Handle glass so as to prevent nicks and flares on glass edges.
- NN. Install glass exceeding 1/8" thickness on identical setting blocks permanently mounted and centered at 1/4 points. If necessary to reduce deflection of horizontal supporting member, blocks may be placed at 1/8 points or with the nearest end 6" (whichever is greater) from edge of glass unit. Ensure that blocks are equidistant from centerline of glass. Do not obstruct weep holes.
- OO. Provide permanently mounted edge blocks at head and jambs of dry-glazed lights to prevent damage to glass edges during installation and lateral shifting of glass due to

thermal and seismic loads and vibrations. Follow recommendations of Flat Glass Marketing Assn. Glazing Manual.

PP. Set glass to maintain bite, edge and face clearance stipulated by code and the glass manufacturer.

QQ. Take special precautions to protect laminated glass edges from deterioration of vinyl interlayer by moisture.

RR. Glaze dry-glazed aluminum doors and frames as per manufacturer's directions using glazing gaskets and seals furnished with the units.

SS. Miter gaskets at corners and install so as to prevent pulling away at corners. Gaskets with gaps or other visible irregularities on door and window units shall be corrected by manufacturer or fabricator at no additional cost to University.

### 3.4 PROTECTION AND CLEANING

TT. Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during construction period, including natural causes, accidents and vandalism.

UU. Wash and polish glass on both faces, not more than 4 days prior to date scheduled for inspections intended to establish Date of Substantial Completion in each area of project. Comply with glass manufacturer's recommendations for final cleaning.

END OF SECTION 088853

## **SECTION 088853.2**

### **SECURITY GLAZING □ 45min**

#### **PART 1 - GENERAL**

##### **RELATED DOCUMENTS**

- A. Drawings and general provision of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

B. Section Includes

1. Shooter Attack Certified Security Glazing
2. Shooter Attack Certified Fire Rated Security Glazing
3. Shooter Attack Certified Insulating Security Glazing

#### **1.3 CODES AND REFERENCES:**

- B. FTD-SA □ Filti Testing and Development, Standard for Shooter Attack certification
- C. GSA □ General Services Administration Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings.
- D. ASTM F1642 □ Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings
- E. UL972 □ Standard for Burglary Resistant Glazing
- F. EN356 P4 □ Testing Classification of Resistance Against Manual Attack
- G. ASTM E330 □ Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

H. TAS 201, 202, 203 - FLORIDA BUILDING CODE (Dade County Small Missile Test) - Hurricane

I. 16 CFR 1201 □ Safety Standard for Architectural Glazing Materials; Consumer Products Commission; current edition.

J. ANSI Z97.1 □ American National Standard for Safety Glazing Materials Used in Building, Safety Performance Specifications and Methods of Test; 2010.

K. ASTM C 1036-06 □ Standard Specification for Flat Glass

L. ASTM C 1349-04 - Standard Specification for Architectural Flat Glass Polycarbonate

M.NFPA 80 □ Fire Doors and Windows.

N.ICC/BC □ International Building Code.

O.NFPA 252 Standard Methods of Fire Tests of Door Assemblies.

1. Tested in accordance with Underwriters Laboratory Standard for Positive Pressure Fire Tests of Door Assemblies UL9, UL10B and UL10C.

P. State Building Codes, Local Amendments.

#### 1.4 QUALITY ASSURANCE

Q.Manufacturers Qualifications: Provide glazing systems produced by a manufacturer with not less than 5-years successful experience in the fabrication of assemblies of the type and quality required.

R. Installer's Qualifications: Glazed systems shall be installed by a firm that has not less than 5-years successful experience in the installation of systems like those required.

S. Source Limitations for Glass: Obtain all glass products from a single manufacturer.

T. Glass Product Testing: Obtain glass test results for product test reports in  
□Submittals□Article from a qualified independent agency.

## 1.5 SUBMITTALS

U. Submit under provisions of Division 1

V. Product Data: Manufacturers data sheets of each product to be used, including:

1. Preparation instructions and recommendation
2. Storage and handling requirements and recommendations
3. Installation methods.

W. Glazing Schedule:

1. Use same designations indicated on Drawings.
2. Listing types and thicknesses for each size, opening and location.

3. Samples:

- a. Submit one 12□x 12□sample of each glass type specified
- b. Submit one sample of each glazing sealant and/or glazing tape for color review.

4. Warranty: Warranty documents specified herein.

X. Certifications:

1. Certification that all sealants are fully compatible with the surfaces and finishes with which they are in applied.
2. Certification that all products comply with the test methods listed under Paragraph 1.3 Codes and References.

## 1.6 DELIVERY, STORAGE AND HANDLING

- Y. Deliver materials in manufacturer's unopened and undamaged packaging, with manufacturer's labels intact.
- Z. Protect glass and glazing materials from damage in ordinance with manufacturer's recommendations.

## 1.7 WARRANTIES

- AA. Non-Rated Glass Units: Warrant for 10 years from date of Delivery to be free from delamination and failure of seals and not to develop material obstruction of vision, as a result of dust, moisture or film formation on internal glass surfaces.
- BB. Low-E Glass: Warrant for 10 years from date of Delivery to be free of peeling or other deterioration of the Low-E coating.
- CC. Fire Rated Glass: Warrant for 5 years from date of Delivery to be free from delamination and discoloration.
- DD. Glazing Sealants: Warrant for 10 years per sealant manufacturer's standard warranty of merchantable quality. Warranty shall certify that cured sealants:
  - EE. Will perform as a watertight weather-seal.
  - FF. Will not become brittle or crack due to weathering or normal expansion and contraction of adjacent surfaces.
  - GG. Will not harden beyond a Shore A durometer of 50, nor soften below a durometer of 10.
  - HH. Will not change color when used with compatible back-up materials.
- II. Will not bleed.

## PART 2 □ PRODUCTS

### 2.1 MANUFACTURER'S

- A. Acceptable Manufacturer: Armoured One, LLC., Which is located at: 386 North Midler Ave. Syracuse, NY 13206. Tel: 315-720-4186; Email: [info@armouredone.com](mailto:info@armouredone.com); Web: [www.armouredone.com](http://www.armouredone.com).
- B. Substitutions: Not Permitted
- C. Requests for substitutions will be considered in accordance with provisions in Division 1.



## 2.2 MATERIALS

### A. Shooter/Attack Resistant Security Glass, 45-Minute Rated: AOTSG1016FR-45

1. Thickness: 5/8"
2. Tested in accordance with NFPA 80, NFPA 252, UL 9, UL 10B, UL 10C
3. FTD-SA □ Standard for Shooter Attack certification Class 4.
4. GSA-Level 2 □ General Services Administration Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings.
5. ASTM F1642 □ Standard Test Method for Glazing and Glazing Systems Subject to Air blast Loadings.
6. UL972 □ Standard for Burglary Resisting Glazing.
7. EN356 P4 □ European Standard for Testing and Classification of Resistance against manual attack.
8. ASTM E330 □ Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
9. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Consumer Products Safety Commission; current edition.
10. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.

### B. GLAZING MATERIAL

1. General: Comply with manufacturer's recommendations for applications and conditions at time of installation.

2. Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.
3. Setting Blocks: Neoprene, silicone or EPDM, 70-90 durometer hardness, with proven compatibility with glazing materials used.
4. Spacers: Neoprene, silicone or EPDM, 40-50 durometer hardness with proven compatibility with glazing materials used.
5. Compressible Fillers: Closed-cell or waterproof-jacketed rod stock of synthetic rubber or plastic foam, proven to be compatible with sealants used, flexible and resilient, with 5-10 psi compression strength for 25% deflection.

## C. FABRICATION

- JJ. Cut glass to full fit and play, consistent with glass and glazing material manufacturers' recommendations and the requirements of the Drawings and References, Codes and Standards Article.
- KK. Follow code requirements and glass manufacturer's recommendations for minimum bite and edge and face clearances.
1. Cut lights to smooth straight edges, clean, free of nicks and flares; nipping not permitted. Follow glass manufacturer's directions exactly for tinted and Low-E glass
  2. Glass Identification:
    - a. Glazing in fire rated doors and fire rated windows shall bear UL classification marking in accordance with UL 9.
    - b. Manufacturer's and UL identifications for glazing shall be permanently etched to be visible after glass has been set in place and glazed.

## PART 3 -EXECUTION

### 3.1 GENERAL

- LL. Each glazing installation must withstand normal temperature changes, and impact loading without failure of glass, failure of sealants or gaskets, deterioration of glazing materials and other defects in the work.

- MM. Protect glass from damage during handling and installation, and subsequent operation of glazed components of the work. Discard units with edge damage or other imperfections.
- NN. Glazing channel dimensions are intended to provide for necessary bite on glass, minimum edge clearance, and adequate tape or sealant thicknesses, with reasonable tolerances.
- OO. Comply with recommendations by manufacturers of glass and glazing products, except where more stringent requirements are indicated, including those of referenced glazing standards.

### 3.2 PREPARATION

- PP. Clean glazing channel and other framing members to receive glass, immediately before glazing. Remove coatings which are not firmly bonded to substrate.
- QQ. Where sealants are used, apply primer or sealant to joint surfaces where recommended by sealant manufacturer.

### RR. 3.3 INSTALLATION

- SS. Set units of glass in each series with uniformity of pattern, draw, bow and similar characteristics.
- TT. Where sealants are used at butt joints, apply sealant in thin continuous clear bead. Tool sealant to a uniform, continuous, even profile.
- UU. Apply glazing stops and clean up any excess structural sealants from finished surfaces.
- VV. Conform to recommendations of glass manufacturer where such covers points not shown on Drawings or specified herein.
- WW. Remove "loose" stops furnished with the units and reinstall as a part of the glazing operation.
- XX. Handle glass so as to prevent nicks and flares on glass edges.
- YY. Install glass exceeding 1/8" thickness on identical setting blocks permanently mounted and centered at 1/4 points. If necessary to reduce deflection of horizontal supporting member, blocks may be placed at 1/8 points or with the nearest end 6" (whichever is greater) from edge of glass unit. Ensure that blocks are equidistant from centerline of glass. Do not obstruct weep holes.
- ZZ. Provide permanently mounted edge blocks at head and jambs of dry-glazed lights to prevent damage to glass edges during installation and lateral shifting of glass due to

thermal and seismic loads and vibrations. Follow recommendations of Flat Glass Marketing Assn. Glazing Manual.

AAA. Set glass to maintain bite, edge and face clearance stipulated by code and the glass manufacturer.

BBB. Take special precautions to protect laminated glass edges from deterioration of vinyl interlayer by moisture.

CCC. Glaze dry-glazed aluminum doors and frames as per manufacturer's directions using glazing gaskets and seals furnished with the units.

DDD. Miter gaskets at corners and install so as to prevent pulling away at corners. Gaskets with gaps or other visible irregularities on door and window units shall be corrected by manufacturer or fabricator at no additional cost to University.

### 3.4 PROTECTION AND CLEANING

EEE. Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during construction period, including natural causes, accidents and vandalism.

FFF. Wash and polish glass on both faces, not more than 4 days prior to date scheduled for inspections intended to establish Date of Substantial Completion in each area of project. Comply with glass manufacturer's recommendations for final cleaning.

END OF SECTION 088853.2

## **SECTION 088853.3**

### **3/8" 90minute SECURITY GLAZING**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provision of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. Section Includes

- 1. Shooter Attack Certified Security Glazing
- 2. Shooter Attack Certified Fire Rated Security Glazing
- 3. Shooter Attack Certified Insulating Security Glazing

##### **1.3 CODES AND REFERENCES:**

- A. FTD-SA "Filti Testing and Development, Standard for Shooter Attack certification
- B. GSA "General Services Administration Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings.
- C. ASTM F1642 "Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings
- D. UL972 "Standard for Burglary Resistant Glazing
- E. EN356 P4 "Testing Classification of Resistance Against Manual Attack
- F. ASTM E330 "Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- G. 16 CFR 1201 "Safety Standard for Architectural Glazing Materials; Consumer Products Commission; current edition.

- H. ANSI Z97.1 □ American National Standard for Safety Glazing Materials Used in Building, Safety Performance Specifications and Methods of Test; 2010.
- I. ASTM C 1036-06 □ Standard Specification for Flat Glass
- J. NFPA 80 □ Fire Doors and Windows.
- K. ICC/BC □ International Building Code.
- L. NFPA 252 Standard Methods of Fire Tests of Door Assemblies.
  - 1. Tested in accordance with Underwriters Laboratory Standard for Positive Pressure Fire Tests of Door Assemblies UL9, UL10B and UL10C.
- M. State Building Codes, Local Amendments.

#### 1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Provide glazing systems produced by a manufacturer with not less than 5-years successful experience in the fabrication of assemblies of the type and quality required.
- B. Installer's Qualifications: Glazed systems shall be installed by a firm that has not less than 5-years successful experience in the installation of systems like those required.
- C. Source Limitations for Glass: Obtain all glass products from a single manufacturer.
- D. Glass Product Testing: Obtain glass test results for product test reports in □Submittals□Article from a qualified independent agency.

#### 1.5 SUBMITTALS

- A. Submit under provisions of Division 1
- B. Product Data: Manufacturers data sheets of each product to be used, including:
  - 1. Preparation instructions and recommendation
  - 2. Storage and handling requirements and recommendations
  - 3. Installation methods.

C. Glazing Schedule:

1. Use same designations indicated on Drawings.
2. Listing types and thicknesses for each size, opening and location.
3. Samples:
  - a. Submit one 12"x 12" sample of each glass type specified
  - b. Submit one sample of each glazing sealant and/or glazing tape for color review.
4. Warranty: Warranty documents specified herein.

D. Certifications:

1. Certification that all sealants are fully compatible with the surfaces and finishes with which they are in applied.
2. Certification that all products comply with the test methods listed under Paragraph 1.3 Codes and References.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in manufacturer's unopened and undamaged packaging, with manufacturer's labels intact.
- B. Protect glass and glazing materials from damage in ordinance with manufacturer's recommendations.

1.7 WARRANTIES

- A. Non-Rated Glass Units: Warrant for 10 years from date of Delivery to be free from delamination and failure of seals and not to develop material obstruction of vision, as a result of dust, moisture or film formation on internal glass surfaces.
- B. Fire Rated Glass: Warrant for 5 years from date of Delivery to be free from delamination and discoloration.
- C. Glazing Sealants: Warrant for 10 years per sealant manufacturer's standard warranty of merchantable quality. Warranty shall certify that cured sealants:
  1. Will perform as a watertight weather-seal.
  2. Will not become brittle or crack due to weathering or normal expansion and contraction of adjacent surfaces.

3. Will not harden beyond a Shore A durometer of 50, nor soften below a durometer of 10.
4. Will not change color when used with compatible back-up materials.
5. Will not bleed.

## PART 2 □ PRODUCTS

### 2.1 MANUFACTURER'S

- A. Acceptable Manufacturer: Armoured One, LLC., Which is located at: 386 North Midler Ave. Syracuse, NY 13206. Tel: 315-720-4186; Email: [info@armouredone.com](mailto:info@armouredone.com); Web: [www.armouredone.com](http://www.armouredone.com).
- B. Substitutions: Not Permitted
- C. Requests for substitutions will be considered in accordance with provisions in Division 1.

### 2.2 MATERIALS

- A. Shooter/Attack Resistant Security Glass, 90-Minute Rated: AOTSG616FR-90
  1. Thickness: 3/8" □
  2. Tested in accordance with UL 9, UL 10B, UBC 7-2, UBC 7-4, NFPA 252, NFPA 257, ULC CAN4-S106 and ULC CAN4-S106.
  3. FTD-SA □ Standard for Shooter Attack certification Class 5.
  4. GSA-Level 2 □ General Services Administration Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings.
  5. ASTM F1642 □ Standard Test Method for Glazing and Glazing Systems Subject to Air blast Loadings.
  6. UL972 □ Standard for Burglary Resisting Glazing.
  7. EN356 P4 □ European Standard for Testing and Classification of Resistance against manual attack.
  8. ASTM E330 □ Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.



9. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Consumer Products Safety Commission; current edition.
10. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.

#### B. GLAZING MATERIAL

1. General: Comply with manufacturer's recommendations for applications and conditions at time of installation.
2. Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.
3. Setting Blocks: Neoprene, silicone or EPDM, 70-90 durometer hardness, with proven compatibility with glazing materials used.
4. Spacers: Neoprene, silicone or EPDM, 40-50 durometer hardness with proven compatibility with glazing materials used.
5. Compressible Fillers: Closed-cell or waterproof-jacketed rod stock of synthetic rubber or plastic foam, proven to be compatible with sealants used, flexible and resilient, with 5-10 psi compression strength for 25% deflection.

#### C. FABRICATION

1. Cut glass to full fit and play, consistent with glass and glazing material manufacturers' recommendations and the requirements of the Drawings and References, Codes and Standards Article.
2. Follow code requirements and glass manufacturer's recommendations for minimum bite and edge and face clearances.
3. Cut lights to smooth straight edges, clean, free of nicks and flares; nipping not permitted. Follow glass manufacturer's directions exactly for tinted and Low-E glass
4. Glass Identification:
  - a. Glazing in fire rated doors and fire rated windows shall bear UL classification marking in accordance with UL 9.
  - b. Manufacturer's and UL identifications for glazing shall be permanently etched to be visible after glass has been set in place and glazed.

## PART 3 EXECUTION

### 3.1 GENERAL

- A. Each glazing installation must withstand normal temperature changes, and impact loading without failure of glass, failure of sealants or gaskets, deterioration of glazing materials and other defects in the work.
- B. Protect glass from damage during handling and installation, and subsequent operation of glazed components of the work. Discard units with edge damage or other imperfections.
- C. Glazing channel dimensions are intended to provide for necessary bite on glass, minimum edge clearance, and adequate tape or sealant thicknesses, with reasonable tolerances.
- D. Comply with recommendations by manufacturers of glass and glazing products, except where more stringent requirements are indicated, including those of referenced glazing standards.

### 3.2 PREPARATION

- A. Clean glazing channel and other framing members to receive glass, immediately before glazing. Remove coatings which are not firmly bonded to substrate.
- B. Where sealants are used, apply primer or sealant to joint surfaces where recommended by sealant manufacturer.

### 3.3 INSTALLATION

- A. Set units of glass in each series with uniformity of pattern, draw, bow and similar characteristics.
- B. Where sealants are used at butt joints, apply sealant in thin continuous clear bead. Tool sealant to a uniform, continuous, even profile.
- C. Apply glazing stops and clean up any excess structural sealants from finished surfaces.
- D. Conform to recommendations of glass manufacturer where such covers points not shown on Drawings or specified herein.
- E. Remove "loose" stops furnished with the units and reinstall as a part of the glazing operation.
- F. Handle glass so as to prevent nicks and flares on glass edges.
- G. Install glass exceeding 1/8" thickness on identical setting blocks permanently mounted and centered at 1/4 points. If necessary to reduce deflection of horizontal supporting member, blocks may be placed at 1/8 points or with the nearest end 6" (whichever is greater) from edge of glass unit. Ensure that blocks are equidistant from centerline of glass. Do not obstruct weep holes.
- H. Provide permanently mounted edge blocks at head and jambs of dry-glazed lights to prevent damage to glass edges during installation and lateral shifting of glass due to thermal and

seismic loads and vibrations. Follow recommendations of Flat Glass Marketing Assn. Glazing Manual.

- I. Set glass to maintain bite, edge and face clearance stipulated by code and the glass manufacturer.
- J. Take special precautions to protect laminated glass edges from deterioration of vinyl interlayer by moisture.
- K. Glaze dry-glazed aluminum doors and frames as per manufacturer's directions using glazing gaskets and seals furnished with the units.
- L. Miter gaskets at corners and install so as to prevent pulling away at corners. Gaskets with gaps or other visible irregularities on door and window units shall be corrected by manufacturer or fabricator at no additional cost to University.

#### 3.4 PROTECTION AND CLEANING

- A. Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during construction period, including natural causes, accidents and vandalism.
- B. Wash and polish glass on both faces, not more than 4 days prior to date scheduled for inspections intended to establish Date of Substantial Completion in each area of project. Comply with glass manufacturer's recommendations for final cleaning.

END OF SECTION 088853



## **SECTION 089119**

### **FIXED LOUVERS**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section includes fixed extruded-aluminum louvers.

##### **1.2 ACTION SUBMITTALS**

- A. Product Data:
  - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
- C. Samples: For each type of metal finish required.

##### **1.3 INFORMATIONAL SUBMITTALS**

- A. Product Test Reports: Based on tests performed according to AMCA 500-L.
- B. Windborne-debris-impact-resistance test reports.
- C. Sample warranties.

##### **1.4 QUALITY ASSURANCE**

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.3/D1.3M.

##### **1.5 WARRANTY**

- A. Special Finish Warranty: Manufacturer agrees to repair or replace components on which finishes fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
  - 1. Wind Loads: Determine loads based on pressures as indicated on Drawings.
- B. Seismic Performance: As indicated on drawings.
- C. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

### 2.2 FIXED EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal, Wind-Driven-Storm-Resistant Drainable-Blade DADE County Hurricane Louver
  - 1. Construction Specialties Model DCH-5704 or approved equal
  - 2. Louver Depth: as detailed on drawings
  - 3. Frame Thickness 0.075" and Blade Thickness: Not less than 0.060 inch
  - 4. Louver Performance Ratings:
    - a. Free Area: Not less than 7.2 sq. ft.
    - b. Air Performance: Maximum intake core velocity 4.0m/s (763FPM), Maximum intake free area velocity 7.9m/s (1,546 FPM)
    - c. Wind-Driven Rain Performance: Class B Not less than 85 percent effectiveness when subjected to a rainfall rate of 8 inches per hour and a wind speed of 50 mph
  - 5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

### 2.3 LOUVER SCREENS

- A. General: Provide screen at [each exterior louver] [louvers indicated].
  - 1. Screen Location for Fixed Louvers: Interior face.
  - 2. Screening Type: Insect screening.
- B. Louver Screen Frames: Same type and form of metal as indicated for louver to which screens are attached.
  - 1. Insect Screening: Stainless steel, 18-by-18 (1.4-by-1.4-mm) mesh, 0.009-inch (0.23-mm) wire.

## 2.4 MATERIALS

- A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003 or 5005, with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Fasteners: Use types and sizes to suit unit installation conditions.
  - 1. Use tamper-resistant screws for exposed fasteners unless otherwise indicated.
  - 2. For fastening aluminum, use 300 series stainless-steel fasteners.
  - 3. For color-finished louvers, use fasteners with heads that match color of louvers.
- D. Post-installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, fabricated from stainless-steel components, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing according to ASTM E 488/E 488M conducted by a qualified testing agency.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

## 2.5 FABRICATION

- A. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
- B. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

## 2.6 ALUMINUM FINISHES

- A. High-Performance Organic Finish: Three coat fluoropolymer finish complying with AAMA 2605 and containing not less than 50 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 1. Color and Gloss: As selected by Architect from manufacturer's full range

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- D. Protect unpainted galvanized- and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

### 3.2 ADJUSTING

- A. Restore louvers damaged during installation and construction, so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

END OF SECTION 089119



## **SECTION 090561.13**

### **MOISTURE VAPOR EMISSION CONTROL**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section includes fluid-applied, resin-based, membrane-forming systems that control the moisture-vapor-emission rate of high-moisture, interior concrete to prepare it for floor covering installation.

##### **1.2 DEFINITIONS**

- A. MVE: Moisture vapor emission.
- B. MVER: Moisture vapor emission rate.

##### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

##### **1.4 INFORMATIONAL SUBMITTALS**

- A. Product test reports.
- B. Preinstallation testing reports.

##### **1.5 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Employs factory-trained personnel who are available for consultation and Project-site inspection.
- B. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. MVE-Control System Capabilities: Capable of suppressing MVE without failure where installed on concrete that exhibits the following conditions:
  - 1. MVER: Maximum 15 lb of water/1000 sq. ft. (6.80 kg of water/92.9 sq. m) when tested according to ASTM F 1869.
  - 2. Relative Humidity: Maximum 90 percent when tested according to ASTM F 2170 using in situ probes.
- B. Water-Vapor Transmission: Through MVE-control system, maximum 0.02 perm (1.15 ng/Pa x s x sq. m) when tested according to ASTM E 96/E 96M.
- C. Tensile Bond Strength: For MVE-control system, greater than 200 psi (1.38 MPa) with failure in the concrete according to ASTM D 7234.

### 2.2 MVE-CONTROL SYSTEM

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. BASF Corporation.
  - 2. Floor Seal Technology, Inc.
  - 3. MAPEI Corporation.
- B. MVE-Control System: ASTM F 3010-qualified, fluid-applied, two-component, epoxy-resin, membrane-forming system; formulated for application on concrete substrates to reduce MVER to level required for installation of floor coverings indicated and acceptable to manufacturers of floor covering products indicated, including adhesives.
  - 1. Substrate Primer: Provide MVE-control system manufacturer's concrete-substrate primer if required for system indicated by substrate conditions.
  - 2. Cementitious Underlayment Primer: If required for subsequent installation of cementitious underlayment products, provide MVE-control system manufacturer's primer to ensure adhesion of products to MVE-control system.

### 2.3 ACCESSORIES

- A. Patching and Leveling Material: Moisture-, mildew-, and alkali-resistant product recommended in writing by MVE-control system manufacturer and with

minimum of 3000-psi (20.68-MPa) compressive strength after 28 days when tested according to ASTM C 109/C 109M.

- B. Crack-Filling Material: Resin-based material recommended in writing by MVE-control system manufacturer for sealing concrete substrate crack repair.
- C. Cementitious Underlayment: If required to maintain manufacturer's warranty, provide MVE-control system manufacturer's hydraulic cement-based underlayment.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Preinstallation Testing:
  - 1. Testing Agency: Engage a qualified testing agency to perform tests.
  - 2. Alkalinity Testing: Perform pH testing according to ASTM F 710. Install MVE-control system in areas where pH readings are less than 7.0 and in areas where pH readings are greater than 8.5
  - 3. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m) and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
    - a. Anhydrous Calcium Chloride Test: ASTM F 1869. Install MVE-control system in locations where concrete substrate MVER exceeds 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
    - b. Internal Relative Humidity Test: Using in situ probes, ASTM F 2170. Install MVE-control system in locations where concrete substrates exhibit relative humidity level greater than 75 percent.
  - 4. Tensile-Bond-Strength Testing: For typical locations indicated to receive installation of MVE-control system, install minimum 100-sq. ft. (9.29-sq. m) area of MVE-control system to prepared concrete substrate and test according to ASTM D 7234.
    - a. Proceed with installation only where tensile bond strength is greater than 200 psi (1.38 MPa) with failure in the concrete.
- B. Concrete Substrates: Prepare and clean substrates according to MVE-control system manufacturer's written instructions to ensure adhesion of system to concrete.

### 3.2 INSTALLATION

- A. General: Install MVE-control system according to ASTM F 3010 and manufacturer's written instructions to produce a uniform, monolithic surface free of surface deficiencies such as pin holes, fish eyes, and voids.
  - 1. Install primers as required to comply with manufacturer's written instructions.
- B. Do not apply MVE-control system across substrate expansion, isolation, and other moving joints.
- C. Apply system, including component coats if any, in thickness recommended in writing by MVE-control system manufacturer for MVER indicated by preinstallation testing.
- D. After curing, examine MVE-control system for surface deficiencies. Repair surface deficiencies according to manufacturer's written instructions.
- E. Install cementitious underlayment over cured membrane if required to maintain manufacturer's warranty and in thickness required to maintain the warranty.
- F. Protect MVE-control system from damage, wear, dirt, dust, and other contaminants before floor covering installation. Use protective methods and materials, including temporary coverings, recommended in writing by MVE-control system manufacturer.
- G. Do not allow subsequent preinstallation examination and testing for floor covering installation to damage, puncture, or otherwise compromise the MVE-control system membrane.

END OF SECTION 090561.13

## **SECTION 092116.23**

### **GYPSUM BOARD SHAFT WALL ASSEMBLIES**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section includes gypsum board shaft wall assemblies.

##### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each component of gypsum board shaft wall assembly.

#### **PART 2 - PRODUCTS**

##### **2.1 PERFORMANCE REQUIREMENTS**

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

##### **2.2 GYPSUM BOARD SHAFT WALL ASSEMBLIES**

- A. Fire-Resistance Rating: As indicated
- B. Gypsum Shaftliner Board, materials to match location:
  - 1. Moisture- and Mold-Resistant Type X: ASTM C 1396/C 1396M; manufacturer's proprietary fire-resistive liner panels with ASTM D 3273 mold-resistance score of 10 as rated according to ASTM D 3274, 1 inch (25.4 mm) thick, and with double beveled long edges. □ Damp / wet Locations
  - 2. Type X: ASTM C 1396/C 1396M; manufacturer's proprietary fire-resistive liner panels with paper faces, 1 inch (25.4 mm) thick, with double beveled long edges.
- C. on-Load-Bearing Steel Framing, General: Complying with ASTM C 645 requirements for metal unless otherwise indicated and complying with requirements for fire-resistance-rated assembly indicated.

- D. Studs: Manufacturer's standard profile for repetitive, corner, and end members as follows:
  - 1. Depth: As indicated.
  - 2. Minimum Base-Metal Thickness: As indicated.
- E. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but at least 2 inches (51 mm) long and matching studs in depth.
  - 1. Minimum Base-Metal Thickness: Matching steel studs.
- F. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- G. Finish Panels: As indicated.
- H. Sound Attenuation Blankets: As specified in Section 092900 "Gypsum Board."

## 2.3 AUXILIARY MATERIALS

- A. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes as specified in Section 092900 "Gypsum Board" that comply with gypsum board shaft wall assembly manufacturer's written instructions for application indicated.
- B. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
- C. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.
- D. Reinforcing: Galvanized-steel reinforcing strips with 0.033-inch (0.84-mm) minimum thickness of base metal (uncoated).

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General: Install gypsum board shaft wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated and manufacturer's written installation instructions.

- B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.
- C. Sprayed Fire-Resistive Materials: Coordinate with gypsum board shaft wall assemblies so both elements of Work remain complete and undamaged.
- D. Do not bridge building expansion joints with shaft wall assemblies; frame both sides of expansion joints with furring and other support.
- E. Install supplementary framing in gypsum board shaft wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, wall-mounted door stops, and similar items that cannot be supported directly by shaft wall assembly framing.
  - 1. Reinforcing: Provide where items attach directly to shaft wall assembly as indicated on Drawings; accurately position and secure behind at least one layer of face panel.
- F. Penetrations: Install supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons and floor indicators, and similar items.
- G. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels while maintaining continuity of fire-rated construction.
- H. Firestop Tracks: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
- I. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect while maintaining fire-resistance rating of gypsum board shaft wall assemblies.
- J. Gypsum Board Cants: At projections into shaft exceeding 4 inches (102 mm) install gypsum board cants covering tops of projections.
- K. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.
- L. Remove and replace panels that are wet, moisture damaged, or mold damaged.

END OF SECTION 092116.23





## **SECTION 092216**

### **NON-STRUCTURAL METAL FRAMING**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Non-load-bearing steel framing systems for interior partitions.
  - 2. Suspension systems for interior ceilings and soffits.

##### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

##### **1.4 INFORMATIONAL SUBMITTALS**

- A. Product Certificates: For each type of code-compliance certification for studs and tracks.
- B. Evaluation Reports: For embossed, high-strength steel studs and tracks, firestop tracks, post-installed anchors, and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

##### **1.5 QUALITY ASSURANCE**

- A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association or the Steel Stud Manufacturers Association.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.
- C. Horizontal Deflection: For wall assemblies, limited to 1/360 of the wall height based on horizontal loading of 10 lbf/sq. ft. (480 Pa)

### 2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C754 for conditions indicated.
  - 1. Steel Sheet Components: Comply with ASTM C645 requirements for steel unless otherwise indicated.
  - 2. Protective Coating: [ASTM A653/A653M, G40 (Z120) hot-dip galvanized unless otherwise indicated.
- B. Studs and Tracks: ASTM C645. Use either conventional steel studs and tracks or embossed, high-strength steel studs and tracks.
  - 1. Steel Studs and Tracks:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) ClarkDietrich.
      - 2) MarinoWARE.
      - 3) SCAFCO Steel Stud Company.
      - 4) Steel Construction Systems.
    - b. Minimum Base-Steel Thickness: As indicated on Drawings. See "Embossed, High-Strength Steel Studs and Tracks" Article in the Evaluations for information about embossed, high-strength steel studs and tracks.
  - 2. Embossed, High Strength Steel Studs and Tracks: Roll-formed and embossed with surface deformations to stiffen the framing members so that they are structurally comparable to conventional ASTM C645 steel studs and tracks.

- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) MarinoWARE.
    - 2) SCAFCO Steel Stud Company.
    - 3) Steel Construction Systems.
  - b. Minimum Base-Steel Thickness: As indicated on Drawings.
  - c. Depth: As indicated on Drawings.
- C. Slip-Type Head Joints: Where indicated, provide one of the following:
- 1. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) ClarkDietrich.
      - 2) MarinoWARE.
      - 3) SCAFCO Steel Stud Company.
      - 4) Steel Construction Systems.
- D. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ClarkDietrich.
    - b. MarinoWARE.
    - c. SCAFCO Steel Stud Company.
    - d. Steel Construction Systems.
- E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ClarkDietrich.
    - b. MarinoWARE.
    - c. SCAFCO Steel Stud Company.
    - d. Steel Construction Systems.

2. Minimum Base-Steel Thickness: 0.0329 inch (0.836 mm)
- F. Cold-Rolled Channel Bridging: Steel, 0.0538-inch (1.367-mm) minimum base-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ClarkDietrich.
    - b. MarinoWARE.
    - c. SCAFCO Steel Stud Company.
    - d. Steel Construction Systems.
  2. Depth: 1-1/2 inches (38 mm).
  3. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38 by 38 mm), 0.068-inch- (1.72-mm-) thick, galvanized steel.
- G. Hat-Shaped, Rigid Furring Channels: ASTM C645.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ClarkDietrich.
    - b. MarinoWARE.
    - c. SCAFCO Steel Stud Company.
    - d. Steel Construction Systems.
  2. Minimum Base-Steel Thickness: 0.0329 inch (0.836 mm).
  3. Depth: As indicated on Drawings.
- H. Resilient Furring Channels: 1/2-inch- (13-mm-) deep, steel sheet members designed to reduce sound transmission.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ClarkDietrich.
    - b. MarinoWARE.
    - c. SCAFCO Steel Stud Company.
    - d. Steel Construction Systems.
  2. Configuration: hat shaped.

## 2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.
- B. Hanger Attachments to Concrete:
  - 1. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, AC193, AC58 or AC308 as appropriate for the substrate.
    - a. Uses: Securing hangers to structure.
    - b. Type: Torque-controlled, expansion anchor, or torque-controlled, adhesive anchor.
    - c. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941 (ASTM F1941M), Class Fe/Zn 5, unless otherwise indicated.
  - 2. Power-Actuated Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- C. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch (4.12 mm) in diameter.
- D. Flat Hangers: Steel sheet, 1 by 3/16 inch (25 by 5 mm).
- E. Furring Channels (Furring Members):
  - 1. Cold-Rolled Channels: 0.0538-inch (1.367-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges, 3/4 inch (19 mm) deep.
  - 2. Steel Studs and Tracks: ASTM C645.
    - a. Minimum Base-Steel Thickness: 0.0329 inch (0.836 mm).
    - b. Depth: As indicated on Drawings.
  - 3. Embossed, High-Strength Steel Studs and Tracks: ASTM C645.
    - a. Minimum Base-Steel Thickness: As indicated on Drawings
    - b. Depth: As indicated on Drawings.
  - 4. Hat-Shaped, Rigid Furring Channels: ASTM C645, 7/8 inch (22 mm) deep.
    - a. Minimum Base-Steel Thickness: 0.0329 inch (0.836 mm).
  - 5. Resilient Furring Channels: 1/2-inch- (13-mm-) deep members designed to reduce sound transmission.
    - a. Configuration: Asymmetrical or hat shaped.

- F. Grid Suspension System for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Armstrong World Industries, Inc.
    - b. Rockfon (Rockwool International).
    - c. USG Corporation.

## 2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
  - 1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide one of the following:
  - 1. Asphalt-Saturated Organic Felt: ASTM D226/D226M, Type I (No. 15 asphalt felt), nonperforated.
  - 2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

B. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling tracks to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches (610 mm) o.c.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that are required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

### 3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754.

1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C841 that apply to framing installation.
2. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

### 3.4 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Single-Layer Application: 16 inches (406 mm) o.c. unless otherwise indicated.

2. Multilayer Application: 16 inches (406 mm) o.c unless otherwise indicated.
  3. Tile Backing Panels: As required by horizontal deflection performance requirements unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
  2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
    - a. Install two studs at each jamb unless otherwise indicated.
    - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
    - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
  3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
  4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
    - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
  5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
  6. Curved Partitions:
    - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.



- b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches (150 mm) o.c.

E. Direct Furring:

- 1. Screw to wood framing.
- 2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

### 3.5 INSTALLING CEILING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

- 1. Hangers: 48 inches (1219 mm) o.c.
- 2. Carrying Channels (Main Runners): 48 inches (1219 mm) o.c.
- 3. Furring Channels (Furring Members): 16 inches (406 mm) o.c.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

- 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
  - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
- 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

- a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
- 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
- 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
- 5. Do not attach hangers to steel roof deck.
- 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
- 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
- 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Seismic Bracing: Sway-brace suspension systems with hangers used for support
- F. Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

## **SECTION 092900**

### **GYPSUM BOARD**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. Section Includes:

- 1. Interior gypsum board.
- 2. Tile backing panels.

- B. Related Requirements:

- 1. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for metal shaft-wall framing, gypsum shaft liners, and other components of shaft-wall assemblies.
- 2. Section 092216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.
- 3. Section 093013 "Ceramic Tiling" for cementitious backer units installed as substrates for ceramic tile.

##### **1.3 ACTION SUBMITTALS**

- A. Product Data: For the following:

- 1. Gypsum board, Type X.
- 2. Abuse-Resistant Gypsum Board
- 3. Mold-resistant gypsum board.
- 4. Cementitious backer units.
- 5. Interior trim.
- 6. Joint treatment materials.
- 7. Sound-attenuation blankets.
- 8. Acoustical sealant.

- B. Samples: For the following products:

- 1. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.

## 1.4 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

## 1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, and mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

### 2.2 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

### 2.3 INTERIOR GYPSUM BOARD

- A. Gypsum Board, Type X: ASTM C1396/C1396M.
  - 1. Thickness: 5/8 inch (15.9 mm).
  - 2. Long Edges: Tapered.

- B. Abuse-Resistant Gypsum Board: ASTM C1396/C1396M gypsum board, tested according to ASTM C1629/C1629M.
  - 1. Core: 5/8 inch (15.9 mm), Type X.
  - 2. Surface Abrasion: ASTM C1629/C1629M, meets or exceeds Level 2 requirements.
  - 3. Indentation: ASTM C1629/C1629M, meets or exceeds Level 2 requirements.
  - 4. Hard-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 2 requirements.
  - 5. Long Edges: Tapered.
  - 6. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.
  
- C. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.
  - 1. Core: 5/8 inch (15.9 mm), Type X.
  - 2. Long Edges: Tapered.
  - 3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

## 2.4 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 and ASTM C1325, with manufacturer's standard edges.
  - 1. Thickness: As indicated.
  - 2. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

## 2.5 TRIM ACCESSORIES

- A. Interior Trim: ASTM C1047.
  - 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
  - 2. Shapes:
    - a. Cornerbead.
    - b. Bullnose bead.
    - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
    - d. L-Bead: L-shaped; exposed long flange receives joint compound.
    - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    - f. Expansion (control) joint.
    - g. Base-of-Wall Galvanized Moisture Barrier Trim: Galvanized-steel sheet, 2 inches (50 mm) high.

## 2.6 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C475/C475M.
- B. Joint Tape:
  - 1. Interior Gypsum Board: Paper.
  - 2. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
  - 1. Prefilling: At open joints, beveled panel edges, and damaged surface areas, use setting-type taping compound.
  - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
    - a. Use setting-type compound for installing paper-faced metal trim accessories.
  - 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
  - 4. Finish Coat: For third coat, use setting-type, sandable topping compound.
  - 5. Skim Coat: For final coat of Level 5 finish, throughout wall surface, use setting-type, sandable topping compound.
- D. Joint Compound for Tile Backing Panels:
  - 1. Cementitious Backer Units: As recommended by backer unit manufacturer.

## 2.7 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
  - 1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
  - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- C. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- D. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."
- E. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."
- F. Vapor Retarder: As specified in Section 072600 "Vapor Retarders."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

- A. Comply with ASTM C840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
  2. Fit gypsum panels around ducts, pipes, and conduits.
  3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

### 3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
1. Type X: As indicated on Drawings, and where required for fire-resistance-rated assembly.
  2. Ceiling Type: As indicated on Drawings.
  3. Abuse-Resistant Type: As indicated on Drawings.
  4. Mold-Resistant Type: As indicated on Drawings.
- B. Single-Layer Application:
1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
  2. On partitions/walls, apply gypsum panels vertically (parallel to framing) otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.



- a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
  3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
  4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- 3.4 INSTALLATION OF EXTERIOR GYPSUM PANELS FOR CEILINGS AND SOFFITS
- A. Apply panels perpendicular to supports, with end joints staggered and located over supports.
    1. Install with 1/4-inch (6.4-mm) open space where panels abut other construction or structural penetrations.
    2. Fasten with corrosion-resistant screws.
- 3.5 INSTALLATION OF TILE BACKING PANELS
- A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.
  - B. Water-Resistant Backing Board: Install where indicated with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.
  - C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.
- 3.6 INSTALLATION OF TRIM ACCESSORIES
- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
  - B. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect for visual effect.
  - C. Interior Trim: Install in the following locations:
    1. Cornerbead: Use at outside corners
    2. Bullnose Bead: Use at outside corners.
    3. LC-Bead: Use at exposed panel edges
    4. L-Bead: Use where indicated
    5. U-Bead: Use at exposed panel edges
- 3.7 FINISHING GYPSUM BOARD
- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to

prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

- B. Prefill open joints beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:
  - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
  - 2. Level 2: Panels that are substrate for tile.
  - 3. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
    - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
  - 4. Level 5: Where indicated on Drawings.
    - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
- E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

### 3.8 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

## **SECTION 093013**

### **CERAMIC TILING**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Porcelain tile.
  - 2. Stone thresholds.
  - 3. Tile backing panels.
  - 4. Waterproof membrane for thinset applications.
  - 5. Crack isolation membrane.
  - 6. Metal edge strips.
- B. Related Requirements:
  - 1. Section 079200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
  - 2. Section 092900 "Gypsum Board" for cementitious backer units.

##### **1.3 DEFINITIONS**

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."
- C. Face Size: Actual tile size, excluding spacer lugs.
- D. Module Size: Actual tile size plus joint width indicated.

#### 1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Samples for Initial Selection: For tile, grout, and accessories involving color selection.
- D. Samples for Verification:
  - 1. Full-size units of each type and composition of tile and for each color and finish required.
  - 2. Full-size units of each type of trim and accessory for each color and finish required.
  - 3. Stone thresholds in 6-inch (150-mm) lengths.
  - 4. Metal edge strips in 6-inch (150-mm) lengths.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- C. Product Certificates: For each type of product.
- D. Product Test Reports: For tile-setting and -grouting products and certified porcelain tile.

#### 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

## 1.8 QUALITY ASSURANCE

### A. Installer Qualifications:

1. Installer is a Five-Star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors Association of America.

## 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.

## 1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.
  1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.

1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
2. Obtain waterproof membrane and crack isolation membrane, except for sheet products, from manufacturer of setting and grouting materials.

## 2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
  1. Provide tile complying with Standard grade requirements unless otherwise indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

## 2.3 TILE PRODUCTS

- A. Ceramic Tile Type: Glazed porcelain tile.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Olean; a division of Dal-Tile Corporation.
    - b. Daltile.
    - c. Florim USA.
    - d. Milestone
  2. Certification: Tile certified by the Porcelain Tile Certification Agency.
  3. Face Size: Refer to Drawing Finish Schedule
  4. Face Size Variation: Refer to Drawing Finish Schedule
  5. Thickness: Refer to Drawing Finish Schedule
  6. Face: Refer to Drawing Finish Schedule
  7. Shade Variation: Refer to Drawing Finish Schedule
  8. Water Absorption: PEI IV, ASTM C1027
  9. Breaking Strenght: Equal or greater than 400 , ASTM C648
  10. Scratch Hardness: Equal or greater than 7, MOHS
  11. Dynamic Coefficient of Friction: Floor Not less than 0.65, or as noted in Finish Schedule. Wall 0.42
  12. Tile Color, Glaze, and Pattern: Match Architect's sample

13. Grout Color: Match Architect's sample.
14. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable[ and matching characteristics of adjoining flat tile]. Provide shapes as follows, selected from manufacturer's standard shapes. Refer to drawings for additional requirements.
  - a. External Corners: Surface bullnose, module size same as adjoining flat tile.
  - b. Internal Corners: Field-buttet square corners.

## 2.4 THRESHOLDS

- A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
  1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch (1.5 mm) above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch (12.7 mm) or less above adjacent floor surface.
- B. Granite Thresholds: ASTM C615/C615M, with honed finish.
  1. Description: Match Architect's sample.

## 2.5 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 or ASTM C1325, Type A, in maximum lengths available to minimize end-to-end butt joints.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. USG Corporation., Bases of Design
    - b. Custom Building Products.
    - c. Georgia-Pacific Gypsum LLC.
  2. Thickness: As indicated.

## 2.6 WATERPROOF MEMBRANE

- A. General: Manufacturer's standard product, selected from the following that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Custom Building Products.
  - b. Laticrete Supercap, LLc.
  - c. Mapei Corporation.

## 2.7 CRACK ISOLATION MEMBRANE

- A. General: Manufacturer's standard product that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Corrugated Polyethylene: Corrugated polyethylene with dovetail-shaped corrugations and with anchoring webbing on the underside; 3/16-inch (4-mm) nominal thickness.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ARDEX Americas.
    - b. Custom Building Products.
    - c. Schluter Systems L.P.

## 2.8 SETTING MATERIALS

- A. Modified Dry-Set Mortar (Thinset): ANSI A118.4.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Laticrete Supercap, LLc
    - b. Mapei Corporation.
    - c. Siena Products; Omega.
  2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
  3. Provide prepackaged, dry-mortar mix combined with acrylic resin liquid-latex additive at Project site.
  4. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.



## 2.9 GROUT MATERIALS

- A. Water-Cleanable Epoxy Grout: ANSI A118.3, with a VOC content of 65 g/L or less.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. LATICRETE SUPERCAP, LLC.
    - b. MAPEI Corporation.
    - c. Siena Products; Omega.
  - 2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F (60 and 100 deg C), respectively, and certified by manufacturer for intended use.

## 2.10 MISCELLANEOUS MATERIALS

- A. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, metallic designed specifically for flooring applications; stainless steel, ASTM A276/A276M or ASTM A666, 300 Series exposed-edge material.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Schluter Systems L.P. , Bases of Design
    - b. Blanke Corporation.
    - c. Ceramic Tool Company, Inc.
- B. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- C. Floor Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Custom Building Products.
    - b. Southern Grouts & Mortars, Inc.
    - c. Summitville Tiles, Inc.

## 2.11 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.

- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
  - 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
  - 2. Verify that concrete substrates for tile floors installed with mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
    - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
  - 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
  - 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.

- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

### 3.3 INSTALLATION OF CERAMIC TILE

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
  - 1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
    - a. Tile floors in wet areas.
    - b. Tile floors consisting of tiles 8 by 8 inches (200 by 200 mm) or larger.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
- F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
  - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
  - 2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.

3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
- G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
  1. Porcelain Tile: 1/4 inch (6.4 mm)
- H. Lay out tile to dimensions indicated or to next full tile beyond dimensions indicated.
- I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
  1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- J. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
  1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in improved modified dry-set mortar (thinset).
  2. Do not extend cleavage membrane, waterproof membrane or crack isolation membrane under thresholds set in improved modified dry-set mortar. Fill joints between such thresholds and adjoining tile set on cleavage membrane, waterproof membrane or crack isolation membrane with elastomeric sealant.
- K. Metal Edge Strips: Install at locations indicated
- L. Floor Sealer: Apply floor sealer to cementitious grout joints according to floor-sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

### 3.4 INSTALLATION OF TILE BACKING PANEL

- A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use modified dry-set mortar for bonding material unless otherwise directed in manufacturer's written instructions.

### 3.5 INSTALLATION OF WATERPROOF MEMBRANE

- A. Install waterproof membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.
- B. Allow waterproof membrane to cure and verify by testing that it is watertight before installing tile or setting materials over it.

### 3.6 INSTALLATION OF CRACK ISOLATION MEMBRANE

- A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.
- B. Allow crack isolation membrane to cure before installing tile or setting materials over it.

### 3.7 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
  - 1. Remove grout residue from tile as soon as possible.
  - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

### 3.8 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

### 3.9 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

#### A. Interior Floor Installations, Concrete Subfloor:

1. Ceramic Tile Installation TCNA F113; thinset mortar.
  - a. Ceramic Tile Type: Refer to Drawing Finish Schedule
  - b. Thinset Mortar: Improved modified dry-set mortar.
  - c. Grout: Water-cleanable epoxy grout.
2. Ceramic Tile Installation TCNA F125-Full: thinset mortar on crack isolation membrane.
  - a. Ceramic Tile Type: Refer to Drawing Finish Schedule
  - b. Thinset Mortar: Improved modified dry-set mortar.
  - c. Grout: Water-cleanable epoxy grout.

#### B. Interior Floor Installations, Wood Subfloor:

1. Ceramic Tile Installation TCNA F144; thinset mortar on waterproof / isolation membrane.
  - a. Ceramic Tile Type: Refer to Drawing Finish Schedule
  - b. Thinset Mortar: Improved modified dry-set mortar.
  - c. Grout: Water-cleanable epoxy grout.

#### C. Interior Wall Installations, Wood or Metal Studs or Furring:

1. Ceramic Tile Installation: TCNA W244C or TCNA W244F; thinset mortar on cementitious backer units or fiber-cement backer board.
  - a. Ceramic Tile Type: Refer to Drawing Finish Schedule
  - b. Thinset Mortar: Improved modified dry-set mortar.
  - c. Grout: Water-cleanable epoxy grout.

END OF SECTION 093013

## **SECTION 09 51 23**

### **ACOUSTICAL TILE CEILINGS**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

##### **1.2 DESCRIPTION OF WORK**

- A. The work of this section includes, but is not limited to, acoustical ceiling systems including suspension systems as specified and as detailed on the Drawings.
  - 1. Fiberglass ceiling tiles in suspension grid.
  - 2. Metal ceiling tiles in suspension grid.
  - 3. Suspended acoustic cloud shapes

##### **1.3 RELATED WORK**

- A. Examine Contract Documents for requirements that affect Work of this Section. Other Specification Sections that directly relate to Work of this Section include, but are not limited to:
  - 1. Section 09 21 16, Gypsum Drywall; drywall ceilings and soffits.
  - 2. Section 09 81 29, Sprayed Acoustic Insulation; sprayed acoustical ceiling treatment.
  - 3. Division 21 – Fire Suppression, sprinklers located in ceilings.
  - 4. Division 23 - HVAC; grilles, and diffusers located in ceilings.
  - 5. Division 26 - Electrical; light fixtures and alarm system components located in ceilings.

##### **1.4 SUBMITTALS**

- A. Product Data: Submit manufacturer's product data, installation instructions, use limitations and recommendations for each material used. Provide certifications stating that materials comply with requirements.
- B. Verification Samples: Submit representative samples of each material that is to be exposed in the finished work, showing the full range of color and finish variations expected. Provide samples having minimum area of 144 square inches.

- C. Test Reports: Submit certified reports for tests required.

## 1.5 QUALITY ASSURANCE

- A. Source: For each type of material required for the work of this section, provide primary materials which are the products of one manufacturer. Provide secondary materials which are acceptable to the manufacturers of the primary materials.

## 1.6 TESTS

- A. Fire-Resistance: Where fire-resistance ratings are indicated or required by authorities having jurisdiction, provide materials and construction which are identical to assemblies whose fire-resistance rating has been tested in compliance with ASTM E119 by independent agencies acceptable to the Architect and authorities having jurisdiction.
- B. Burning Characteristics: Provide materials whose surface burning characteristics, when tested in compliance with ASTM E84 are Class A or Class 1.

## 1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and products in unopened factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage, moisture and direct sunlight. Sequence deliveries to avoid delays, but minimize on-site storage.

## 1.8 PROJECT CONDITIONS, SEQUENCING AND SCHEDULING

- A. Environment: Perform work only when conditions are within the limits established by manufacturers of the materials and products used.
- B. Conference: Convene a pre-installation conference to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.
  - 1. Proceed with installation of ceiling tiles and panels only when construction above ceilings and penetrating work is complete.
  - 2. Perform work of this section to coordinate with the layout of light fixtures, HVAC equipment and fixtures, fire suppression system components and all other related work. In general, every penetration shall occur at the center of a ceiling tile or panel.

## 1.9 EXTRA MATERIAL

- A. Provide packaged, wrapped and labeled maintenance stock equal to 2% of the actual quantity installed for the following items of work:



1. Each type of ceiling tile and panel.
2. Each type of suspension system component.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
1. Armstrong World Industries, Inc.
  2. USG Interiors, Inc.
  3. Certainteed.

### 2.2 SUSPENDED ACOUSTICAL TILE CEILINGS

- A. Basis of Design: Armstrong Optima 2 x 2 Square Lay-In 1" fiberglass ceiling tiles, White. Equivalent products by the following may also be considered subject to approval of the Architect:
1. Certainteed
  2. USG
- B. Tile properties
1. Fire performance: Class A. ASTM E84 flame spread 25 or less, smoke developed 50 or less.
  2. NRC: 0.95
  3. Light reflectance: 0.90
  4. Humidity and sag resistant.
  5. Washable surface.
  6. Mold/mildew resistant.
  7. Formaldehyde free.
  8. Greenguard Gold Certified for emissions.

### 2.3 SUSPENDED METAL TILE CEILINGS

- A. Basis of Design: Armstrong MetalWorks Tegular 2 x 2 ceiling tiles, White with microperforations and black acoustic backer. Equivalent products by the following may also be considered subject to approval of the Architect:
1. Certainteed
  2. USG
- B. Tile properties
1. Fire performance: Class A. ASTM E1264.
  2. NRC: 0.10
  3. Light reflectance: 0.77

4. Ceiling Attenuation Class: ASTM C 1414, 36.
5. Washable surface.
6. Mold/mildew resistant.
7. Formaldehyde free.

## 2.4 SUSPENSION SYSTEMS

- A. Basis of Design: Armstrong Prelude 15/16" White. Equivalent products by the following may also be considered subject to approval of the Architect:
  1. Cetainteed
  2. USG
- B. Suspension Systems: Provide suspension systems complying with requirements of ASTM C635 for Heavy Duty Systems. Provide suspension system to suit ceiling tiles specified. Provide lay-in suspension systems with 100% accessibility. Locate accessible tiles where required or field directed for access to controls, valves and equipment.
- C. Attachment Devices: Provide and size for 5 times design load indicated in ASTM C635, Table 1, direct hung.
- D. Moldings and Trim: Provide perimeter edge trim and fascia trim profiles as shown on Drawings to suit edge conditions, panel profile and penetrations. Provide custom fabricated work as necessary to provide exact fit.
- E. Basis of Design for Fascia Trim: Armstrong Axiom Classic, Blizzard White. Equivalent products by the following may also be considered subject to approval of the Architect:
  1. Cetainteed Terminus
  2. USG 8" Edge Trim

## 2.5 ACOUSTIC CLOUD FIXTURES

- A. Basis of Design: Armstrong Soundscapes Shapes. Equivalent products by the following may also be considered subject to approval of the Architect:
  1. Hunter Douglas
  2. USG Ceiling
- B. Systems Type: Smooth surface perforated metal panel cloud shapes. Size as indicated on Drawings. Caps at ends. Provide manufacturers standard heavy duty suspension system, concealed attachment clips and alignment hardware. Colors as selected by Architect.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. The Installer shall examine substrates, supports, and conditions under which this work is to be performed and notify Contractor, in writing, of conditions detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected. Beginning work means Installer accepts substrates and conditions.

### 3.2 PREPARATION & INSTALLATION

- A. General Requirement: Strictly comply with manufacturer's instructions and recommendations, except where more restrictive requirements are specified in this section.
- B. Coordination: Coordinate installation with other work to ensure proper location of related work such as light fixtures, mechanical fixtures, fire protection systems and the like.
- C. Layout: Measure each area and layout ceilings to balance panel widths on opposites edges of each ceiling in both directions unless otherwise noted. Avoid use of less than 1/2 width ceiling units wherever possible.
- D. Suspension Installation: Erect suspension system supported only from building structure. Level main suspension members to within tolerance of 1/8" in 12'. Splay hangers where necessary and countersplay to balance resulting horizontal forces. Cross brace suspension to prevent lateral sway and displacement during full seismic load prescribed by code.
- E. Edge Moldings and Trim: Provide edge moldings at entire perimeter of ceiling, at columns, and wherever necessary to conceal edges of acoustical units. Miter corners of edge moldings accurately and connect securely.
  - 1. Do not use exposed fasteners nor pop rivets.
  - 2. Sealing: Provide a continuous bead of exposed acoustical sealant, specified in Section 07 92 00 - Joint Sealants, between edge moldings and walls.
- F. Ceiling Panel Installation: Use clean white gloves when handling ceiling materials. Install ceiling panels in coordination with suspension system. Scribe and cut panels to fit accurately.
  - 1. Orientation: Lay panels with grain [if any] running in one direction throughout the project.
  - 2. Square Edge: Field cut and paint edges of tiles cut in field to produce painted edge at all tile.

### 3.3 ADJUSTING, TOUCH-UP, CLEANING

- A. Adjust panels so that ceilings are in one plane and look uniform with no individual panels too high or too low.
- B. Touch-up damaged suspension system coatings and finishes and repair minor damage to eliminate all evidence of repair. Remove and replace work which cannot be satisfactorily repaired.
- C. Clean exposed surfaces using materials and methods recommended by manufacturer of material or product being cleaned. Remove and replace work that cannot be successfully cleaned.

END OF SECTION

## **SECTION 09 65 00**

### **RESILIENT FLOORING**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

##### **1.2 DESCRIPTION OF WORK**

- A. The work of this section includes, but is not limited to, the following:

- 1. LVT tile and plank flooring.
- 2. Resilient sheet flooring
- 3. Rubber wall base.
- 4. Resilient reducer strips and trim pieces.
- 5. Subfloor preparation.

##### **1.3 RELATED WORK**

- A. Examine Contract Documents for requirements that affect Work of this Section. Other Specification Sections that directly relate to Work of this Section include, but are not limited to:

- 1. Section 03 30 00, Cast-In-Place Concrete.
- 2. Section 03 54 00, Self Leveling Underlayment

##### **1.4 SUBMITTALS**

- A. Product Data: Submit manufacturer's product data, installation instructions, use limitations and recommendations for each material and product used. Provide certifications stating that materials comply with requirements and applicable fire ratings.
- B. Verification Samples: Submit representative samples of each material that is to be exposed in the finished work, showing the full range of color and finish variations expected. Provide flooring samples having minimum area of 144 square inches. Provide 6 inch lengths of base and trim pieces.

##### **1.5 QUALITY ASSURANCE**

- A. Source: For each type of flooring product required for the work of this section, provide primary materials and products which are the products of one manufacturer. Provide secondary materials such as adhesives which are

acceptable to the manufacturers of the primary materials.

- B. Installer Qualifications: Acceptable to manufacturer of resilient flooring for the requirements of the project.
- C. Sustainable Design Requirements:
  - 1. ISO 14001 Environmental Management Systems certification.
  - 2. Construction waste take back program for the purpose of reducing jobsite waste by taking back uninstalled waste flooring.
  - 3. Flooring surfaces that are easily cleaned and do not require coatings and stripping, or use chemicals that may be hazardous to human health.
  - 4. Flooring that is free of materials known to be teratogenic, mutagenic or carcinogenic.
  - 5. Flooring that contains no polyvinyl chloride or plasticizers.
  - 6. Flooring that contains no halogens.
  - 7. Flooring that contains no asbestos.

#### 1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and products in unopened factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage.
- B. Sequence deliveries to avoid delays, but minimize on-site storage.

#### 1.7 PROJECT CONDITIONS, SEQUENCING AND SCHEDULING

- A. Conference: Convene a pre-installation conference to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.
- B. Environment: Perform work only when temperature and humidity conditions are within the limits established by manufacturers of the materials and products used. Provide continuous exhaust through vent windows during cement/adhesive application.
- C. Substrates: Proceed with work only when substrate construction and penetrating work is complete. To the greatest extent possible, perform work of this section after other finishing operations such as painting have been completed.
- D. Subfloors: Ensure that concrete subfloors are properly cured and sufficiently dry by making bond and moisture tests as recommended by flooring manufacturer. Coordinate work of this section with work of Section 03 30 00, Cast-In-Place Concrete, to ensure that concrete curing compounds used do not interfere with adhesion of resilient flooring.
  - 1. Concrete Substrates: Prepare according to ASTM F 710-08.
    - a. Verify that substrates are dry and free of curing compounds, sealers,

- and hardeners.
- b. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
  - c. Moisture Testing:
    - 1) Perform anhydrous calcium chloride test, ASTM F 1869-04. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    - 2) Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
  - d. Adhesion Bond Test: After substrate has been properly prepared perform adhesion bond test as recommended by the manufacturer.

## PART 2 - PRODUCTS

### 2.1 LUXURY VINYL TILE (LVT) FLOORING

- A. Refer to the Finish Schedule on Drawings for type, colors, patterns and locations.
- C. Heavy Commercial Luxury Vinyl Tile, ASTM F1700, Class III, Type B.
  - 1. Flammability: NFPA 253 Class 1
  - 2. Smoke Density: NFPA 258 <450
  - 3. Slip Resistance: ASTM D 2047 >0.5
- D. Edging: 1 in. wide, length as required, tapered, maximum thickness same as flooring, solid vinyl, as selected from manufacturer's standard plain colors, as produced by manufacturer of floor tile used, or other manufacturer whose products meet all the Architect's requirements and are approved by him for use on the Project.
- E. Polyurethane based adhesive as recommended by manufacturer.

### 2.2 RESILIENT SHEET FLOORING

- A. Refer to the Finish Schedule on Drawings for type, colors, patterns and locations.
- B. Heavy Commercial Vinyl Sheet Flooring, ASTM F1303. Heterogeneous PVC with glass fiber reinforcement scrim between the film print and backing. Blown PVC with black fleece backing. Shaw Luxury Vinyl or approved equal.
  - 1. Flammability: NFPA 253 Class 1
  - 2. Smoke Density: NFPA 258 <450
  - 3. Slip Resistance: ASTM D 2047 >0.6
  - 4. Total thickness: 0.11" (2.85 mm)
  - 5. Installation method: Glue-Down
  - 6. Pattern: Wood look print

## 2.3 WALL BASE

- A. Rubber Wall Base: Provide rubber wall base by Nora or approved equal by Armstrong, Forbo or Tarkett conforming to ASTM F 1861, Type TP, and as follows:
  - 1. Height: 4 in. typical.
  - 2. Thickness: 1/8 in. gage.
  - 3. Style: Top-set cove at resilient flooring Style B (Cove). Provide formed corners.
  - 4. Finish: Matte.
  - 5. Roll Lengths: 100 ft. rolls, continuous runs with no pieces less than 10 ft. in any run over 100 ft.
  - 6. Adhesive: Polyurethane based adhesive as recommended by manufacturer.
  - 7. Colors: As indicated on Finish Schedule.

## 2.4 UNDERLAYMENT

- A. Polyurethane Sound Absorbing Underlayment: Provide Shaw Ground Works underlayment or approved equal. 100% polyurethane foam manufactured with post-consumer granulated rubber tires.
  - 1. Moisture Retarder film
  - 2. Smooths out minor subfloor irregularities up to 1/32"
  - 3. Nominal 2 mm thickness

# PART 3 - EXECUTION

## 3.1 INSPECTION

- A. The Installer shall examine substrates and conditions under which this work is to be performed and notify Contractor, in writing, of conditions detrimental to the proper completion of the work. Beginning work means Installer accepts substrates and conditions.

## 3.2 PREPARATION

- A. Manufacturer's Recommendations: Strictly comply with manufacturer's instructions and recommendations, except where more restrictive requirements are specified in this section.
- B. Clean: Vacuum clean subfloors immediately before installation.
- C. Level: Check subfloor/underlayment tolerances and fill holes, depressions and cracks with leveling compound. Do not scrape, grind, or sand down existing tiles containing asbestos.
- D. Slab Moisture Testing: Comply with manufacturer's recommendations. Verify



slab moisture content is within acceptable levels by one of the following:

1. ASTM F2170, Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
2. (RFCI) Resilient Floor Covering Institute, Standard Slab Moisture Test Method (Calcium Chloride Method)

E. Bond Test: Perform bond and moisture tests on concrete subfloors to determine if surfaces are sufficiently cured and dry to receive flooring within the limits specified by flooring manufacturer.

1. Randomly adhere 3 ft. x 3 ft. panels of specified flooring materials spaced about 50 ft. apart throughout areas to receive resilient flooring. Install test panels with adhesives to be used in the actual installation.
2. If panels are securely bonded after 72 hours, installation work may proceed.
3. If panels are not securely bonded, reclean substrates and repeat test until adequate bond is achieved.

E. Primers: Apply primer prior to application of adhesive if recommended by manufacturer for porous or powdery subfloors.

### 3.3 INSTALLATION

A. Manufacturer's Recommendations: Strictly comply with manufacturer's instructions and recommendations, except where more restrictive requirements are specified in this section.

B. Color Control: Maintain uniformity of color and pattern; use flooring from same manufactured lots.

C. Extent: Extend work into closets, toe spaces and similar areas. Provide flooring on covers and other items within floor areas. Cut flooring neatly around fixtures and obstructions. Terminate flooring at the centerline of doors when adjacent finish is dissimilar to avoid seeing dissimilar material when door is closed.

D. Edges: Provide securely bonded resilient edge strips where indicated and wherever edge of floor would otherwise be exposed.

E. Lay flooring from room centerlines with grain in same direction. Adhere with full coverage of adhesive observing the manufacturer's recommended trowel notching spreading rates and open times. Roll floor with 150 pound roller to ensure good contact and bond.

### 3.4 RESILIENT BASE

A. Base: Adhere base to walls, columns, casework, and all other permanent surfaces and fixtures. Install base in rolls to minimize seams. Tightly bond base to walls without any gaps between wall and base and with 100% coverage

of adhesive. Hand roll base to ensure full contact and adhesion. Field form sharp external corners and keep seams and joints as far from external corners as possible. Cut and cope base at internal corners; do not round internal corner with base.

1. Fill top edge of base with sealant where base runs along an irregular wall surface such as masonry. Sealant color shall closely match base color.

### 3.5 CLEANING AND PROTECTION

- A. Repair minor damage to eliminate all evidence of repair. Clean exposed surfaces using materials and methods recommended by manufacturer of material or product being cleaned. Remove excess adhesives immediately. Remove and replace work that cannot be successfully repaired or cleaned.
- B. Prohibit traffic over newly installed flooring for at least 48 hours. Provide temporary protection to ensure work being without damage or deterioration at time of final acceptance. Remove protections and reclean as necessary immediately before final acceptance.
- C. Polish and buff floors and base in strict compliance with manufacturer's instructions and recommendations immediately before final acceptance.

END OF SECTION

**SECTION 096513**  
**RESILIENT BASE AND ACCESSORIES**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Vinyl base.
  - 2. Vinyl molding accessories.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches (300 mm) long.
- C. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

**1.4 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Furnish not less than 10 linear feet (3 linear m) for every or fraction thereof, of each type, color, pattern, and size of resilient product installed.

**1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended

by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

## 1.6 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C) in spaces to receive resilient products during the following periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C)
- C. Install resilient products after other finishing operations, including painting, have been completed.

## PART 2 - PRODUCTS

### 2.1 VINYL BASE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Armstrong World Industries, Inc.
  - 2. Johnsonite; a Tarkett company.
  - 3. Roppe Corporation, USA.
- B. Product Standard: ASTM F1861, Type TV (vinyl, thermoplastic).
  - 1. Group: I (solid, homogeneous)
  - 2. Style and Location:
    - a. Style B, Cove: Provide in areas with resilient floor coverings
- C. Minimum Thickness: 0.125 inch (3.2 mm)
- D. Height: As indicated on Drawings.
- E. Lengths: Coils in manufacturer's standard length
- F. Outside Corners: Preformed
- G. Inside Corners: Preformed

- H. Colors and Patterns: Match Architect's sample

## 2.2 VINYL MOLDING ACCESSORY

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Armstrong World Industries, Inc.
  - 2. Johnsonite; a Tarkett company.
  - 3. Roppe Corporation, USA.
- B. Description: Vinyl cap for cove resilient floor covering, nosing for resilient floor covering, reducer strip for resilient floor covering, transition strips.
- C. Profile and Dimensions: As indicated
- D. Locations: Provide vinyl molding accessories in areas indicated
- E. Colors and Patterns: Match Architect's sample or on finish schedule

## 2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
  - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F710.
  1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
  3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
  4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m) and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
    - a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
    - b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient products until materials are the same temperature as space where they are to be installed.
  1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

### 3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.
- H. Job-Formed Corners: NOT ALLOWED

### 3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

### 3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
  - 1. Remove adhesive and other blemishes from surfaces.
  - 2. Sweep and vacuum horizontal surfaces thoroughly.
  - 3. Damp-mop horizontal surfaces to remove marks and soil.

- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513



**SECTION 096519**  
**RESILIENT TILE FLOORING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Luxury vinyl tile (LVT).

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Samples: Full-size units of each color, texture, and pattern of floor tile required.
- C. Product Schedule: For floor tile. Use same designations indicated on Drawings.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For Installer.

**1.5 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

**1.6 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.
  - 1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces.

## 1.9 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C) in spaces to receive floor tile during the following periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C)
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

## 2.2 LUXURY VINYL TILE (LVT)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Shaw Contract Group; Berkshire Hathaway company BASIS OF DESIGN
  2. Armstrong World Industries, Inc.
  3. Congoleum Corporation.
  4. Mannington Mills, Inc.
- B. Tile Standard: ASTM F1700,
- C. Style: Solitude 0648V
- D. Color: Fawn 48516
- E. Wearing Surface: Embossed.
- F. Thickness: Refer to Finish Schedule
- G. Size: 6"x48" (15cm x 122cm) Refer to Finish Schedule
- H. Colors and Patterns: Refer to Finish Schedule

## 2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
- C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F710.
1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
  3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
  4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m) and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
    - a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
    - b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- C. Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.
- D. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- E. Do not install floor tiles until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
- F. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

### 3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
1. Lay tiles square with room axis
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
1. Lay tiles with grain running in one direction.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- H. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

### 3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
  - 1. Remove adhesive and other blemishes from surfaces.
  - 2. Sweep and vacuum surfaces thoroughly.
  - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile from marks, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.
  - 1. Apply three coat(s).
- E. Cover floor tile until Substantial Completion.

END OF SECTION 096519

## **SECTION 09 77 00**

### **MAGNETIC WALL COVERINGS**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

##### **1.2 DESCRIPTION OF WORK**

- A. The work of this section includes, but is not limited to magnetic dry erase fabric wall coverings and preparation of surfaces.

##### **1.3 RELATED WORK**

- A. Carefully examine all of the Contract Documents for requirements which affect the work of this section. Other specifications sections which directly relate to the work of this section include, but are not limited to, the following:
  - 1. Section 09 21 16, GYPSUM BOARD ASSEMBLIES.
  - 2. Section 09 91 00, PAINTING.

##### **1.4 QUALITY ASSURANCE**

- A. Installer: A firm which has at least five years experience in work of the type required by this section.
- B. Source: For each type of wall covering required for the work of this section, provide products which are the products of one manufacturer. Provide secondary materials, such as primers and adhesives, which are acceptable to the wall covering manufacturers.
- C. Mock-ups: Before beginning work of this section, provide mock-ups at locations acceptable to Architect and obtain Architect's acceptance of visual qualities. Protect and maintain acceptable mock-ups throughout the work of this section to serve as criteria for acceptance of this work.

##### **1.5 TESTS**

- A. Burning Characteristics: Provide materials whose surface burning characteristics, when tested in compliance with ASTM E84 are Class A.

## 1.6 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, installation and maintenance instructions, use limitations and recommendations for each material used. Provide certifications stating that materials comply with requirements.
- B. Initial Selection Samples: Submit samples showing complete range of colors, textures, and finishes available for each wall covering material used.
- C. Verification Samples: Submit representative samples of each wall covering material that is to be exposed in the finished work, showing the full range of color and finish variations expected. Provide samples having minimum area of 144 square inches.
- D. Test Reports: Submit certified reports for tests required.

## 1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and products in unopened factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage.
- B. Sequence deliveries to avoid delays, but minimize on-site storage.

## 1.8 PROJECT CONDITIONS

- A. Environment: Perform work only when temperature and humidity conditions are within the limits established by manufacturers of the materials and products used.
- B. Substrates: Proceed with work only when substrate construction and penetrating work is complete.
- C. Ventilation: Comply with wall covering and adhesive manufacturers' requirements and recommendations.
- D. Lighting: Since lighting conditions can change the appearance of the work, install work only when permanent lighting system is operational and in use.

## 1.9 COORDINATION

- A. Conference: Convene a pre-installation conference to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.



## PART 2 - PRODUCTS

### 2.1 WALL COVERING

- A. Wall Covering Types: Provide the magnetic dry erase fabric wallcovering by one of the following meeting the requirements of this section and as indicated in Finish Schedule:
  - 1. Visual Magnetics Dry Erase magnetic Wallcovering.
  - 2. Walltalkers Mag Rite 48 writeable, projectable magnetic surface
  - 3. Idea Paint Mag Wallcovering

### 2.2 MATERIALS

- A. Magnetic Dry Erase Fabric Wall Covering:
  - 1. Wall covering shall consist of mildew-resistant fabric coated thin magnet liner below the wall covering's surface and micro-iron coating on the backside. Face shall have a dry erase coverings with a non-ghosting surface.
  - 2. Wall covering shall conform to Class A flame resistance requirements.
- B. Magnetic Fabric Wall Covering - Custom Mural:
  - 1. Wall covering shall consist of mildew-resistant fabric coated thin magnet liner below the wall covering's surface and micro-iron coating on the backside. Face fabric shall have a custom printed mural with stain/graffiti resistant surface.
  - 2. Wall covering shall conform to Class A flame resistance requirements.
- C. Adhesive, primer, sealer, and related items shall be as recommended by wall covering manufacturer, each manufactured expressly for use with the selected wall covering. Materials shall be mildew-resistant and non-staining to the wall covering.

### 2.3 FIRE HAZARD CLASSIFICATION

- A. Provide materials bearing the U.L. label and marking, indicating the fire hazard classification of the wall covering, as determined by ASTM E 84, Tunnel Test.
- B. Materials shall comply with Underwriters' Laboratories Class A, Fire Hazard Classification (Flame Spread 25 max., Fuel Contributed 25 max., and Smoke Developed 25 max.).

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. The Installer shall examine substrates, supports, and conditions under which this work is to be performed and notify Contractor, in writing, of conditions detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected. Beginning work means Installer accepts substrates and conditions.

### 3.2 PREPARATION

- A. Strictly comply with manufacturer's instructions and recommendations, except where more restrictive requirements are specified in this section.
- B. Acclimatize materials by storing unwrapped in rooms to be covered at least 24 hours before installation.
- C. Remove wallplates, fixtures, hardware and similar items and replace when work is completed.
- D. Prime and seal substrates in accordance with wall covering manufacturer's recommendations. Provide release coat on all virgin drywall surfaces.
- E. Test substrates with moisture meters to verify that surfaces do not exceed 4% moisture content or other limit prescribed by wall covering manufacturer.

### 3.3 INSTALLATION

- A. Strictly comply with manufacturer's instructions and recommendations, except where more restrictive requirements are specified in this section.
- B. Provide full coverage of adhesive on back of wall coverings. Install vertically and truly plumb with seams located more than 6" from corners. Overlap and double cut seams to form tightly matched closures. Roll and brush to remove air bubbles. Trim neatly at penetrations and terminations. Horizontal seams are not permitted.
- C. Remove excess adhesive before it dries by following manufacturer's instructions and recommendations.

### 3.4 TOLERANCES

- A. Wall covering seams shall be invisible after completion. Free edges of wall coverings and locations where wall coverings abut dissimilar materials shall be neatly trimmed, straight and tight against the dissimilar material or corner.

### 3.5 CLEANING, REPAIR AND PROTECTION

- A. Repair minor damage to eliminate all evidence of repair. Clean exposed surfaces using materials and methods recommended by manufacturer of material or product being cleaned. Remove and replace work that cannot be

successfully cleaned or repaired.

- B. Provide temporary protection to ensure work being without damage or deterioration at time of final acceptance. Remove protections and reclean as necessary immediately before final acceptance.

END OF SECTION



**SECTION 09 81 29**  
**SPRAY APPLIED ACOUSTICAL INSULATION**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. This Section includes spray applied acoustic treatment at ceilings.
- B. Related Sections include the following:
  - 1. Divisions 21, 23, and 26 Sections for light fixtures, sprinklers, and air-distribution components.

**1.3 DEFINITIONS**

- A. LR: Light Reflectance coefficient.
- B. NRC: Noise Reduction Coefficient.

**1.4 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:
  - 1. Joint pattern.
  - 2. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, and access panels.
  - 3. Ceiling perimeter and penetrations through ceiling; trim and moldings.
- C. Samples for Initial Selection: For components with factory-applied color and other decorative finishes.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each wood specialty ceiling.
- E. Research/Evaluation Reports: For ceiling and components and anchor type.
- F. Maintenance Data: For finishes to include in maintenance manuals.

**1.5 QUALITY ASSURANCE**

- A. Manufacturer must have a current Underwriters Laboratories (UL) Code Evaluation Report.
- B. Manufacturer must be in compliance with the 2015 International Building Code.
- C. Manufacturer must be ISO 9001:2015 Certified.
- D. Applicator: Licensed by manufacturer.
- E. Manufacturer must subscribe to independent laboratory follow-up inspection services of Underwriters Laboratories and Factory Mutual. Each bag shall be labeled accordingly.
- F. Mock-up: Apply a 100 square foot representative sample to be reviewed by the Architect and Owner prior to proceeding.
- G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials, system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

#### 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install spray applied acoustical insulation until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

#### 1.8 COORDINATION

- A. Coordinate layout and installation with other construction including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

### PART 2 - PRODUCTS

#### 2.1 SPRAYED ACOUSTICAL TREATMENT AT CEILINGS

- A. International Cellulose Corporation, K-13 Spray-On-Systems or approved equal.
  - 1. Bond strength to be greater than 100 psf per ASTM E 736.
  - 2. Product will be Class 1 Class A per ASTM E 84/ UL 723.
  - 3. Non-corrosive per ASTM C 739.

4. Bond Deflection per ASTM E 759: 6" Deflection in 10' Span – No Spalling or Delamination.
5. R-Value to be 3.75 per inch per ASTM C 518.
6. Comply with 2015 IBC stability requirements for interior finishes.
7. Meet ASTM C 1149
8. Minimum Fiber Recycled Content to be 75%.
9. Shall not contain any added Urea-Formaldehyde Resins.
10. Material to have been tested in accordance with ASTM E 1042. Testing laboratory must be NVLAP accredited.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing and substrates to which specialty ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of specialty ceilings.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Provide masking, drop cloths or other satisfactory coverings for materials/surfaces that are not to receive insulation to protect from over-spray.
- B. Coordinate installation of the sprayed cellulose fiber with work of other trades.
- C. Prime surfaces as required by manufacturer's instructions or as determined by examination..

#### 3.3 INSTALLATION

- A. General: Install specialty ceilings to comply with manufacturer's recommendations.
- B. Cure insulation with continuous natural or mechanical ventilation.
- C. Remove and dispose of over-spray.

END OF SECTION 09 81 29





**SECTION 099113**  
**EXTERIOR PAINTING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section includes surface preparation and the application of paint systems on the following exterior substrates:
  - 1. Concrete masonry units (CMU).
  - 2. Steel.
  - 3. Galvanized metal.
  - 4. Wood.
- B. Related Requirements:
  - 1. Section 051200 "Structural Steel Framing" for shop priming of metal substrates with primers specified in this Section.
  - 2. Section 099123 "Interior Painting" for surface preparation and the application of paint systems on interior substrates.
  - 3. Section 099300 "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on exterior wood substrates.

**1.3 DEFINITIONS**    □ Refer to Drawing Finish Schedule for Gloss Level Requirements

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

- E. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
  - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
  - 2. Step coats on Samples to show each coat required for system.
  - 3. Label each coat of each Sample.
  - 4. Label each Sample for location and application area.
- D. Product List: For each product indicated, include the following:
  - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
  - 2. Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
  - 3. VOC content.

#### 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Paint: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
  - 1. Maintain containers in clean condition, free of foreign materials and residue.
  - 2. Remove rags and waste from storage areas daily.

## 1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following
  1. Benjamin Moore & Co. - Basis of Design Product
  2. PPG Architectural Finishes, Inc.
  3. Sherwin-Williams Company (The).
  4. Corotech

### 2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. Material Compatibility:
  1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.
- D. Colors: As indicated in finish schedule

### 2.3 BLOCK FILLERS

1. Block Filler, Latex, Interior/Exterior Factory-formulated high-performance latex block fillers (50 g/L:

- a. Benjamin Moore; Super Spec Masonry Hi-Build Block Filler 206:  
Applied at a dry film thickness of not less than 8.5 mils.

## 2.4 METAL PRIMERS

- 1. Primer, Alkali Resistant, Water Based Exterior Galvanized Metal Primer:  
Factory-formulated galvanized metal primer for exterior application.
  - a. Benjamin Moore; Super Spec HP Acrylic Metal Primer No. P04:  
Applied at a dry film thickness of not less than 2.0 mils Primer,  
Bonding, Water Based:

## 2.5 WATER-BASED PAINTS

- 1. Acrylic Enamel, Exterior Semi-Gloss (Gloss Level 5: Factory-formulated water-borne acrylic-latex enamel for exterior metal application.
  - a. Benjamin Moore; Super Spec HP DTM Acrylic Gloss Enamel, P28:  
Applied at a dry film thickness of not less than 1.7 to 2.3 mils.

## 2.6 EPOXY COATINGS

- 1. Epoxy Low Luster Coating for Masonry and Gypsum Board Surfaces (100 g/L). a. Corotech; V342 Pre-Catalyzed Waterborne Epoxy EXTERIOR, applied at a dry film thickness of not less than 1.5 mils.

## 2.7 EXTERIOR PAINT

- 1. Zinc-Coated Metal: Provide the following finish systems over exterior zinc-coated metal surfaces:
  - a. Full-Gloss Acrylic-Enamel Finish: Two finish coats over galvanized metal.
- 2. Ferrous and Zinc-Coated Metal: Provide the following finish systems over ferrous metal: a. Semi-Gloss Acrylic-Enamel Finish: Two finish coats.

## 2.8 WOOD PRIMER & TOP COATS

- A. Alkyd for Exterior Wood

## 2.9 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
  1. Concrete: 12 percent.
  2. Masonry (Clay and CMU): 12 percent.
  3. Wood: 15 percent.
  4. Portland Cement Plaster: 12 percent.
  5. Gypsum Board: 12 percent.
- C. Portland Cement Plaster Substrates: Verify that plaster is fully cured.
- D. Exterior Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- E. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- F. Proceed with coating application only after unsatisfactory conditions have been corrected.
  1. Application of coating indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
  - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.
  - 1. SSPC-SP 2, "Hand Tool Cleaning."
  - 2. SSPC-SP 3, "Power Tool Cleaning."
  - 3. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Aluminum Substrates: Remove loose surface oxidation.
- J. Wood Substrates:

1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

### 3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."
  1. Use applicators and techniques suited for paint and substrate indicated.
  2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
  3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
  4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. Tint undercoats one and two same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
  1. Paint the following work where exposed to view:
    - a. Equipment, including panelboards
    - b. Uninsulated metal piping.
    - c. Uninsulated plastic piping.
    - d. Pipe hangers and supports.
    - e. Metal conduit.
    - f. Plastic conduit.
    - g. Tanks that do not have factory-applied final finishes.

### 3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
  - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
  - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

### 3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION 099113



## **SECTION 099123**

### **INTERIOR PAINTING**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. Section includes surface preparation and the application of paint systems on interior substrates.
  - 1. Concrete masonry units (CMUs).
  - 2. Steel and iron.
  - 3. Wood.
  - 4. Gypsum board.

##### **1.3 DEFINITIONS**

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D523. (Traditional Matte Finish - Flat)
- B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523. (Traditional Velvet-like Finish)
- C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523. (Traditional Eggshell Finish)
- D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523. (Traditional Satin Finish)
- E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523. (Traditional Semi-Gloss Finish)
- F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523. (Traditional Gloss Finish)
- G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523. (Traditional High Gloss Finish)

- H. VOC: Concentration solution unit between gram/liter and percentage, (g/L).

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
  - 1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
  - 2. Indicate VOC content.
- B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
  - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
  - 2. Apply coats on Samples in steps to show each coat required for system.
  - 3. Label each coat of each Sample.
  - 4. Label each Sample for location and application area.
- C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

#### 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Paint: 1 gal. (3.8 L) of each material and color applied.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
  - 1. Maintain containers in clean condition, free of foreign materials and residue.
  - 2. Remove rags and waste from storage areas daily.

#### 1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Benjamin Moore & Co. - BASIS OF DESIGN
  - 2. Pratt & Lambert.
  - 3. Sherwin-Williams Company (The).

### 2.2 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
  - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. Colors: As indicated in Finish Schedule

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
  - 1. Concrete: 12 percent.
  - 2. Masonry (Clay and CMUs): 12 percent.

3. Wood: 15 percent.
  4. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- E. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer. but not less than the following:
1. SSPC-SP 2.
  2. SSPC-SP 3.
  3. SSPC-SP 7/NACE No. 4.
  4. SSPC-SP 11.

- F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- G. Galvanized-Metal Substrates (Doors and/or Frames as applicable): Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- H. Wood Substrates:
  - 1. Sand surfaces that will be exposed to view, and dust off.
  - 2. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
  - 3. For transparent finished work, use putty and filler color matched to wood to minimize its appearance.
  - 4. Seal and backprime all interior woodwork immediately after delivery to site and before installation.
- I. Doors: Finish tops, bottoms, and edges of doors the same as door faces.
- J. Drywall: Clean surfaces free from dust and foreign substances. Joint treatment materials shall be thoroughly dry. Paint metal corner beads and trim with metal primer before application of water based finish coatings

### 3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
  - 1. Use applicators and techniques suited for paint and substrate indicated.
  - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
  - 3. Paint front and backsides of access panels / doors, removable or hinged covers, and similar hinged items to match exposed surfaces.
  - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
  - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
  - 1. Paint the following work where exposed in occupied spaces:
    - a. Equipment, including panelboards.
    - b. Uninsulated metal piping.
    - c. Uninsulated plastic piping.
    - d. Pipe hangers and supports.
    - e. Metal conduit.
    - f. Plastic conduit.
    - g. Duct, equipment,
  - 2. Paint portions of internal surfaces of new or existing metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

### 3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
  - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
  - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

### 3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

### 3.6 INTERIOR PAINTING SCHEDULE

#### A. CONCRETE UNIT MASONRY BLOCK FILLERS

- 1. Concrete Unit Masonry Block Filler: Factory-formulated high-performance latex block fillers (50 g/L).
- 2. Intermediate Coat: Matching topcoat.
- 3. Top Coat:
  - a. Benjamin Moore; Super Spec Masonry Hi-Build Block Filler 206: Applied at a dry film thickness of not less than 8.5 mils.

#### B. INTERIOR PRIMERS

- 1. General: Provide tinted primers as required for dark colors.
- 2. Interior Gypsum Board Primer: Factory-formulated latex-based primer for interior application (100 g/L).
  - a. Benjamin Moore, Ultra Spec 500 Interior Latex Primer N534: Applied at a dry film thickness of not less than 1.8 mils.
- 3. Interior Metal Primer: Factory-formulated metal primer (250 g/L).
  - a. Benjamin Moore; Super Spec Acrylic Metal Primer No. P04: Applied at a dry film thickness of not less than 1.7 mils.

#### C. INTERIOR PAINTS □ 2 coats required, Tint Intermediate Coat.

- 1. Interior Matt Finish: Factory-formulated Flat-latex interior for Toilet Room Ceilings.
  - a. Benjamin Moore, Ultra Spec Scuff-X Interior Matt Finish 484: Applied at a dry film thickness of not less than 1.7 mils.
- 2. Interior Semi-Gloss Finish: Factory-formulated Semi-Gloss-latex interior for Toilet Room Walls.
  - a. Benjamin Moore, Ultra Spec Scuff-X Interior Semi-Gloss Finish N539:

Applied at a dry film thickness of not less than 1.8 mils.

3. Interior Semi-Gloss Acrylic Enamel for Metal Surfaces: Factory-formulated semi-gloss acrylic interior enamel (250 g/L).
  - a. Benjamin Moore; Super Spec HP DTM Acrylic Semi-Gloss Enamel P29: Applied at a dry film thickness of not less than 1.5 mils.
4. Interior Wood-Painted, Field Applied:  
(Semi Gloss Latex System)  
Coat 1: Benjamin Moore Super Spec Alkyd Enamel Undercoater and Primer/Sealer (C245)  
Coat 2: Benjamin Moore Ultra Spec 500 Acrylic Copolymer Semi Gloss (N539)  
Coat 3: Same as Coat
5. Interior Drywall - Non Toilet Rooms:  
(Eggshell Latex System)  
Coat 1: Benjamin Moore Ultra Spec 500 Interior Latex Primer (N534)  
Coat 2: Benjamin Moore Ultra Spec 500 Acrylic Copolymer Eggshell (N538)  
Coat 3: Same as Coat 2  
Note\*\*: Provide Benjamin Moore Ultra Spec 500 Flat (N536) on ceilings
6. Mechanical and Electrical Work (Paint all exposed items throughout the project except factory finished items with factory-applied baked enamel finishes which occur in mechanical rooms or areas, and excepting chrome or nickel plating, stainless steel, and aluminum other than mill finished. Paint all exposed ductwork and inner portion of all ductwork: Same as specified for other interior metals, hereinabove.

END OF SECTION 099123



## **SECTION 099300**

### **STAINING AND TRANSPARENT FINISHING**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. Section includes surface preparation and application of wood stains and transparent finishes fielded applied on the following substrates:
  - 1. Interior Substrates:
    - a. Doors
- B. Related Requirements:
  - 1. Section 081416 "Flush Wood Doors"

##### **1.3 DEFINITIONS**

- A. MPI Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D523. (Traditional Matte Finish)
- B. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523. (Traditional Satin Finish)
- C. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523. (Traditional Semi-gloss Finish)
- D. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523. (Traditional Gloss Finish)
- E. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523. (Traditional High Gloss Finish)

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
  - 1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
  - 2. Indicate VOC content.
- B. Samples for Initial Selection: For each type of product.
- C. Samples for Verification: For each type of finish system and in each color and gloss of finish required.
  - 1. Submit Samples on representative samples of actual wood substrates, 8 inches (200 mm) square.
  - 2. Apply coats on Samples in steps to show each coat required for system.
  - 3. Label each coat of each Sample.
  - 4. Label each Sample for location and application area.
- D. Product List: Cross-reference to finish system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

#### 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Stains and Transparent Finishes: 5 percent, but not less than 1 gal. (3.8 L) each material and color applied.

#### 1.6 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each finish system indicated and each color selected to verify preliminary selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
  - 1. Final approval of stain color selections will be based on mockups.
    - a. If preliminary stain color selections are not approved, apply additional mockups of additional stain colors selected by Architect at no added cost to Owner.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
  - 1. Maintain containers in clean condition, free of foreign materials and residue.
  - 2. Remove rags and waste from storage areas daily.

## 1.8 FIELD CONDITIONS

- A. Apply finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply finishes when relative humidity exceeds 85 percent, at temperatures less than 5 deg F (3 deg C) above the dew point, or to damp or wet surfaces.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Lenmar Lacquers; Benjamin Moore & Co.
  - 2. Pratt & Lambert.
  - 3. Sherwin-Williams Company (The).

### 2.2 MATERIALS, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products List."
- B. Material Compatibility:
  - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  - 2. For each coat in a paint system, products shall be recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

- C. Stain Colors: As indicated in a color schedule, or match existing doors.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Interior Wood Substrates: 15 percent, when measured with an electronic moisture meter.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Proceed with finish application only after unsatisfactory conditions have been corrected.
  - 1. Beginning finish application constitutes Contractor's acceptance of substrates and conditions.

### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.
  - 1. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each substrate condition and as specified.
  - 1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
  - 2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.

- D. Interior Wood Substrates:
  - 1. Sand surfaces exposed to view and dust off.
  - 2. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dry.

### 3.3 APPLICATION

- A. Apply finishes according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
  - 1. Use applicators and techniques suited for finish and substrate indicated.
  - 2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.
  - 3. Do not apply finishes over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

### 3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.

### 3.5 INTERIOR WOOD -FINISH-SYSTEM SCHEDULE

- A. Wood Substrates: doors □ (MATCHING EXISTING DOOR FINISHES)
  - 1. Polyurethane Varnish over Stain System:
    - a. Stain Coat: Stain, semitransparent, for interior wood.
    - b. First Intermediate Coat: Polyurethane varnish matching topcoat.
    - c. Second Intermediate Coat: Polyurethane varnish matching topcoat.

- d. Topcoat: Varnish, interior, polyurethane, oil modified. Match Existing Door Finishes, color and sheen.

END OF SECTION 099300

## **SECTION 10 14 00**

### **SIGNAGE**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

##### **1.2 DESCRIPTION OF WORK**

- A. The work of this section includes, but is not limited to, the following:
  - 1. Interior panel signs as scheduled at the end of this Section.

##### **1.3 RELATED WORK**

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that relate directly to work of this Section include, but are not limited to:
  - 1. Section 06 10 00, Rough Carpentry; blocking.
  - 2. Section 09 91 00, Painting; painting materials and specifications.
  - 3. Section 10 44 13, Fire Extinguishers and Cabinets; "fire extinguisher" signs.
  - 4. Division 26 - Electrical; "Exit" signs; wiring for external sign illumination

##### **1.4 SUBMITTALS**

- A. Product Data: Submit manufacturer's product data, installation instructions, use limitations and recommendations for each material used. Provide certifications stating that materials comply with requirements. Manufacturers shall have at least five years experience in the manufacture of sign systems specified.
- B. Shop Drawings: Provide large scale shop drawings for fabrication, installation and erection of all parts of the work. Provide large scale layouts of sign wording, spacing, type size and style. Provide plans, elevations, and details of anchorages, connections and accessory items. Provide installation templates for work installed by others. Provide full size spacing templates for individual letters and numbers.
- C. Initial Selection Samples: Submit samples showing complete range of colors, textures, and finishes available for each material used.

- D. Verification Samples: Submit representative samples of each material that is to be exposed in the finished work, showing the full range of color and finish variations expected. Provide samples having minimum area of 144 square inches or full-size units.

## 1.5 INTENT

- A. A major intent of the work of this section is to provide colorfast, durable building identification devices as scheduled and as required by codes. Provide all signs and graphics required by authorities having jurisdiction even if not otherwise indicated in the Contract Documents.

## 1.6 QUALITY ASSURANCE

- A. Source: For each type of material required for the work of this section, provide primary materials which are the products of one manufacturer. Provide secondary materials which are acceptable to the manufacturers of the primary materials.
- B. ADA Requirements: Comply with State of New York requirements and Americans with Disabilities Act requirements, including Type 2 Braille.

## 1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and products in unopened factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage.
- B. Sequence deliveries to avoid delays, but minimize on-site storage.

## 1.8 SEQUENCING AND SCHEDULING

- A. Delay installation of work of this section until near time of Substantial Completion.

# PART 2 - PRODUCTS

## 2.1 ACCEPTABLE MANUFACTURERS

- A. Provide products of one of the following manufacturers if they meet or exceed the requirements of these specifications, or approved equal:
  - 1. Andco Industries
  - 2. Cornelius
  - 3. Gemini, Inc.
  - 4. Lynn Sign Company
  - 5. Mohawk Engraving Company
  - 6. The Supersine Company



## 2.2 MATERIALS AND PRODUCTS

- A. Panel Signs: Aluminum Sheet and Plate: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of 5005-H15. Fabricate with edges smoothly beveled.
  - 1. Machine engrave letters, numbers, symbols, and other graphic devices into panel sign on face indicated to produce precisely formed copy, incised to uniform depth
  - 2. Tactile and Braille Copy: Manufacturer's standard process for producing copy complying with ADA Accessibility Guidelines and ICC/ANSI A117.1. Text shall be accompanied by Grade 2 braille. Produce precisely formed characters with square cut edges free from burrs and cut marks

## 2.3 FABRICATION

- A. Fabricate work to be truly straight, plumb, level and square with smooth flat surfaces and sharp corners, except where indicated otherwise.
- B. Precisely form work to sizes, shapes, and profiles indicated on approved shop drawings.
- C. Fabricate metal work with uniform, invisible joints.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. The Installer shall examine substrates, supports, and conditions under which this work is to be performed and notify Contractor, in writing, of conditions detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected. Beginning work means Installer accepts substrates and conditions.

### 3.2 INSTALLATION

- A. Strictly comply with manufacturer's instructions and recommendations, except where more restrictive requirements are specified in this section.
- B. Install work plumb, level, in true plane and alignment. Provide signs and graphics where shown or scheduled using mounting methods indicated.

### 3.3 TOLERANCES

- A. The following allowable installed tolerances are allowable variations from locations and dimensions indicated by the Contract Document and shall not be added to allowable tolerances indicated for other work.

1. Allowable Variation from True Plumb, Level and Line:  $\pm 1/8"$  in 10'-0"
2. Allowable Variation from True Plane of Adjacent Surfaces:  $\pm 1/16"$

### 3.4 ADJUSTING, CLEANING AND PROTECTION

- A. Adjust work to present the best possible appearance. Touch-up damaged finishes and repair damage to eliminate evidence of repair. Clean exposed surfaces using materials and methods recommended by manufacturer of material or product being cleaned. Remove and replace work that cannot be successfully repaired or cleaned.
- B. Provide temporary protection to ensure work being without damage or deterioration at time of final acceptance. Remove protections and reclean as necessary immediately before final acceptance.

### 3.5 SIGNAGE AND GRAPHICS SCHEDULE

- A. Schedule to be determined.

END OF SECTION

## **SECTION 101423.16**

### **ROOM-IDENTIFICATION PANEL SIGNAGE**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section includes room-identification signs that are directly attached to the building.

##### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: For room-identification signs.
  - 1. Include fabrication and installation details and attachments to other work.
  - 2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
  - 3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.
- C. Samples: For each exposed product and for each color and texture specified.

##### **1.3 INFORMATIONAL SUBMITTALS**

- A. Sample warranty.

##### **1.4 CLOSEOUT SUBMITTALS**

- A. Maintenance data.

##### **1.5 WARRANTY**

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1

### 2.2 ROOM-IDENTIFICATION SIGNS

- A. Room-Identification Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Allen Industries Architectural Signage.
    - b. Inpro Corporation.
    - c. Seton Identification Products; a Brady Corporation company.
  - 2. Match Existing Building Standards.
  - 3. Laminated-Sheet Sign: Photopolymer face sheet with raised graphics laminated over subsurface graphics to acrylic backing sheet to produce composite sheet.
    - a. Composite-Sheet Thickness: [Manufacturer's standard for size of sign
    - b. Subsurface Graphics: Reverse etch image
    - c. Color(s): As selected by Architect from manufacturer's full range.
  - 4. Sign-Panel Perimeter: Finish edges smooth.
  - 5. Mounting: Surface mounted to wall with adhesive

### 2.3 SIGN MATERIALS

- A. Acrylic Sheet: ASTM D 4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

### 2.4 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. Sign Mounting Fasteners:
  - a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly unless otherwise indicated.
- B. Adhesive: As recommended by sign manufacturer.

## 2.5 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
  1. Mill joints to a tight, hairline fit. Form assemblies
  2. Conceal connections
- B. Subsurface-Etched Graphics: Reverse etch back face of clear face-sheet material. Fill resulting copy with manufacturer's standard enamel. Apply opaque manufacturer's standard background color coating over enamel-filled copy.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
  1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
  2. Install signs so they do not protrude or obstruct according to the accessibility standard.
  3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
- B. Mounting Methods:
  1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
    - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until

flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.

- b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
2. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
3. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.

END OF SECTION 101423.16

## **SECTION 102113.17**

### **PHENOLIC-CORE TOILET COMPARTMENTS**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Phenolic-core toilet compartments configured as toilet enclosures and urinal screens.
- B. Related Requirements:
  - 1. Section 061053 "Miscellaneous Rough Carpentry"
  - 2. Section 108100 "Toilet and Bath Accessories" for toilet tissue dispensers, grab bars, and similar accessories mounted on toilet compartments.

##### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.
- B. Shop Drawings: For toilet compartments.
  - 1. Include plans, elevations, sections, details, and attachment details.
  - 2. Show locations of cutouts for compartment-mounted toilet accessories.
  - 3. Show locations of centerlines of toilet fixtures.
  - 4. Show locations of floor drains.
  - 5. Show overhead support or bracing locations.
- C. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:

1. Each type of material, color, and finish required for toilet compartments, prepared on 6-inch- (152-mm-) square Samples of same thickness and material indicated for Work.
  2. Each type of hardware and accessory.
- D. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of toilet compartment.

#### 1.5 Warranty

- A. Manufacturers Standard Warranty: Provide warranty for Phenolic Material against delamination, breakage, or corrosion for 10 years, assuming proper maintenance according to manufacturer's recommendations.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet compartments to include in maintenance manuals.

#### 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents per Toilet Room.
1. Door Hinges: two hinge(s) with associated fasteners.
  2. Latch and Keeper: two latch(es) and keeper(s) with associated fasteners.
  3. Door Bumper: One door bumper(s) with associated fasteners.
  4. Door Pull: two door pull(s) with associated fasteners.
  5. Fasteners: five fasteners of each size and type.

#### 1.8 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.



## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 75 or less.
  - 2. Smoke-Developed Index: 450 or less.
- B. ASTM D 1735 - Standard Practice for Testing Water Resistance of Coatings Using Water Fog Apparatus
- C. ASTM D 2247 - Standard Practice for Testing Water Resistance of Coatings in 100 percent Relative Humidity
- D. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for toilet compartments designated as accessible.

### 2.2 PHENOLIC-CORE TOILET COMPARTMENTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. ASI Global Partitions. BASIS OF DESIGN  
Eastanollee, GA Tel: 706-827-2700; Web:[asi-globalpartitions.com](http://asi-globalpartitions.com)  
Manufacturers Rep: Paul Kechejian (203)-424-6821
  - 2. Accurate
  - 3. All American
- B. Requests for substitutions will be considered in accordance with provisions of Section 016000.

### 2.3 COMPARTMENTS AND SCREENS

- C. Toilet Compartments: Floor anchored/overhead braced.
  - 1. Compartment Depth and Width: As scheduled and indicated on Drawings.
  - 2. Door Width: 24 inches (610 mm), minimum; at ADA accessible compartments 36 inches (915 mm) minimum.
  - 3. Height Above Floor: 9 inches (152 mm)
  - 4. Door Height: 72 inches (1829 mm)
  - 5. Panel Height: 72 inches (1829mm)
  - 6. Pilaster Height: 86 inches (2083 mm).

- D. Privacy and Urinal Screens: Wall hung with pilaster support in front
  - 1. Screen Panel Size: 18 inches (610 mm) wide by 48 inches (1219 mm) high.
  - 2. Height Above Floor: 18 inches (457 mm).

## 2.4 SOLID PHENOLIC.

- 1. Doors, Panels, Screens, and Pilasters: Decorative surface sheet with solid phenolic core of melamine resin impregnated kraft paper fused under high temperature and pressure; edges machine sanded with a 45 degree radius edge. Manufacturer's standard.
  - a. Doors and Pilasters: 3/4 inch (19 mm) thick.
  - b. Panels and Screens: 1/2 inch (13 mm) thick.
  - c. Edges: Black core.
  - d. Fire Rated Material: Class B, ASTM E 84

No-Sight System: No-Sight System: Doors and panels to be routed to allow overlapping edges and providing no sight lines into compartment.

- 3. Finish: Solid phenolic with black core, Formica White Twill 9285-58

## 2.3 HARDWARE AND ACCESSORIES

- A. Hardware and Accessories: Manufacturer's standard operating hardware and accessories.
  - 1. Material: Stainless steel
  - 2. Hinges: Manufacturer's standard type 304 Stainless steel barrel hinges 4 per standard door, 5 per accessible door. Door to be predrilled at factory for hinge location.
  - 3. Latch and Keeper: Manufacturer's standard stainless steel latch/keeper system with integral occupancy indicator to be installed on pilaster for in-swinging doors and on door for out-swinging doors latch unit designed for emergency access and with combination rubber-faced door strike and keeper: Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
  - 4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
  - 5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
  - 6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units to both sides of doors on all non-accessible and accessible compartments.

7. Fastening Hardware: Manufacturer's standard, Type 304 stainless steel, No. 4 satin finish, with theft-resistant barrel nuts and machine screws.
- B. Mounting Brackets: Provide stainless steel continuous U bracket Type 304 stainless steel, No. 4 satin finish, with stainless steel theft-resistant barrel nuts and machine screws of same material and finish.
- C. Headrail: Manufacturer's standard anodized aluminum rail with anti-grip profile.
- D. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.
- E. Pilaster Anchors, Floor Anchored/Overhead Braced.
  1. Easy Stall shoe system. 1/4 inch by 2 inch steel screws attach Easy Stall shoe to floor. Pilaster to be inserted into shoe and secured after height adjusted. Leveling adjustment to be concealed by pilaster shoe. Height/leveling adjustment to be made via machine thread bolts inserted into factory installed threaded insert in bottom of pilaster.
- F. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

## 2.4 MATERIALS

- A. Aluminum Castings: ASTM B26/B26M.
- B. Aluminum Extrusions: ASTM B221 (ASTM B221M).
- C. Brass Castings: ASTM B584.
- D. Brass Extrusions: ASTM B455.
- E. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.
- F. Stainless Steel Castings: ASTM A743/A743M.
- G. Zamac: ASTM B86, commercial zinc-alloy die castings.

## 2.5 FABRICATION

- A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.

- B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
- C. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.
- D. Urinal-Screen Posts: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at tops and bottoms of posts. Provide shoes and sleeves (caps) at posts to conceal anchorage.
- E. Door Size and Swings: Unless otherwise indicated, provide 24-inch- (610-mm-) wide in-swinging doors for standard toilet compartments and 36-inch- (914-mm-) wide out-swinging doors with a minimum 32-inch- (813-mm-) wide clear opening for compartments designated as accessible.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
  - 1. Confirm location and adequacy of blocking and supports required for installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
  - 1. Maximum Clearances:
    - a. Pilasters and Panels: 1/2 inch (13 mm).
    - b. Panels and Walls: 1-1/2 inch (38 mm).
    - c. Maximum variations from plumb or level: 1/8 inch (3mm)
  - 2. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.

- a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
  - b. Align brackets at pilasters with brackets at walls.
- B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches (44 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.
- C. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches (51 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.
- D. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

### 3.3 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 102113.17



**SECTION: 10 26 41**  
**BULLET RESISTANT PANELS**

**PART 1 □ GENERAL**

**1.1 SUMMARY**

- A. Section includes bullet resistant fiberglass panels.

**1.2 REFERENCES**

- A. American Society for Testing and Materials:
  - 1. ASTM E119-98 Standard Test for One-Hour Fire-Rating of Building Construction and Materials
- B. International Organization for Standardization:
  - 1. ISO 9001:2015 Quality Management System
- C. Small Business Administration:
  - 1. SBA Small Business Size Standard
- D. Underwriters Laboratories:
  - 1. UL 752 Specifications and Ammunition, 11th Edition, Standard for Bullet Resisting Equipment published September 9, 2005, revised December 21, 2006, Level 1
- E. The United States Department of State:
  - 1. The International Traffic in Arms Regulations (ITAR)

**1.3 SUBMITTALS**

- A. Submittals for Review: Submit for approval prior to fabrication.
  - 1. Product Data: Include specifications, brochures, and samples.
  - 2. Recommendations for installation of Bullet Resistant Fiberglass Panels available in print document and video link.
- B. Certificates: Submit printed data to indicate compliance with following requirements.
  - 1. UL LISTING Verification and UL752 Current Test Results as provided by Underwriters Laboratories.
  - 2. ASTM E119-98 One-Hour Fire Rating of Building Construction and Materials.
  - 3. Manufacturer's third party certificate of registration with ISO 9001:2015.
  - 4. Manufacturer's U.S. Dept. of State ITAR Statement of Registration.
  - 5. Manufacturer's SBA Profile verifying small business status by the SBA.

**1.4 DELIVERY, HANDLING, AND STORAGE**

- A. Deliver materials to project with manufacturer's UL LISTED Labels intact and legible.
- B. Handle material with care to prevent damage. Store materials inside under cover, stack flat and off the floor.

**1.5 WARRANTY**

- A. Warrant all materials and workmanship against defects for a period of ten (10) years from the date of Substantial Completion.

## PART 2 □ PRODUCTS

### 2.1 MANUFACTURER

Product: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- A. Design Basis: Contract Documents are based on ArmorCore by Waco Composites, (Waco, TX 76710, phone: 254-752-3622, toll free: 866-688-3088, email: sales@armorcore.com, web: www.armorcore.com)
- B. Substitutions will be reviewed and may be acceptable if approved by Architect and Owner.

### 2.2 PERFORMANCE CRITERIA

- A. Bullet Resistant Fiberglass Panels shall be □non ricochet type□to permit the encapture and retention of an attacking projectile lessening the potential of a random injury or lateral penetration.
- B. Panel Rating: UL752 Level 1.
- C. Bullet resistance of joints: equal to that of the panel.

### 2.3 MATERIALS

- A. Panels fabricated of multiple layers of woven roving ballistic grade fiberglass cloth impregnated with a thermoset polyester resin and compressed into flat rigid sheets.
- B. Thickness: 1/4□nominal thickness
- C. Nominal Weight: 2.6 lbs. per sq. ft.
- D. Panel Size: As noted on drawings
- E. Panels manufactured in the United States of America with raw materials sourced from the U.S.A. for quality assurance purposes and to comply with any applicable □Buy American□provisions.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Prior to starting installation, verify work of related trades required in contract documents and architectural drawings is complete to the point where work of this Section may properly commence.

### 3.2 JOINTS

- A. Reinforce joints with a back-up layer of bullet resistive material.  
Minimum width of reinforcing layer at joint shall be 4-inches, centered



on panel joints.

### 3.3 APPLICATION

- A. Install armor in accordance with manufacturer's printed recommendations and as required by contract documents.
- B. Secure armor panels using screws, bolts, or an industrial adhesive.
  - 1. Method of application shall install panels minimizing vulnerabilities by fitting tightly to adjacent surfaces including concrete floor slab, concrete roof slab, bullet resistive door frames, bullet resistive window frames, and the like.

END OF SECTION 102641



## **SECTION 10 44 00**

### **FIRE PROTECTION SPECIALTIES**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

##### **1.2 DESCRIPTION OF WORK**

- A. The work of this section includes, but is not limited to, the following:
  - 1. Fire extinguisher cabinets.
  - 2. Mounting brackets.
  - 3. Fire extinguishers.

##### **1.3 RELATED WORK**

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that relate directly to work of this Section include, but are not limited to:
  - 1. Division 21: Fixed fire protection systems, standpipes, valves and hose cabinets.

##### **1.4 SUBMITTALS**

- A. Product Data: Submit cabinet manufacturer's product data, installation instructions and recommendations.
- B. Verification Samples: Submit representative samples of each material that is to be exposed in the finished work, showing the full range of color and finish variations expected. Provide samples having minimum area of 144 square inches.

##### **1.5 QUALITY ASSURANCE**

- A. Source: For each type of product required for the work of this section, provide products which are the products of one manufacturer.
- B. Provide portable extinguishers which bear the UL listing mark.
- C. Comply with applicable building and fire code regulations of the State of New York.

## 1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver products in unopened factory labeled packages. Store and handle in strict compliance with manufacturers' instructions and recommendations. Protect from damage.
- B. Sequence deliveries to avoid delays, but minimize on-site storage.

## PART 2 - PRODUCTS

### 2.1 HOSE AND VALVE CABINETS

- A. Cabinets: Provide recessed units of proper size to accommodate fire hose and valve. Provide stainless steel door with vertical plate breakable glass and include manufacturer's standard piano hinge, door pull and friction catches or latches.

### 2.2 EXTINGUISHER CABINETS

- A. Cabinets: Provide recessed units of proper size to accommodate extinguisher. Provide stainless steel door with vertical plate breakable glass and include manufacturer's standard piano hinge, door pull and friction catches or latches.

### 2.3 MOUNTING BRACKETS

- A. Provide manufacturer's standard bracket designed to prevent accidental dislodgment of extinguisher, of proper size for type and capacity of extinguisher indicated, in manufacturer's standard plated finish.
  - 1. Provide brackets for extinguishers not located in cabinets.
  - 2. Mounting bracket shall be a heavy gage steel bracket with baked enamel finish equal to Larsen's Model Number 862 Fire Extinguisher Bracket.

### 2.4 FIRE EXTINGUISHERS

- A. General: Provide fire extinguishers for each cabinet and other locations indicated, in colors and finishes selected by Architect from manufacturer's standard, that comply with authorities having jurisdiction.
- B. Multipurpose Dry Chemical Type: UL-rated 4-A:60-B:C, 10-lb nominal capacity, in enameled steel container.

### 2.5 FABRICATION

- A. Fabricate cabinets to be truly straight, plumb, level and square.

- B. Provide cabinets to sizes, shapes, and profiles indicated on approved shop drawings.
- C. Fabricate cabinets with uniform, tight joints and smoothly finished edges.

## 2.6 FINISHES

- A. Factory Baked Enamel: For all exposed surfaces visible when cabinet door is closed, provide manufacturer's standard baked-on primer suitable for field finishing. For all cabinet surfaces concealed when door is closed, provide minimum 1. mil dry film thickness of thermosetting acrylic enamel over substrate which has been prepared by inhibited chemical cleaning, conversion coating, and priming. Provide AA C12 C42 R1X.
- B. Hardware: Provide chrome plated exposed door pull or fully concealed pull.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. The Installer shall examine substrates, supports, and conditions under which this work is to be performed and notify Contractor, in writing, of conditions detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected. Beginning work means Installer accepts substrates and conditions.

### 3.2 INSTALLATION

- A. Strictly comply with manufacturer's instructions and recommendations, except where more restrictive requirements are specified in this section.
- B. Securely install at heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction and the Architect. If exact locations are not indicated, locate where field directed by Architect.
- C. Prepare recesses accurately to neatly accept cabinets. Coordinate with work in other sections to ensure proper sequence, position, height and clearances.

### 3.3 ADJUSTING, CLEANING, PROTECTION

- A. Adjust operating parts to work easily, smoothly, and correctly.
- B. Repair minor damage to eliminate all evidence of repair. Remove and replace work which cannot be satisfactorily repaired.
- C. Clean exposed surfaces using materials and methods recommended by manufacturer of product being cleaned. Remove and replace work that cannot be successfully cleaned.

- D. Provide temporary protection to ensure work being without damage or deterioration at time of final acceptance. Remove protections and reclean as necessary immediately before final acceptance.

END OF SECTION

## **SECTION 108100.1**

### **TOILET AND BATH ACCESSORIES**

#### **PART 1 GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. Cabinet-type toilet accessories.
- B. Toilet accessories.
- C. Grab bars.

##### **1.3 RELATED REQUIREMENTS**

- A. Section 061053 □ Miscellaneous Rough Carpentry
- B. Section 092216 □ Non-Structural Metal Framing.
- C. Section 093013 □ Ceramic Tiling.
- D. Section 102113.17 - Toilet Compartments.
- E. Section 108110 - Electric Hand Dryers.

##### **1.4 REFERENCES**

- A. Americans with Disabilities Act Accessibility Guidelines (ADA).

##### **1.5 SUBMITTALS**

- A. Submit under provisions of Section 013300.
- B. Product Data: Manufacturer's product data for products specified, indicating selected options and accessories.
- C. Shop Drawings:
  - 1. Plans: Locate each specified unit in project.
  - 2. Elevations: Indicate mounting height of each product.
  - 3. Details: Indicate anchoring and fastening details, required locations and types of anchors and reinforcement, and materials required for installation of specified products.

- D. Verification Samples: Two sample chips of each specified color and finish.
- E. Quality Assurance Submittals:
  - 1. Manufacturer's printed installation instructions for each specified product.
  - 2. Documentation of Manufacturer's Qualifications, specified in 1.5 of this Section.
- F. Closeout Submittals: Warranty, issued and executed by manufacturer, and countersigned by Contractor.

## 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum five years documented experience producing products specified.
- B. Source Limitations: To the greatest extent possible products shall be provided by a single manufacturer.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Ship products in manufacturer's standard protective packaging with vinyl coating on exposed surfaces.
- B. Storage and Protection: Store products in manufacturer's protective packaging until installation.

## 1.8 SEQUENCING

- A. Supply locations, dimensions, and other pertinent details to installing Contractor for coordination of blocking, support and recess size and locations required for accessory installation.

## 1.9 WARRANTY

- A. Manufacturer's standard warranty against defects in product workmanship and materials.
- B. Manufacturer's 15-year warranty against silver spoilage of mirrors.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- 1) Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Specialties, Inc.- BASIS OF DESIGN;;  
Yonkers NY (914) 476-9000.  
Email:PKechajian@americanspecialties.com  
<http://www.americanspecialties.com>.



- b. Bobrick Washroom Equipment, Inc.
- c. Bradley Corporation.
- d. Truebro, Basin Guard

- B. Requests for substitutions will be considered in accordance with provisions of Section 016000.

## 2.2 CABINET-TYPE TOILET ACCESSORIES (ROVAL COLLECTION)

- A. Basic Construction Requirements:
  - 1. Doors: Curved design, one piece 304 stainless steel.
  - 2. Cabinets: Stainless steel, trimless; joints welded, sight-exposed welds finished to match sheet finish. Full access back panels.
  - 3. Hinges: Concealed, multi-staked stainless steel piano hinge, full length of cabinet.
  - 4. Locks: 2 flush, rimless tumbler locks, keyed alike other toilet accessory locks, with one key for each lock.
  - 5. Exposed Finish: Satin finish, unless noted otherwise.
- B. Mirrors: Roval Collection by ASI. 24x36
  - 1. Stainless Steel Mirror (Tempered Glass): Model 20650-B2436. Radiused edges complement the curves of the ASI Roval Collection. Frame fabricated of 18 ga type 304 stainless steel with satin finish and polished seamless mitered corners. 1/4 in (6.4 mm) thick plate glass mirror.

## 2.3 CABINET-TYPE TOILET ACCESSORIES (PROFILE COLLECTION)

- A. Basic Construction Requirements:
  - 1. Doors: 16 ga stainless steel, formed 15/16 in (23.8 mm) return to wall, with vertical edges eased at 3/4 in (19 mm) radius; welded corners.
  - 2. Cabinets: 20 ga stainless steel, formed 1 in (25 mm) wide flat perimeter trim four sides; joints welded, sight-exposed welds finished to match sheet finish.
  - 3. Hinges: Stainless steel piano hinge, 3/16 in (4.8 mm) dia barrel, full length of cabinet; hinge leaves spot-welded to door and cabinet body.
  - 4. Locks: Flat rimless tumbler locks, keyed like other toilet accessories, with two keys for each lock.
  - 5. Cabinet and Door Finish: Satin finish.
- B. Toilet Tissue Dispensers/Holders: Profile Collection by ASI.
  - 1. Surface Mounted Dual Roll Toilet Tissue Dispenser: Model 9030. Holds two rolls up to 5-1/4 in (135 mm) dia (1800 sheets). Top roll automatically drops in place when bottom roll done. Type 304 stainless cabinet and mechanism. Theft resistant spindles.

## 2.4 TOILET ACCESSORIES

- A. Basic Construction Requirements:
  - 1. Doors: 22 ga satin 304 stainless steel, formed hems at sight-exposed edges.
  - 2. Cabinets: 22 ga satin 304 stainless, formed hems at sight-exposed edges; joints welded.
  - 3. Hinges: Stainless steel piano hinge, 3/16 in (4.8 mm) dia barrel, full length of cabinet; hinge leaves spot-welded to door and cabinet body.
  - 4. Locks: Tumbler locks, keyed alike other toilet accessories, two keys for each lock.
- B. Feminine disposal: Surface Mounted
  - 1. ASI Model # 20852 Surface mounted stainless steel

## 2.5 GRAB BARS

- A. Grab Bars: (Sizes needed 18", 36", 42")
  - 1. Covers: Snap over flange to conceal screws; type 304 stainless steel, 22 ga, 3-3/16 in (81 mm) dia.
  - 2. Concealed Mounting Flanges: 3-1/8 in (79 mm) O.D. dia with two screw holes and three locking dimples; 1/8 in (3 mm) thick, type 304 stainless steel.
  - 3. Series: 3700 Series by ASI; 1-1/4 in (32 mm) dia handrail with snap-on flange covers.
    - a. Product: Model's 3701-18, 3701-36, 3701-42

## 2.6 Note: Waste cans, Napkin Vendor, towel dispensers and soap dispesners by others/purchased by owner

## 2.7 ADA - SINK DRAIN TRAP COVER, under sink protection

- A. Basin Guard Cover, Collerville, TN

# PART 3 EXECUTION

## 3.1 EXAMINATION

- A. Inspect and prepare substrates using the methods recommended by the manufacturer for achieving best result for the substrates under project conditions.
  - 1. Verify reinforcement and anchoring devices are correct type and are located in accordance with shop drawings.
- B. Do not proceed with installation until substrates have been prepared using the methods recommended by the manufacturer and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.
- C. If preparation is the responsibility of another installer, notify Architect in

writing of deviations from manufacturer's recommended installation tolerances and conditions.

### 3.2 INSTALLATION

- A. Install toilet accessories plumb and level in accordance with shop Drawings and manufacturer's printed installation instructions.
- B. Locate toilet accessories at heights and locations required for compliance with local accessibility regulations and the Americans with Disabilities Act.

### 3.3 CLEANING

- A. Remove manufacturer's protective vinyl coating from sight-exposed surfaces 24 hours before final inspection.
- B. Clean surfaces in accordance with manufacturer's recommendations.

### 3.4 PROTECTION OF INSTALLED PRODUCTS

- A. Protect products from damage caused by subsequent construction activities.
- B. Field repair of damaged product finishes is prohibited; replace products having damaged finishes caused by subsequent construction activities.

END OF SECTION 108100.1



## **SECTION 12 20 00**

### **WINDOW TREATMENTS**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 General Requirements, apply to the work of this section.

##### **1.2 DESCRIPTION OF WORK**

- A. Furnish and install roller window shades and related items as shown on Drawings and as specified. Refer to Drawings for sizes, quantities, and locations.

##### **1.3 RELATED WORK**

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that relate directly to work of this Section include, but are not limited to:
  - 1. Section 05 50 00, Metal Fabrications, Miscellaneous supports.
  - 2. Section 06 10 00, Rough Carpentry; Blocking.
  - 3. Section 08 51 00, Aluminum Windows

##### **1.4 SUBMITTALS**

- A. Product Data: Submit manufacturer's product data, installation instructions, use limitations and maintenance and cleaning recommendations for each product used. Provide certifications stating that materials comply with requirements.
- B. Shop Drawings: Provide large scale shop drawings for fabrication, installation and erection of all parts of the work. Provide plans, elevations, and details of anchorages, connections and accessory items, and wiring diagrams. Provide detailed sections of head, jamb and sill conditions. Provide installation templates for work installed by others.
- C. Field Measurements: Where possible, take accurate field measurements before preparation of shop drawings and fabrication. Do not delay job progress; allow for field cutting and fitting.
- D. Initial Selection Samples: Submit samples showing complete range of colors and finishes available for each material used.

- E. Verification Samples: Submit representative samples of each material that is to be exposed in the finished work, showing the full range of color and finish variations expected. Provide one complete small window shade unit finished as specified in colors selected by Architect.

#### 1.5 INTENT

- A. A major intent of the work of this section is to provide window shades for all windows and to provide proper clearances between shades and windows to prevent heat build-up which could damage windows.

#### 1.6 QUALITY ASSURANCE

- A. Source: Provide window shades which are complete, functional assemblies produced by one manufacturer for the entire project. Provide secondary materials which are acceptable to the manufacturer of the primary products.
- B. Mock-ups: Before beginning primary work of this section, provide mock-ups at locations acceptable to Architect and obtain Architect's acceptance of visual qualities. Protect and maintain acceptable mock-ups throughout the work of this section to serve as criteria for acceptance of this work. Acceptable mock-ups may be incorporated into the finished work.

#### 1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and products in unopened factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage.
- B. Sequence deliveries to avoid delays, but minimize on-site storage.

#### 1.8 SEQUENCING AND SCHEDULING

- A. Conference: Convene a pre-installation conference to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.
- B. Delay installation of shade units until near time of Substantial Completion of Project.

#### 1.9 WARRANTY

- A. Provide shade manufacturer's lifetime warranty on all hardware components. Provide 5 year warranty on fabrics.

## 1.10 EXTRA MATERIAL

- A. Provide packaged, wrapped and labeled maintenance stock equal to 2% of the actual quantity of shade units installed.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Hunter Douglas Architectural Window Coverings
2. Kirsch.
3. Levolor Corp.
4. Louverdrape, Inc.

### 2.2 ROLLER SHADE OPERATORS

- A. SINGLE ROLLER SHADES: Universal mount steel brackets with solar roller shades.
- B. ROLLER TUBE: Circular-shaped aluminum tube extruded from alloy and temper 6063 T-6. Extruded tube to have a .063" wall thickness (2.5" outside diameter to have a 0.79" wall thickness). Heavily reinforced with minimum of six internal ribs and flutes providing additional tensile strength and allows for secure placement of clutch and end plug.
- C. SPRING-LOADED IDLE END: Reinforced idler assembly containing spring loaded end plug with positive locking wheel allowing for up to 7/8" adjustment and provides for a secure installation and removal of shade. Locking tube bearing plug contains minimum 6 ribs and flutes and inserted a minimum of 2 3/8" into roller tube on heavy duty systems.
- D. CLUTCH OPERATED: Chain-driven operator capable of lifting up to 20 pounds of weight with a maximum allowable pull force of 10 pounds. Utilization of adjustment-free continuous qualified T304 stainless ball chain with 110 lbs. breaking strength for precise control, smooth operation, and ensures a uniform look. Components must be maintenance-free from adjustments or lubrication for trouble-free lifetime operation.
  1. 90 pound breaking strength chains will not be accepted.
  2. Chain anchor device to be compliant with WCMA safety standard A100.1.1-2010 and must prevent the clutch system from moving the roller shade through lowering and raising if not properly installed as specified in ANSI Standard Section 6.5.2.

- E. BOTTOM BAR: Industry standard sealed hembar with weight sewn into pocket providing for tracking adjustments and uniform look of the hanging fabric panel. Flat Fabric Wrapped Hembar.
- F. MOUNTING HARDWARE: Manufacturer's standard or heavy duty bracket constructed of hardened 1/8" thick steel to support full weight of shade with bracket and screw hole covers to provide uniform look. Locking mechanism on bracket adapter provides for a secure installation and removal of the shade.
- G. CEILING-RECESSED POCKET: Extruded aluminum alloy U-shaped housing for recessed mounting in acoustical tile or drywall ceilings. 9" for Dual Shades x 5.25" profile with removable bottom aluminum closure. Ceiling-recessed pockets include an integrated tile support.

## 2.3 SHADE FABRIC

- A. General: Inherently anti-static, flame retardant, fade and stain resistant, light filtering, room darkening fabric. Comply with NFPA 701.
- B. Fabric 1: SheerWeave 7000, PVC-free polyester with acrylic backing. Color Canyon.

## 2.3 FABRICATION

- A. Fabricate work to be truly straight, plumb, level and square and to completely fill window openings from jamb-to-jamb and sill-to-head.
- B. Provide work to sizes, shapes, and profiles indicated on approved shop drawings. Provide units fabricated from non-fading, non-staining materials which do not required lubrication for the life of the installation.
- C. Fabricate work with uniform, tight joints and with ends of units occurring only over window mullions.

# PART 3 - EXECUTION

## 3.1 INSPECTION

- A. The Installer shall examine substrates, supports, and conditions under which this work is to be performed and notify Contractor, in writing, of conditions detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected. Beginning work means Installer accepts substrates and conditions.

## 3.2 INSTALLATION

- A. Strictly comply with manufacturer's instructions and recommendations, except



where more restrictive requirements are specified in this section.

- B. Securely install units plumb and level at proper height and relationship to surrounding work.

### 3.3 ADJUSTING, CLEANING, PROTECTION

- A. Adjust operating parts to work easily, smoothly, and correctly.
- B. Touch-up damaged coatings and finishes to eliminate evidence of repair.
- C. Repair minor damage to eliminate all evidence of repair. Remove and replace work which cannot be satisfactorily repaired.
- D. Clean exposed surfaces using materials and methods recommended by manufacturer of material or product being cleaned. Remove and replace work that cannot be successfully cleaned.
- E. Provide temporary protection to ensure work being without damage or deterioration at time of final acceptance. Remove protections and reclean as necessary immediately before final acceptance.

### 3.4 DEMONSTRATION

- A. Demonstrate equipment and instruct Owner's personnel in routine maintenance and proper operation procedures.

END OF SECTION



## **SECTION 123661.16**

### **SOLID SURFACING COUNTERTOPS**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

**A. Section Includes:**

1. Solid surface material countertops.
2. Solid surface material backsplashes.
3. Solid surface material end splashes.

##### **1.2 ACTION SUBMITTALS**

- A. Product Data:** For countertop materials
- B. Shop Drawings:** For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
- C. Samples:** For each type of material exposed to view.

#### **PART 2 - PRODUCTS**

##### **2.1 SOLID SURFACE COUNTERTOP MATERIALS**

- A. Solid Surface Material:** Homogeneous-filled plastic resin complying with ICPA SS-1.
1. Type: Provide Standard type unless Special Purpose type is indicated.
  2. Colors and Patterns: As selected by Architect from manufacturer's full range
- B. Plywood:** Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

##### **2.2 COUNTERTOP FABRICATION**

- A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."**
1. Grade: Premium.

- B. Configuration:
  - 1. Front: Straight, slightly eased at top
  - 2. Backsplash: Straight, slightly eased at corner
  - 3. End Splash: Matching backsplash
- C. Countertops: 3/4-inch- (19-mm-)] thick, solid surface material laminated to 3/4-inch Plywood
- D. Backsplashes: 3/4-inch- (19-mm-)] thick, solid surface material
- E. Joints: Fabricate countertops without joints.
- F. Joints: Fabricate countertops in sections for joining in field, with joints at locations indicated
- G. Cutouts and Holes:
  - 1. Undercounter Plumbing Fixtures: Make cutouts for fixtures[ in shop] using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

## 2.3 INSTALLATION MATERIALS

- A. Adhesive: Product recommended by solid surface material manufacturer.
- B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants "

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer.
- B. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.
- C. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions.
- D. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

- E. Install backsplashes and end splashes by adhering to wall and countertops with adhesive.
- F. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
- G. Apply sealant to gaps at walls; comply with Section 079200.1 "Joint Sealants Toilet Rooms."

END OF SECTION 123661.16



## **SECTION 12 48 13**

### **ENTRANCE MATS AND FRAMES**

#### **PART 1 GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 General Requirements, apply to the work of this section.

##### **1.2 DESCRIPTION OF WORK**

- A. The work of this Section includes, but is not limited to:
  - 1. Recessed entrance mats with carpet inserts and recessed drain pans and frames.

##### **1.3 RELATED WORK**

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that relate directly to work of this Section include, but are not limited to:
  - 1. Section 02 41 19, Selective Demolition
  - 2. Section 03 30 00, Cast-In-Place Concrete.

##### **1.4 SUBMITTALS**

- A. Product Data: Submit manufacturer's product data, installation instructions, and maintenance recommendations for each material used. Provide certifications stating that materials comply with requirements.
- B. Shop Drawings: Provide large scale shop drawings for fabrication and installation of all parts of the work. Provide large scale plans and details of anchorages, connections and accessory items. Provide installation templates for frames installed in coordination with concrete work.
- C. Field Measurements: Where possible, take accurate field measurements before preparation of shop drawings and fabrication. Do not delay job progress; allow for field cutting and fitting where taking field measurements before fabrication is not possible.
- D. Initial Selection Samples: Submit samples showing complete range of colors, textures, and finishes available for each material used.

- E. Verification Samples: Submit representative samples of each material that is to be exposed in the finished work, showing the full range of color and finish variations expected. Provide samples having minimum area of 144 square inches.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and products in unopened factory labeled packages. Store and handle in strict compliance with manufacturers' instructions and recommendations. Protect from damage.
- B. Sequence deliveries to avoid delays, but minimize on-site storage.

#### 1.6 SEQUENCING AND SCHEDULING

- A. Conference: Convene a pre-installation conference to establish procedures to coordinate this work with related and adjacent work.
- B. Provide oversized recess in concrete subfloors and delay actual installation of recessed mat frame until near time of Substantial Completion of Project. Do not install mats until immediately before Owner's Final Acceptance of the Project.

### PART 2 PRODUCTS

#### 2.1 ACCEPTABLE PRODUCTS/MANUFACTURERS

- A. Recessed Entrance Mats: Provide the following products that meet or exceed specified requirements and as shown on Drawings :
  - 1. Basis of Design: Metrosteel Grate and drain pan as manufactured by MATS INC or approved equal.

#### 2.2 RECESSED ENTRANCE MATS - MATERIALS AND PRODUCTS

- A. General Type 304 stainless steel wire resistance welded to Type 304 stainless steel support rods, containing 80% pre-consumer recycled content.
  - 1. Surface Aspect Linear wire rails resistance welded to support rods
  - 2. 1-1/8" Thickness
  - 3. Wire rails: height: 0.150"; width: 0.090"; spacing between wire rails: 0.145";
  - 4. Support rod: height: 1", width: 0.070"
  - 5. Weight 88 oz/sq. ft.
  - 6. Accessories Framing, pit liners, hold downs
  - 7. Rolling load No deformation was observed when testing a rolling load of 500 lbs. on a single caster 5" diameter x 2" wide after 1000 passes.



## 2.3 FABRICATION

- A. Fabricate frame to be truly straight, level and square. Provide frame pieces in longest available lengths to minimize joints. Space unavoidable joints evenly about centerline of mat and spline butt-joints with connecting pins. Form corners with tightly mitered joints or use prefabricated jointless corners.
- B. Provide frames and mats to sizes, shapes, and profiles indicated on approved shop drawings. Provide one-piece mats except where size exceeds manufacturer's recommended limit for easy removal and cleaning. Where more than one-piece mats are used, locate seams away from main traffic pattern.
- C. Shop fabricate framework to the greatest extent possible.

## 2.4 FINISHES

- A. Provide clear stainless frames.

## PART 3 EXECUTION

### 3.1 INSPECTION

- A. The Installer shall examine substrates, supports, and conditions under which this work is to be performed and notify Contractor, in writing, of conditions detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected. Beginning work means Installer accepts substrates and conditions.

### 3.2 INSTALLATION

- A. Strictly comply with manufacturer's instructions and recommendations, except where more restrictive requirements are specified in this Section.
- B. Coordinate top of mat elevation with frame and floor elevations to provide proper foot cleaning and to avoid all possibility of tripping hazard. Coordinate installation with door bottom clearances of doors that swing across mats.
- C. Install frame near time of Substantial Completion of Project. Shim and grout frame into oversize recess. Provide temporary filler of plywood or other suitable material to protect frame until installation of mat at time of final acceptance of Project.

### 3.3 CLEANING

- A. Clean exposed surfaces using materials and methods recommended by manufacturer of material or product being cleaned. Remove and replace work

that cannot be successfully cleaned.

END OF SECTION

**SECTION 142100**  
**ELECTRIC TRACTION ELEVATORS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes electric traction passenger elevators.

**1.2 ACTION SUBMITTALS**

- A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information.
- B. Shop Drawings:
  - 1. Include plans, elevations, sections, and large-scale details indicating service at each landing, coordination with building structure, relationships with other construction, and locations of equipment.
  - 2. Indicate maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.
- C. Samples: For exposed finishes.

**1.3 INFORMATIONAL SUBMITTALS**

- A. Seismic Qualification Certificates: For elevator equipment, accessories, and components, from manufacturer.
- B. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.

**1.4 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.
- B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

- C. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner, in the form of a standard five-year maintenance agreement, starting on date initial maintenance service is concluded.

## 1.5 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.

- 1. Warranty Period: Ten years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provided by ThyssenKrupp Elevator, Traction Elevator
- B. or comparable product by one of the following:
  - 1. KONE Inc.
  - 2. Mitsubishi Electric Corporation.
  - 3. Otis Elevator Co.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with ASME A17.1/CSA B44.
- B. Accessibility Requirements: Comply with Section 407 in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and with ICC A117.1.
- C. Seismic Performance: Elevator system shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and shall comply with elevator safety requirements for local seismic risk Zone in ASME A17.1/CSA B44.
  - 1. Affected peak velocity acceleration (Av) for Project's location
  - 2. Provide earthquake equipment required by ASME A17.1/CSA B44.
  - 3. Provide seismic switch required by ASCE/SEI 7.
  - 4. Design earthquake spectral response acceleration short period (Sds) for Project

5. Project Seismic Zone 1
6. Elevator Component Importance Factor

## 2.3 ELEVATORS

- A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturer's standard components shall be used, as included in standard elevator systems and as required for complete system.
- B. Elevator Description:
  1. Elevator Number, One
  2. Type: Passenger
  3. Machine Location: Hoistway; no machine room is provided.
  4. Machine Type: Gearless traction.
  5. Rated Load: 2100 lb (953 kg)
  6. Rated Speed: 200 fpm (1.0 m/s)
  7. Operation System: Selective-collective automatic operation
  8. Auxiliary Operations:
    - a. Standby power operation.
    - b. Battery-powered lowering.
    - c. Automatic dispatching of loaded car.
    - d. Nuisance call cancel.
    - e. Loaded-car bypass.
  9. Security Feature: Keyswitch operation.
  10. Car Enclosures:
    - a. Platform Width: 5'-9"
    - b. Platform Depth: 5'-0"
    - c. Inside Height: 96 inches to underside of ceiling.
    - d. Front Walls (Return Panels): Satin stainless steel, No. 4 finish.
    - e. Car Fixtures: Satin stainless steel, No. 4 finish
    - f. Side and Rear Wall Panels: Satin stainless steel, No. 4 finish.
    - g. Door Faces (Interior): Satin stainless steel, No. 4 finish
    - h. Ceiling: Luminous ceiling
    - i. Handrails: 1/2 by 2 inches (13 by 50 mm) rectangular satin stainless steel, at sides and rear of car.
    - j. Floor prepared to receive resilient flooring (specified in Section 096500 "Resilient Flooring").
  11. Hoistway Entrances:
    - a. Width: 36 inches (914 mm)
    - b. Height: 84 inches (2134 mm)
    - c. Type: Single-speed side sliding
    - d. Frames Satin stainless steel, No. 4 finish.

- e. Doors Satin stainless steel, No. 4 finish
- 12. Hall Fixtures Satin stainless steel, No. 4 finish.
- 13. Additional Requirements:
  - a. Provide inspection certificate in car, mounted under acrylic cover with frame made from satin stainless steel, No. 4 finish

## 2.4 TRACTION SYSTEMS

- A. Elevator Machines: Variable-voltage, variable-frequency, ac-type hoisting machines and solid-state power converters.
  - 1. Limit total harmonic distortion of regenerated power to 5 percent per IEEE 519.
  - 2. Provide means for absorbing regenerated power when elevator system is operating on standby power.
- B. Fluid for Hydraulic Buffers: If using hydraulic buffers, use only fire-resistant fluid.
- C. Machine Beams: Provide framing to support elevator hoisting machine and deflector sheaves from the building structure. Comply with Section 055000 "Metal Fabrications" for materials and fabrication.
- D. Guides: Roller guides or polymer-coated, nonlubricated sliding guides Provide guides at top and bottom of car and counterweight frames.

## 2.5 OPERATION SYSTEMS

- A. General: Provide manufacturer's standard microprocessor operation systems as required to provide type of operation indicated.
  - 1. Products: Subject to compliance with requirements, provide one of the following.
    - a. ThyssenKrupp Elevator; Trafomatic. - Bases of Design
    - b. KONE Inc.; KCM 831.
    - c. Mitsubishi Electric Corporation; Sigma AI-2200C.
    - d. Otis Elevator Co.; Elevonic.
- B. Auxiliary Operations: In addition to primary operation system features, provide the following operational features for elevators where indicated:
  - 1. Single-Car Battery-Powered Lowering: If power fails and car is at a floor, it remains at that floor, opens its doors, and shuts down. If car is between floors, it is lowered to the next floor below, opens its doors, and shuts

- down. System includes rechargeable battery and automatic recharging system.
- 2. Independent Service: Keyswitch in car-control station removes car from group operation and allows it to respond only to car calls.
- C. Security Feature: Security feature shall not affect emergency firefighters service.
  - 1. Keyswitch Operation: Push buttons are activated and deactivated by security keyswitches at car-control stations.

## 2.6 DOOR REOPENING DEVICES

- A. Infrared Array: Provide door reopening device with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more light beams shall cause doors to stop and reopen.
- B. Nudging Feature: After car doors are prevented from closing for predetermined adjustable time, through activating door reopening device, a loud buzzer shall sound and doors shall begin to close at reduced kinetic energy.

## 2.7 CAR ENCLOSURES

- 1. Provide standard railings complying with ASME A17.1/CSA B44 on car tops where required by ASME A17.1/CSA B44.
- B. Materials and Finishes: Manufacturer's standards, but not less than the following:
  - 1. Stainless-Steel Wall Panels: Flush, hollow-metal construction; fabricated from stainless-steel sheet.
  - 2. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet.
  - 3. Sight Guards: Provide sight guards on car doors.
  - 4. Sills: Extruded aluminum, with grooved surface, 1/4 inch (6.4 mm) thick.
  - 5. Luminous Ceiling: Fluorescent light fixtures and ceiling panels of translucent acrylic or other permanent rigid plastic.
  - 6. Handrails: Manufacturer's standard handrails, of shape, metal, and finish indicated.

## 2.8 HOISTWAY ENTRANCES

- A. Hoistway Entrance Assemblies: Manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Frame size and profile shall accommodate hoistway wall construction.

1. Where gypsum board wall construction is indicated, frames shall be self-supporting with reinforced head sections.
- B. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies shall comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing at as close-to-neutral pressure as possible according to NFPA 252 or UL 10B.
1. Fire-Protection Rating: 2 hour with 30-minute temperature rise of 450 deg F (250 deg C)].
- C. Materials and Fabrication: Manufacturer's standards, but not less than the following:
1. Stainless-Steel Frames: Formed from stainless-steel sheet.
  2. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet
  3. Sight Guards: Provide sight guards on doors matching door edges.
  4. Sills: Extruded aluminum, with grooved surface, 1/4 inch (6.4 mm) thick.
  5. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M.

## 2.9 SIGNAL EQUIPMENT

- A. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Fabricate lighted elements with LEDs.
- B. Car-Control Stations: Provide manufacturer's standard recessed car-control stations. Mount in return panel adjacent to car door unless otherwise indicated.
1. Provide "No Smoking" sign matching car-control station, with text and graphics as required by authorities having jurisdiction.
- C. Emergency Communication System: Two-way voice communication system, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.
- D. Firefighters' Two-Way Telephone Communication Service: Provide flush-mounted cabinet in each car and required conductors in traveling cable for firefighters' two-way telephone communication service specified in Section 283111 "Digital, Addressable Fire-Alarm System."
- E. Car Position Indicator: Provide illuminated, digital-type car position indicator, located above car door or above car-control station. Also, provide audible signal to indicate to passengers that car is either stopping at or passing each of



the floors served. Include travel direction arrows if not provided in car-control station.

- F. Hall Push-Button Stations: Provide hall push-button stations at each landing as indicated.
- G. Hall Lanterns: Units with illuminated arrows; but provide single arrow at terminal landings. Provide the following:
  - 1. Manufacturer's standard wall-mounted units, for mounting above entrance frames.
  - 2. Units mounted in both jambs of entrance frame
- H. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.
- I. Standby Power Elevator Selector Switches: Provide switches, as required by ASME A17.1/CSA B44, where indicated. Adjacent to switches, provide illuminated signal that indicates when normal power supply has failed.
- J. Fire-Command-Center Annunciator Panel: Provide panel containing illuminated position indicators for each elevator, clearly labeled with elevator designation; include illuminated signal that indicates when elevator is operational and when it is at the designated emergency return level with doors open. Provide standby power elevator selector switch(es), as required by ASME A17.1/CSA B44, adjacent to position indicators. Provide illuminated signal that indicates when normal power supply has failed.
- K. Emergency Pictorial Signs: Fabricate from materials matching hall push-button stations, with text and graphics as required by authorities having jurisdiction. Provide one sign at each hall push-button station unless otherwise indicated.

## 2.10 FINISH MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, commercial steel, Type B, exposed, matte finish.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, commercial steel, Type B, pickled.
- C. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.
- D. Stainless-Steel Bars: ASTM A 276, Type 304.
- E. Stainless-Steel Tubing: ASTM A 554, Grade MT 304.
- F. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.
- B. Lubricate operating parts of systems, including ropes, as recommended by manufacturers.
- C. Leveling Tolerance: 1/8 inch (3 mm), up or down, regardless of load and travel direction.
- D. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.
- E. Locate hall signal equipment for elevators as follows unless otherwise indicated:
  - 1. For groups of elevators, locate hall push-button stations between two elevators at center of group or at location most convenient for approaching passengers.
  - 2. Place hall lanterns either above or beside each hoistway entrance.
  - 3. Mount hall lanterns at a minimum of 72 inches (1829 mm) above finished floor.

### 3.2 FIELD QUALITY CONTROL

- A. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.

### 3.3 PROTECTION

- A. Temporary Use: Comply with the following requirements for elevator used for construction purposes:
  - 1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
  - 2. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
  - 3. Engage elevator Installer to provide full maintenance service.

4. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

#### 3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain elevator.

#### 3.5 MAINTENANCE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 24 months full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity.

END OF SECTION 142100



## **SECTION 220100**

### **GENERAL CONDITIONS**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section.

##### **1.1 GENERAL CONDITIONS**

- A. Before submitting a proposal, Bidders shall examine all Drawings related to this work and shall become fully informed as to the extent and character of the work required and its relation to the other work in the building.
- B. Before commencing work, the Contractor will examine all conditions of the project upon which his work is in any way dependent for perfect workmanship according to the intent of this Specification. No "waiver of responsibility" for incomplete, inadequate or defective adjoining work will be considered unless notice has been filed by this Contractor and acceded to by the Owner's representative in writing before the Contractor begins any part of the work.
- C. The Contractor will pay for all licenses, permits and inspection fees required by civil authorities having jurisdiction. Comply with all laws, ordinances, regulations, fire underwriters requirements applicable to work herein specified without additional expense to the Owner. (Also local building code requirements.).
- D. It is specifically intended that anything (whether material or labor) which is usually furnished as a part of such equipment as is hereinafter called for (and which is necessary for the completion and proper operation) shall be furnished as part of this Contract without additional cost the Owner, whether or not shown in detail on the Drawings or described in the Specifications.
- E. When Drawings and Specifications conflict or there is a question as to the proper intent of this Contract, the Contractor shall assume the more expensive method in his pricing. All questions shall be directed to the Architect/Engineer in writing only and only up to ten (10) days prior to bidding.
- F. The Drawings indicate the general runs of the piping, ductwork, etc. systems and the location of equipment and apparatus, but it shall be understood that the right is reserved by the Architect/Engineer to change the location of piping work, ductwork, equipment and apparatus to a reasonable extent as building conditions may dictate, prior to their installation without extra cost to the Owner.
- G. Small scale drilling through walls and floors which may contain asbestos shall be performed by a person with a "restricted asbestos handler allied trades certificate" and shall have a copy of it in his possession at all times while working on the project.

- H. Any changes from the Drawings and Specifications and any interpretation thereof shall have the prior approval of the Architect/Engineer. The Contractor shall submit in writing, at the time of signing the Contract, any items of necessary labor and materials, which, in his opinion, are lacking in requirements of the Drawings and Specifications to insure a complete job in all respects. No consideration will be granted to alleged misunderstanding of materials to be furnished, work to be done, or conditions to be complied with, it being understood that the tender of a proposal carries with it the agreement to all items and conditions referred to herein, or indicated on the accompanying Drawings.

END OF SECTION 220100

## **SECTION 220125**

### **SCOPE OF WORK**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section.

##### **1.1 SCOPE OF WORK**

- A. The work under this section includes all labor, materials, equipment, tools, transportation, cutting and patching, excavation and backfill and the performance of all work necessary and required for the furnishing and installation complete of all Plumbing and Drainage work as shown on Contract Drawings, as specified herein and as otherwise required by job conditions or reasonably implied, including but not necessarily limited to the following:
1. Provide complete new and altered sanitary, storm and vent piping from all new plumbing fixtures connecting to existing sanitary and vent system. See front end spec for bedding requirements.
  2. Provide complete new and altered hot and cold water piping to all new plumbing fixtures, equipment, etc. as indicated.
  3. Provide new and altered gas service and piping and removal of existing as indicated.
  4. Provide transformer and wire to auto-faucets and flush valves for complete installation. Connect to Junction box by Electrical Contractor. Select proper transformer based on number of fixtures. All low voltage wiring by Plumbing Contractor. Furnish access door of proper size for GC to install. Coordinate with Electrical Contractor and General Contractor.
  5. Provide all new plumbing fixtures where indicated, complete including traps, stops, drains, strainers, tailpieces, faucets, escutcheons, etc.
  6. Provide complete new piping and final connections to equipment furnished under other Divisions.
  7. Provide all demolition, removal disconnecting, capping, sealing of all existing plumbing piping, apparatus, equipment, fixtures, specialties, accessories, etc. which are not included or incorporated in the new layout.
  8. Provide all required temporary connections to maintain all plumbing services without interruption.
  9. Pipe insulation.
  10. Tests and adjustments.

11. This Contractor shall obtain all permits, bonds, approvals, etc. at no additional cost to the Owner.
  12. This Contractor shall provide shop drawings for all plumbing fixtures, piping, valves, insulation, equipment, etc.
  13. Furnish minimum 18" x 18" access doors for all valves, cleanouts, etc. in all inaccessible walls, ceilings, etc. Installation by General Contractor.
  14. Cutting and Patching: See Front End Specifications for Trade Responsibilities.
  15. Excavation and Backfill: See Front End Specifications for Trade Responsibilities.
  16. Fire stopping per FM/UL and NFPA. See Front End Specifications for Trade Responsibilities.
- B. Coordination Drawings: Attention is directed to Division 1 for coordination drawing requirements for this project. These drawings are critical to the proper execution of the work and failure to honor these requirements may become the basis for denial of any and all claims for either or both "time" and "money".
- 1.2 ALTERATION WORK
- A. All equipment, piping, plumbing, fixtures, etc. to be removed, shall be disposed of or salvaged as directed by the Owner. They shall not be removed from the premises without Owners approval.
  - B. All piping to be removed shall be properly plugged or capped so that upon completion of all new work, all abandoned piping shall be concealed in finished areas.
  - C. No dead ends shall be left on any piping upon completion of job.
  - D. The existing systems shall be left in perfect working order upon completion of all new work.
  - E. Location and sizes of existing piping are approximate. Exact sizes and locations of all existing piping shall be verified on the job.
  - F. All removals shall be removed from the site.

END OF SECTION 220125



## **SECTION 220130**

### **WATER SUPPLY SYSTEM**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

##### **1.1 DESCRIPTION OF WORK**

- A. Furnish and install a complete cold-water distribution system to supply water to all new fixtures, water consuming equipment, and valved outlets for the use of other trades and connect to existing piping.
- B. The water supply system shall be complete with all pipe, fittings, valves, mains, risers, branches, shock absorbers, air chambers, hangers, anchors, expansion loops, connections to existing piping, covering, tests, etc. all as shown on the Drawings, as hereinafter specified.
- C. Furnish and install a complete hot water distribution system to supply water to all new fixtures and equipment requiring heated water.

#### **PART 2 - PRODUCTS**

##### **2.1 PIPING, FITTINGS AND MATERIALS**

- A. All components of water supply system shall confirm to all "No Lead" requirements including NSF/ANSI-372.
- B. The domestic water systems shall be of the following material and shall be in accordance with the latest ASTM and ASME Standards.
- C. Domestic water piping within the buildings shall be seamless drawn or extruded tubing type "L" copper. Both shall be of Chase, Anaconda, Revere, and approved equal, hard temper ASTM B88 with solder joint sweat end fittings. Fittings for use with copper tubing shall be cast brass of Muellers "Streamlin" pattern or approved equal.
- D. Joints for copper tubing shall be made with 95-5 (lead and antimony free) solder. Flanges where required shall be cast brass. Provide dielectric adapters between ferrous and non-ferrous pipe joints.

##### **2.2 VALVES**

- A. All shut-off valves 2" and smaller shall be ball valves equal to Apollo 70 Series or Milwaukee BA100 Series Valve. Bronze body with chrome plated trim
- B. This Contractor shall furnish all valves as indicated on the Drawings, or as may be required for the proper control of the pipe lines installed under this Specification, so that any fixture, line or piece of apparatus may be cut out for repair without interference or interruption of the service to the rest of the Facility.

- C. All domestic water valves shall have a minimum working pressure of 125 psig, steam rated unless otherwise noted on the Drawings or specified herein. All valves shall be of one manufacture as manufactured by Milwaukee Valve or Hammond.
- D. All gate valves within the buildings shall be wedge gauge valves with painted iron wheel handles, shall have gland followers in stuffing boxes, and shall be so constructed that they may be repacked while open and under pressure. All valves shall have the name of the manufacturer and working pressure cast or stamped thereon.
- E. All gate valves shall be all bronze with sweat or screwed joint ends as required by the piping system in which they are installed.
- F. Globe valves shall be of all bronze with composition disc, threaded or sweat joint ends as required by piping system in which they are installed.
- G. Check valves shall be all bronze swing check type with threaded or sweat joint ends. Check valves 4 inch and larger shall be iron body bronze mountings and shall be provided with screwed or flanged joint ends as required by piping system in which they are installed.
- H. Drain valves, at risers and at low points, shall be 3/4 inch heavy cast brass with composition washers with male thread for hose connections.

## 2.3 SHOCK ABSORBERS

- A. Shock absorbers shall be similar and equal to J.R. Smith 5000 series or Zurn Z1700 series with stainless steel pressurized shell sized in accordance with P.D.I. Bulletin WH-201.
- B. Provide shock absorbers on all fixtures and equipment having quick closing valves whether or not indicated on the Drawings.
- C. Provide access doors where shock absorbers are concealed.

## 2.4 VACUUM BREAKERS

- A. Provide vacuum breakers on water supply piping to each fixture and equipment with submerged inlets, and on faucets and outlets, within the facility to which hose can be, or is attached forming a submerged inlet.
- B. Set vacuum breakers in exposed readily accessible locations at least four inches above floor rim level of fixture, or high point of equipment.
- C. Vacuum breakers shall be chrome-plated brass. "Watts" or other approved.
- D. Vacuum breakers under constant pressure shall be of the continuous pressure type No. 9 "Watts" or Wilkins BFP-8CH or approved equal.

## 2.5 EXPANSION JOINTS, ANCHORS AND GUIDES

- A. The entire piping installation shall be installed with adequate provision for expansion. No rigid connections will be permitted. Refer to Drawings for locations of expansion joints and related guides and anchors. The joints, guides and anchors shall be as manufactured by Flexonics Products, Metraflex or Flex-weld.
- B. Branches shall be of sufficient length and have three elbow swings to allow for pipe expansion.
- C. Any breaks in the piping within the guarantee period due to improper provision for expansion must be replaced at the expense of this Contractor, and the conditions corrected to prevent future recurrence.
- D. Any damages to surrounding areas and equipment due to this failure shall also be repaired and paid for at the expense of this Contractor.
- E. Joints to have 150 psi rating, ANSI-B16.5 with liner and cover.

## 2.6 STERILIZATION

- A. The entire domestic water piping system shall be thoroughly sterilized with chlorine before acceptance for domestic operation.
- B. The amount of chlorine applied shall be such as to provide a dosage of not less than 50 parts per million for 24 hours or 200 p.p.m. for one hour. The chlorinating material shall be either liquid chlorine or sodium hypochlorite solution and shall be introduced into the system and drawn to all points of the system. If possible to do so, the lines shall be thoroughly flushed before introduction of the chlorinating material. After a contact period of not less than 24 hours, the system shall be flushed with clean water until the residual content is not greater than 0.2 parts per million. All valves in the lines being sterilized shall be opened and closed several times during the contact period.
- C. Sterilization and tests for purity of water in the entire piping system shall be performed by the Contractor through an approved independent testing laboratory and a certificate shall be furnished to the Architect certifying the quality of purity.
- D. Per ANSI/AWWA Standard C651-05.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. It is the intent that each part of the plumbing system shall be complete in all details and water lines provided with all control valves as indicated on Drawings, or as may be required for the proper control of the pipe lines under this Specification so that any fixture, line or piece of apparatus may be cut out for repair without interference or interruption of the service to the rest of the facility.

- B. This Contractor shall examine carefully the Architectural Drawings in detail and familiarize himself with all conditions relative to the installation of piping, particularly where same is concealed behind furring or in hung ceilings.
- C. In no case shall this Contractor permit his pipes to be exposed beyond finished walls or ceilings unless specifically shown on Drawings. He shall consult with the Contractors of other trades in the building and install his piping in such a way as to least interfere with the installation of other trades.
- D. The water piping shall all be installed so as to drain to a valve provided by this Contractor and branches shall not be trapped but shall have continuous pitch. Where necessary to raise or lower mains, the same shall be provided with a drip and shall be properly valved.
- E. Piping shall be installed, whether indicated or not, so as to rise and/or drop to clear any and all conduits, lighting fixtures, ductwork and heating mains to maintain the desired clear heights. This Contractor shall consult with the Contractors of other trades and facilitate the erection of the equipment and piping.
- F. Run piping straight and as direct as possible, in general forming right angles with or parallel to walls or other piping. Risers shall be erected plumb and true.
- G. After cutting, all pipes shall be reamed out to full bore and before erection the inside of all pipes shall be thoroughly cleaned.
- H. No piping or work shall be concealed or covered until all required tests have been satisfactorily completed and work has been approved by the Architect.
- I. All materials shall be new and installed in a first class manner.
- J. In erecting pipe, friction wrenches and vises shall be used exclusively, and any pipe cut, dented or otherwise damaged shall be replaced by this Contractor.
- K. All ferrous to non-ferrous pipe connections shall be made with approved dielectric pipe or flange unions isolating joints to prevent any electrolytic action between dissimilar materials.
- L. Any piece of pipe 6 inches in length or less shall be considered a nipple. All nipples with unthreaded portion 1-1/2 inch and less shall be of weight corresponding to fitting connected. Only shoulder nipples shall be used, close nipples will not be accepted.
- M. Revised water service shall be in accordance with the local water supply department requirements. All water lines are to be protected from freezing. Install new piping for water service below frost line and provide concrete separations when crossing other utilities. Provide concrete thrust mass at changes of pipe direction conforming to authorities having jurisdiction.

END OF SECTION 220130

## **SECTION 220150**

### **SANITARY AND STORM DRAINAGE SYSTEMS**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

##### **1.1 DESCRIPTION OF WORK**

- A. The work under this section includes all labor, materials, equipment and appliances necessary and required to completely install all drainage systems as required by the Drawings; code and as specified herein, including but not limited to the following:
- B. Complete sanitary drainage and venting systems including connections to the existing sanitary drainage and venting systems.
- C. Piping and final connections for equipment furnished under other Divisions.
- D. Alterations and removals to existing sanitary and vent systems.
- E. Tests.

#### **PART 2 - PRODUCTS**

##### **2.1 PIPING, FITTINGS AND MATERIALS**

- A. All indoor underground storm soil, waste and vent piping shall be service weight cast iron with fittings of bell and spigot type. All exterior underground storm soil and waste piping shall be extra heavy cast iron. Each length shall have the size, weight per foot and the manufacturer's name clearly cast or stamped thereon. Fittings and traps shall be similarly marked and of corresponding weights.
- B. All aboveground storm, soil, waste and vent piping and fittings 3" and larger shall be service weight and fittings of bell and spigot type as specified in paragraph above. Above ground waste and vent piping 2" and smaller shall be galvanized steel, fittings on waste piping shall be galvanized cast iron, recessed drainage pattern, fitting on vent piping shall be galvanized cast iron, beaded pattern, screwed joints shall be made up to be perfectly tight without the use of lead or filler of any kind, except oil or graphite. Nipples for galvanized pipe shall be shoulder type. No close nipples shall be permitted.
- C. Joints shall be made with compression gaskets conforming to the International Plumbing Code (IPC 705.4.2. See 2.1, E. for aboveground joint options where permitted.
- D. All galvanized pipe and fittings shall be galvanized with prime western spelter by hot drip process.

E. The Contractor has the option of using the following types of joints with hubless cast iron pipe only if approved by the governing agencies. These joints shall be used throughout the project. No mixing of joints shall be permitted.

1. Neoprene gasketed joints similar to Ty-Seal (for above and underground application).
2. Hubless cast iron pipe with neoprene gaskets and stainless steel clamps (by Clamp-All or equal) above ground only. All in accordance with Cast Iron Soil and Pipe Institute Standard 301 latest edition. Hangers and supports shall be in accordance with manufacturer's recommendations.
3. Copper DWV system with 50-50 tin antimony solder, DWV with solvent welded or screwed joints meeting CS-270-65.

F. Pump Discharge Piping

1. Piping: Galvanized steel pipe, Schedule 40 with marker's name rolled into each length.
2. Fittings
  - a. Threaded: Galvanized malleable iron with flat band steam pattern. Cast iron drainage pattern for waste piping.
  - b. Mechanical Joints: Victaulic couplings style 07 for grooved piping only, with gasket.
  - c. Bolted flange with gasket.
3. Joints: Teflon tape for threaded, Victaulic couplings for gasket for mechanical joint.
4. Application: Schedule 40 steel for sewage ejector and sump pump discharge.

## 2.2 CLEANOUTS

- A. Provide easily accessible cleanouts where indicated at base of vertical stacks at ends of horizontal drainage lines and at intervals not exceeding 50 ft.; at each change of direction; on handholes of running traps, and where necessary to make entire drainage system accessible for rodding. Provide at least 18" clearance to permit access to cleanout plugs.
- B. Cleanouts for cast iron pipe shall consist of tarpped extra heavy cast iron ferrule caulked into cast iron fittings and extra heavy brass tapered screw plug with solid hexagonal unit. Cleanouts for wrought iron pipe shall consist of extra heavy brass screw plug in drainage fitting.
- C. Cleanouts turning out through walls and up through floors shall be made by long sweep ells or "Y" and 1/8 bends with plugs and face or deck plates to conform to Architectural finish in the room. Where no definite finish is indicated on the Architectural and/or Mechanical Drawings, wall plates shall be chrome plated cast brass and floor plates shall be nickel bronze.

- D. Cleanouts shall be full size at the pipe up to 6" inclusive. On larger size piping 6" size plugs shall be used.
- E. Cleanout fittings in vertical stacks shall consist of tapped tees capable of receiving a rough brass raised head cleanout plug, J.R. Smith S-4730, Zurn Z1445-A-BP or approved equal.
- F. All cleanout plugs shall be brass lubricated with graphite before installation.
- G. Cleanouts occurring in cast iron soil pipe above floor at change of direction of pipe run and at ends of horizontal runs shall be J.R. Smith S-4425, Zurn Z1441-A-BP or approved equal with cast iron ferrule for caulk connection and fitted with a straight threaded tapered bronze plug with raised hex head.
- H. Cleanout deck plates for finished areas shall be similar and equal to J.R. Smith 4020 series, Zurn ZB1400-X or approved equal with cast iron ferrule, scoriated cutoff sections, brass cleanout plus collar with brass bolts for waterproofed slabs. In tile floor areas the cleanout deck plates shall be recessed to tile.

## 2.3 FLASHING

- A. Provide 6 lb. lead flashing extending at least 10" beyond edge of all floor drains and vents through roof and all floor sleeves in floors with waterproofing or vapor barriers. Flashing shall be held securely in by clamping devices.
- B. All floor drains shall be provided with flashing rings and 24" square 6 lb. sheet lead flashing, properly flashed into flashing ring of the drain.

## 2.4 SANITARY DRAINAGE

- A. A complete system of drainage shall be provided as shown on the Drawings. The system shall include all drains, leaders, branches, house drains with all pipe fittings, hangers, anchors, etc. to make a complete sanitary drainage system. The systems shall extend through house drains and terminate as indicated on the Drawings.
- B. Piping shall be sizes as indicated on the Drawings. The sanitary drains shall have a pitch of 1/8" per ft. minimum unless otherwise noted. Branch connections to stacks and house drains shall pitch a minimum of 1/8" per ft.

## 2.5 PIPING AND FITTINGS

- A. Provide piping of one of the following materials, of weight/class indicated. Provide pipe fittings and accessories of same material and weight/class as pipes, with joining method as indicated.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF PIPING

- A. The size of soil, waste and vent piping shall be as determined by the State codes, rules and regulations for plumbing and drainage, except where specifically noted to be larger by the Specifications or Drawings and all fixed rules of installation, as set forth in the codes, rules and regulations, shall be followed as part of the Specifications.
- B. This Contractor shall carefully examine the Architectural plans in detail and familiarize himself with all conditions relative to the installation of piping, particularly where same is concealed behind furring or in hung ceilings.
- C. In no case shall this Contractor permit his pipes to be exposed beyond finished plaster lines unless specifically shown on Drawings. He shall consult with the Contractors of other trades in the building and install his piping in such a way as to least interfere with the installation of other trades.
- D. Piping shall be installed, whether indicated or not, so to rise and/or drop to clear any and all conduits, lighting fixtures, ductwork and heating mains to maintain the desired cleat heights. This Contractor shall consult with the Contractors of other trades and facilitate the erection of the equipment and piping.
- E. Run piping straight and as direct as possible in general forming right angles with or parallel to walls or other piping. Risers and stacks shall be erected plumb and true. After cutting, all pipes shall be reamed out to full bore and before erection the inside of all pipes shall be thoroughly cleaned.
- F. No piping or work shall be concealed or covered until all required tests have been satisfactorily completed and work has been approved by the Architect and all other authorities having jurisdiction.
- G. Branch connections shall be made with "Wye" and long "Tee-Wye" fittings, short 1/4 bends, common offsets and double hubs will not be permitted. Short "Tee-Wye" fittings are to be used in vertical piping only. All fittings shall conform to code requirements.
- H. Cleanouts shall be provided at foot of all stacks, at changes of directions, at the ends of branch runs where shown and as required by code, and shall be terminated as described under cleanouts.
- I. The house drains must be run at a minimum grade of 1/8" per ft. downward in the direction of flow. Wherever possible, a 1/4" per ft. pitch shall be maintained. Branch connections to stacks from fixtures shall pitch 1/4" per ft. where possible. Attention is again called to the necessity of maintaining the ceiling heights established.
- J. Furnish and install complete systems of vent pipes from the various plumbing fixtures and other equipment to which drainage connections are made. Vent pipes shall be connected to the discharge of each trap and shall be carried to a point above the ultimate overflow level of the fixture before connecting with any other vent pipe; in general, this will be approximately 3'-6" above the finished floor. Branches shall be arranged to pitch back to fixtures.



- K. The individual vent pipes shall be collected together in branch vent lines and connected to existing vent connections through roof.
- L. Any existing vents through roof, damaged, or if flashing on roof comes loose while connecting new vent to them shall be repaired and reflashed to the roof as required to maintain waterproofing the satisfaction of the Architect.

END OF SECTION 220150



## **SECTION 220190**

### **NEW GAS CONNECTIONS AND ASSOCIATED WORK**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

##### **1.1 DESCRIPTION OF WORK**

- A. Furnish and install a gas piping system to boilers, rooftop units and other equipment as shown on Drawings.
- B. All new piping shall be schedule 40 steel, standard weight threaded malleable iron fittings for sizes 2-1/2" and smaller. For sizes 3" and larger joints shall be welded.
- C. All work in this section shall comply with NFPA-54.

#### **PART 2 - PRODUCTS**

NOT USED.

#### **PART 3 - EXECUTION**

##### **3.1 TESTING**

- A. Gas piping shall be tested with air using an air pump and mercury gauge. Tests shall be made by the Contractor with his equipment when directed by the Owner/Inspector/Construction Manager. Testing shall be done with 100 psig pressure (low pressure side) for a period of one hour, and follow Utility Company procedures and all Plumbing Code requirements. Certify and submit written test results to Architect/Engineer. Indicate that system is functioning properly, and has been installed in accordance with NFPA, and all applicable codes.
- B. Contactor is responsible for maintaining gas pressure in existing gas piping to remain in accordance with utility company requirements, whether valving off pilot lights, using bottled gas, etc. Utility fees and re-testing existing piping as required is Contractors responsibility.

END OF SECTION 220190



## **SECTION 220300**

### **PLUMBING FIXTURES AND EQUIPMENT**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

##### **1.1 DESCRIPTION OF WORK**

- A. The work under this section shall consist of furnishing all labor, materials, equipment and appliances necessary and required to completely do all plumbing fixture work, as required by the Drawings and as specified herein, including but not limited to the following: plumbing fixtures, traps, fittings, trimmings, brackets, plates, anchor, chair carriers and supports.
- B. Just before the Owner's taking over the work in the building, this Contractor shall thoroughly clean all fixtures furnished and set under this Contract, leaving every fixture in perfect condition and ready for use.
- C. Submit shop drawings and roughing sheets for all equipment for checking and approval.

#### **PART 2 - PRODUCTS**

##### **2.1 PLUMBING FIXTURES AND EQUIPMENT**

- A. All fixtures shall be free from imperfections, true as to line angles, curves and color, smooth, watertight, complete in every respect and practically noiseless in operation, Fixtures specified are given as the typical standard required as manufactured by American Standard and they or other similar approved fixtures as made by Kohler or Eljer Companies shall be furnished, set and connected in good substantial, neat workmanlike manner.
- B. The letter designations hereinafter correspond with the schedule on the Drawings.
  - 1. Water Closet - Type A1  
Flush valve type, wall mounted Zurn model Z 5615 vitreous china, siphon jet action, elongated bowl, 1-1/2" top spud, Sloan 111ESS, 1.6 GPF hard wired low consumption flush valve, open front seat cover. Provide floor mounted carrier equal to Zurn Z1203 series or Z1204 series.
  - 2. Water Closet - Type A2 (Handicapped) Same as above except Handicapped.
  - 3. Floor Mounted Water Closet - Type A3  
Flush valve type, floor mounted Zurn model Z.WC4M, Z5655-BWL vitreous china, siphon jet action elongated bowl, 1-1/2 " top spud, Sloan 111ESS, 1.6 GPF hard wired low consumption flush valve, open front seat cover.

4. Single Sink Unit - Type B1 (Handicapped)  
Zurn Sundara model Z5001.01 single basin, stainless steel shroud, Sloan model ETF-600 hard wired faucet and floor mounted carrier.
5. Double Sink Unit - Type B2  
Zurn Sundara model Z5001.02 double basin, stainless steel shroud, (2) Sloan model ETF -600 hard wired faucets and floor mounted carriers.
6. Triple Sink Unit - Type B3 (Handicapped)  
Zurn Sundara model Z5001.03 tripe basin, stainless steel shroud, (3) Sloan model ETF-600 hard wired faucets and floor mounted carriers.
7. Single Bowl Stainless Steel Sink - Type B4  
Elkay model no. DLR-1722, 18 gauge stainless steel type 302, self-rimming single bowl, Chicago Faucet model no. 404A-317, 8-inch center, 5-inch spout, 317 4-inch blade handles, E12 aerator.
8. Urinal - Type C  
Zurn model Z5755-U white vitreous china, siphon jet urinal, wall hanger, 3/4" top spud, outlet connection threaded 2" inside, Sloan 186ESS, 1.0 GPF hard wired low consumption flush valve with vacuum breaker and angle stop, Zurn Z-1222 concealed chair carrier.
9. Electric Water Cooler – Type D (Handicapped)  
Elkay Single EZH20 Bottle Filling Station with B1-Level Reverse Filtered LZ Cooler Model LZS8WSLK.
10. Self-Contained Eye Wash - Type E  
Encon "Aquarion" model no. AQ100. Provide 11" x 17" sign.
11. Floor Drains:  
Josam series 30000S coated cast iron, two piece body with double drainage flange, flashing collar, weepholes, bottom outlet and adjustable square strainer.
12. Wall Hydrants (Interior): J.R. Smith model 5518 narrow wall recessed bronze nickel plated quarter turn with 3/4" hose connection, integral vacuum breaker with vandal resistant cap and T-handle key and lockable cover.
13. Under Counter I-Lab Pump:  
Equal Zoeller Pump model 152, 10 gpm @ 35 ft. of head, 5 gallon capacity, basin, 4/10 hp, 1550 rpm, 120/1/60, built in switch, stainless steel shaft, bronze bearing and no clog impeller and Electrical cord.
14. Elevator Sump Pump:  
"Oil Minder" by Stancor Model AHS-05 with plug for outlet. Oil sensor to send signal to alarm panel and prevent operation when oil is detected. Vertical float switch 10 gpm @ 20ft. HD, 1/2 hp, 120/1/60. Type K NEMA enclosure. Mount panel in elevator machine room. Coordinate pit size with General Contractor.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. All fixtures shown on Drawings shall be set, connected and tested by the Contractor. He shall also make all water; soil, waste, vent and other service connections to fixtures as shown on Drawings or as directed and shall set, furnish, connect and test all necessary fittings.
- B. All pipes at fixtures passing into walls, floors or partitions shall be provided with heavy cast brass escutcheons and security (tamperproof) set screws finished to match the pipe. No "waiving" of this section will be permitted.
- C. All fittings escutcheons, faucets, traps, exposed piping etc. shall be brass, chrome plated over nickel plate with polished finish. Any visible hanger nuts shall be security (tamperproof) type and shall likewise be chrome plated over nickel plate.
- D. This Contractor shall be responsible for protecting all plumbing fixtures including in these Specifications against injury from the building materials, tools and equipment. Any fixtures damaged during the construction period shall be replaced new. After all fixtures are set, this Contractor shall carefully grout all around fixtures.

END OF SECTION 220300





## **SECTION 220310**

### **BACKFLOW PREVENTERS**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

##### **1.1 SUBMITTALS**

- A. Product Data: Manufacturers catalog sheets, specifications, and installation instructions for each type backflow preventer.
- B. Approval: Local water utility company and local department of health.

##### **1.2 QUALITY ASSURANCE**

- A. Regulatory Requirements
  - 1. Comply with the State Department of Health Sanitary Code for Cross Connection Control, and the other standards listed in Part 2 of this Section.
  - 2. Where conflicts occur between the referenced standards, the most stringent requirements shall apply.

##### **1.3 MAINTENANCE**

- A. Special Tools (as furnished or recommended by the backflow preventer manufacturer). Deliver to the Owner's Representative:
  - 1. Test Kit B: Sight tube, of required length, for testing backflow preventer for proper operation, and printed procedure for conducting test.
  - 2. Test must be performed by a Certified tester.

#### **PART 2 - PRODUCTS**

##### **2.1 BACKFLOW PREVENTER**

- A. Reduced pressure backflow preventer on cold water make up line to boilers equal to Watts series LF909, with removable bronze seats, stainless steel internal parts and resilient wedge shut-off valves. Other acceptable manufacturers are Febco Inc. and Wilkins/Zurn Industries Inc.
- B. RPZ Discharge Funnel  
RPZ discharge funnel with trap J.R. Smith 3812 or approved equal Duco coated cast iron

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install the work of this section in accordance with the manufacturer's printed installation instructions and local water utility co. and department of health.
- B. Anchor piping to structure at each elbow to secure in the event of a pressure surge.

### 3.2 FIELD QUALITY CONTROL

- A. Operation Test: Test kit as specified under Part 1 of this section may be used. Conduct test in the presence of the Owner's Representative.
  - 1. Type B Backflow Preventer: Test the device with the test kit in accordance with the manufacturer's test procedure.
- B. Re-testing: Repair or replace any device failing the operation test, and repeat the test.

END OF SECTION 220310

## **SECTION 220420**

### **SUPPORTS, SLEEVES AND PLATES**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

##### **1.1 DESCRIPTION OF WORK**

- A. This Contractor shall furnish and install all plates, hangers and supports for his piping.
- B. All piping shall be hung or supported from structural members only.

#### **PART 2 - PRODUCTS**

##### **2.1 PIPING**

- A. All piping shall be supported from building structure in a neat and workmanlike manner wherever possible, parallel runs of horizontal piping shall be grouped together on trapeze hangers. Vertical risers shall be supported at each floor line with steel pipe clamps. Use of wire perforated metal to support pipes will not be permitted. Hanging pipes from other pipes will not be permitted.
- B. Necessary structural members, hangers and supports of approved design to keep piping in proper alignment and prevent transmission of injurious thrusts and vibrations shall be furnished and installed. In all cases where hangers, brackets, etc., are supported from concrete construction, care shall be taken not to weaken concrete or penetrate waterproofing.
- C. All hangers and supports shall be capable of screw adjustment after piping is erected. Hangers supporting piping expanding into loops, bends and offsets shall be secured to the building structure in such a manner that horizontal adjustment perpendicular to the run of piping supported may be made to accommodate displacement due to expansion. All such hangers shall be finally adjusted, both in the vertical and horizontal direction, when the supported piping is hot.
- D. Pipe hangers shall be as manufactured by Grinnell, whose catalog numbers are given herein, or equivalent Carpenter and Paterson, or F&S Mfg. Co.
- E. Piping shall be supported as follows unless otherwise indicated on the Drawings:
  - 1. Piping: 1-1/2 inch and smaller Fig. #260 adjustable clevis hanger. 2 inch and larger Fig. #174 one-rod swivel roll hanger.
  - 2. Two-rod hangers shall be used for piping close to the ceiling slab or where conditions prohibit use of other hanger types.
  - 3. Anchors for hanger rods shall be Phillips "Red Head" self-drilling type. Anchors shall be placed only in vertical surfaces.

4. Spacing of pipe supports shall not exceed 6 feet for pipes up to 1-1/2 inch and 10 feet on all other piping.
  5. Hangers shall pass around insulation and a 16 gauge steel protective band; 12 inch long shall be inserted between hangers and insulation.
  6. All piping shall be supported to allow free movement where expanding or contracting. Pipe shall be anchored as required or directed.
  7. All lateral runs of piping shall be securely supported on hangers, rolls, brackets, etc. and in a manner to allow for proper expansion and elimination of vibration.
  8. 2 inch and smaller pipe, where run on walls, shall be supported on wrought iron "J" hook brackets with anchor bolts.
  9. All horizontal pipe, where run overhead or on walls, shall be supported as follows unless otherwise indicated: On adjustable steel clevis type hangers suspended on hanger rods, pipe sizes up to and including 4 inch.
- F. Space limitations in hung ceilings spaces and conditions in other locations may require use of other type of hangers than those specified above. Suitable and approved pipe hangers shall be provided for such job conditions.
- G. All supports shall be fastened to structural members or additional steel supports furnished by this Contractor.
- H. Hanger rods shall be steel, threaded with nuts and lock nuts, sizes in accordance with following schedule:

| <u>Pipe Size</u>        | <u>Rod Size</u> |
|-------------------------|-----------------|
| 3/4" to 2" inclusive    | 3/8"            |
| 2-1/2" and 3" inclusive | 1/2"            |
| 4" and 5" inclusive     | 5/8"            |
| 6"                      | 3/4"            |
| 8" to 12" inclusive     | 7/8"            |

- I. Cast iron piping shall be supported at intervals of not more than (5) feet (at each hub) on straight runs.

## PART 3 - EXECUTION

### 3.1 PIPING

- A. Where pipes pass through masonry, concrete walls, foundations, or floors, this Contractor shall set sleeves as are necessary for passage of pipes. These sleeves shall be of sufficient size to permit insulation where required to be provided around pipe passing through. This Contractor shall be responsible for exact location of these sleeves.
- B. Sleeves shall not be used in any portion of building where use of same would impair strength or construction features of the building. Inserts for supporting lateral pipes and equipment shall be placed and secured to form work, and all sleeves inserts locations shall be thoroughly checked with Architect so as not to conflict with other trades.
- C. Where pipes pass through floor or walls, they shall be provided with chromium plated escutcheons.
- D. Anchor horizontal piping where indicated and wherever necessary to localize expansion or prevent undue strain on branches. Anchors shall be heavy forged construction entirely separate from supports.
- E. Anchor vertical piping wherever indicated and wherever necessary to prevent undue strains on offsets and branches. Anchors, unless otherwise noted shall be heavy steel clamps securely bolted and welded to pipes. Extension ends shall bear on building construction.
- F. Auxiliary steel supports that may be required for all mechanical equipment shall be furnished and installed by this Contractor.
- G. All operating equipment including pumps, piping, etc. shall be supported so as to produce minimum amount of noise transmission.

END OF SECTION 220420



## **SECTION 220430**

### **INSULATION**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

##### **1.1 DESCRIPTION OF WORK**

- A. The work under this section shall consist of furnishing all labor, materials, equipment and appliances necessary and required to completely do all insulation work as required by the Drawings and as specified herein including but not limited to the following: Insulation, covering, bands, tie wire.

#### **PART 2 - PRODUCTS**

##### **2.1 INSULATION**

- A. The materials as specified have been selected from the catalogs of Owens-Corning Fiberglass Corp. and Johns-Manville Sales Corporation and are representative of the quality, design and finish desired. Insulation as manufactured by Gustin Bacon Co., or other approved manufacturer may be submitted for approval provided the product meets fully in all respects (such as density, moisture absorption, alkalinity, thermal-conductivity, jackets) to the materials as delineated below.
- B. All insulation shall be UL rated non-combustible type classified flame spread-25, smoke-developed-50.

##### **2.2 PIPING, FITTINGS AND VALVES**

- A. All insulation thickness shall be in accordance with the latest edition of the New York State Energy Conservation Construction Code.
- B. Minimum pipe insulation shall be:
  - 1. Hot water piping up to 1-1/4" - 1" insulation and piping 1-1/2" and larger - 1-1/2" insulation.
  - 2. Cold water piping up to 1-1/2" - 1/2" insulation and piping 1-1/2" and larger - 1" insulation.
- C. Domestic cold, hot water hot water return indirect waste, storm and piping aboveground. All piping shall be insulated with sectional glass fiber insulation, Owens-Corning 2 piece ASJ/SSL. Joints between sections shall be sealed with factory supplied 3 inch wide sealing strips. Sealing by means of Owens Corning self-sealing lap will also be acceptable. Install (anti-sweat) vapor barriers on all cold water piping.

- D. Domestic hot and cold water valves and fittings - Fittings, valves, etc. shall be insulated with flexible blanket insulation compressed to 1/2 its thickness, tied on with jute twine over which shall be applied a flood coat of Insul-Coustic IC-102 and 10-20 open weave glass cloth. Glass cloth to be finished within additional coat of IC-102. Insulation blanket shall be Owens-Corning wrap.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. All insulation on pipes running through walls, floors, partitions and beams shall be continuous through sleeves and openings.
- B. Insulation shall be installed only after all tests of the piping system have been completed.
- C. All insulation shall fit snugly.
- D. All surfaces shall be clean and dry when insulation is applied.
- E. Longitudinal joints shall be on least conspicuous side off the pipe.
- F. Valves shall be insulated up to the packing unit.
- G. As specified hereinbefore, all horizontal runs of piping will be supported on adjustable clevis or group trapeze type hangers. Pipe hangers will be installed outside of the insulation. Where hangers occur, prefabricated insulation protective saddles shall be "Insul-Shield-Multi-Purpose-Saddle" as manufactured by Insul-Coustic Corp. or approved equal.
- H. Hot and cold water branch piping extending through slab or knockout panels to serve equipment shall be insulated to a point 4 inch above the top of sleeve provided for pipe.
- I. The use of staples shall not be permitted.
- J. It is the intent of this Specification that all vapor barriers be continuous throughout. Reinstate existing piping at point of new pipe connections.

END OF SECTION 220430



## **SECTION 220470**

### **TESTS AND ADJUSTMENTS**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section.

##### **1.1 TESTS AND ADJUSTMENTS**

- A. The Contractor shall, at his own expense, during the progress of the work or upon its completion as ordered make such tests as are specified or as required by and in the presence of the Architects, Building Inspectors, etc. At least 48 hours notice shall be given in advance of all tests.
- B. The Contractors shall provide all apparatus, temporary work or other requirements necessary for all tests. He shall take all due precautions to prevent damage to the building, its contents or the work of the other Contractors, that may be incurred by all tests. This Contractors shall also be responsible for the work of other Contractors that may be damaged or disturbed by the tests or the repair or replacement of his work, and he shall without extra charges, restore to its original condition, any work of other Contractors to do the work of restoration.
- C. Tests on the various systems may be conducted in sections as the work progresses or when the systems are completed.
- D. No caulking of pipe joints to remedy leaks will be permitted except where joints are made with lead and oakum.
- E. Each section of the sanitary, storm and vent piping tested shall have all openings tightly closed with screw plugs, or equal device. The drainage and vent systems shall be filled with water and proven tight under a 10'-0" head for a minimum of four (4) hours. Water level must remain constant through test without adding water.
- F. Upon final completion of the sanitary systems and when all fixtures and appurtenances have been set and the systems are in complete working order, all traps in the systems shall be filled with water and a thick penetrating smoke shall be introduced into the entire system.
- G. As smoke appears at the stack openings on the roof, such openings on the roof shall be tightly closed and a pressure equivalent to 1-1/2 inch of water shall be maintained during the test. Oils of peppermint shall be added at the smoke making machines so that any leakage is readily discernible.
- H. Before any covering is applied to the domestic water piping systems, the entire domestic water piping systems shall be hydrostatically tested for eight (8) hours to a hydraulic pressure of 125 psig.
- I. At the completion of the test, Contractor shall furnish the Owner with one (1) copy of test certificates as issued by the insurance company.

- J. Adjustments: Tests and adjustments shall be repeated as often as necessary until the systems are tight and are to the entire satisfaction of the Plumbing Inspector, Engineers and any other authorities having jurisdiction.
1. Contractor is to thoroughly instruct the building custodian in the proper care and operation of the entire system. Contractor shall prepare for use by custodian, detailed brochures of instructions in non-technical terms, describing the maintenance and operation of all fixtures, apparatus, valves, controls etc. furnished by him.
  2. Should any part of the work performed under this Contract fail to function because of cracked piping, obstructions, debris in piping, leaks in piping or any other cause, this Contractor shall disconnect, clean and reconstruct the work at his own expense and pay for any damages to adjoining work.
  3. Water flow is to be balanced and adjusted to all flush valves, faucets, etc.
  4. All parts of the plumbing system are to be thoroughly flushed until cleared of all grease and sediment and all dirt pockets cleaned. Repeat as often as necessary, open all cleanouts and reset in graphite.
  5. All new motors shall be oiled as required.
  6. All new valves are to have stuffing boxes packed and adjusted.

END OF SECTION 220470

## **SECTION 220480**

### **TAGS, CHARTS AND IDENTIFICATION**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

##### **1.1 TAGS, CHARTS AND IDENTIFICATION**

- A. Every valve installed under this Contract shall be tagged or labeled as follows: Tag shall be etched brass securely fastened to valve handwheels with heavy brass "S" hooks, soldered closed. At lock shield and similar type valves, tags for same shall be securely wired to valve body.
- B. Charts shall be provided for each piping system, as approved and shall consist of schematic diagrams of piping layouts showing and identifying each valve and piece of equipment etc., and its use. Upon completion one (1) copy of diagrams and valve charts suitably framed under glass, shall be furnished and mounted where directed. One (1) copy of diagrams and valve charts shall be delivered to Owner.
- C. This Contractor shall provide on all piping, semi-rigid, wrap around plastic identification markers equal to Seton Snap-Around and/or Seton Strap-On pipe markers.
- D. Each marker background is to be appropriately color coded with a clearly printed legend to identify the contents of the pipe. Directions of flow arrows are to be included on each marker.
- E. Identification of all piping shall be adjacent to each valve, at each pipe passage through wall, floor and ceiling construction and at each branch and riser take-off.
- F. Identification shall be on all horizontal pipe runs, marked every 15 ft. as well as at each inlet outlet of equipment at changes in direction.

END OF SECTION 220480



## **SECTION 220490**

### **GUARANTEE**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section.

##### **1.1 GUARANTEE**

- A. The Contractor shall remove, replace and/or repair at his own expense and at the convenience of the Owner, any defects in workmanship, materials, ratings, capacities and/or characteristics occurring in the work within three (3) years or within such longer period as may be provided in the Drawings and/or Section of the Specifications, which guarantee period shall commence with the final acceptance of the entire Contract in accordance with provisions stated in the General Conditions, and the Contractor shall pay for all damage to the system resulting from defects in the work and all expenses necessary to remove, replace and/or repair and any other work which may be damaged in removing, replacing and/or repairing the work.

END OF SECTION 220490



## **SECTION 230100**

### **GENERAL CONDITIONS**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section.

##### **1.1 GENERAL CONDITIONS**

- A. Before submitting a proposal, Bidders shall examine all related to this work and shall become fully informed as to the extent and character of the work required and its relation to the other work in the building.
- B. Before commencing work, the Contractor will examine all conditions of the project upon which his work is in any way dependent for perfect workmanship according to the intent of this Specification. No "waiver of responsibility" for incomplete, inadequate or defective adjoining work will be considered unless notice has been filed by this Contractor and acceded to by the Owner's representative in writing before the Contractor begins any part of the work.
- C. The Contractor will pay for all licenses, permits and inspection fees required by civil authorities having jurisdiction. Comply with all laws, ordinances, regulations, and fire underwriter's requirements applicable to work herein specified without additional expense to the Owner.
- D. Small scale drilling through walls and floors or cutting of piping insulation which may contain asbestos shall be performed by a person with a "restricted asbestos handler allied trades certificate" and shall have a copy of it in his possession at all times while working of the project. This shall also apply to removal of piping, ductwork or equipment insulation.
- E. It is specifically intended that anything (whether material or labor), which is usually furnished as a part of such equipment, as is hereinafter called for (and which is necessary for the completion and proper operation) shall be furnished as part of this Contract without additional cost the Owner, whether or not shown in detail or described in the Specifications.
- F. When Drawings and Specifications conflict or there is a question as to the proper intent of this Contract, the Contractor shall assume the greater quantity, the higher quality and/or the more expensive method in his pricing. All questions shall be directed to the Architect/Engineer in writing only and only up to ten (10) days prior to bidding.
- G. The Drawings indicate the general runs of the piping, ductwork, etc. systems and the location of equipment and apparatus, however it shall be understood that the right is reserved by the Architect/Engineer to change the location of piping work, ductwork, equipment and apparatus to a reasonable extent as building conditions may dictate, prior to their installation without extra cost to the Owner.
- H. All components supplied by this Contractor shall be UL listed and/or ETL labeled and shall conform to ASHRAE Standard 15.

- I. Any changes from the Drawings and Specifications and any interpretation thereof shall have the prior approval of the Architect/Engineer. The Contractor shall submit in writing, at the time of signing the Contract, any items of necessary labor and materials, which, in his opinion, are lacking in requirements of the Drawings and Specifications to insure a complete job in all respects. No consideration will be granted to alleged misunderstanding of materials to be furnished, work to be done, or conditions to be complied with, it being understood that the tender of a proposal carries with it the agreement to all items and conditions referred to herein, or indicated on the accompanying Drawings.

END OF SECTION 230100



## **SECTION 230110**

### **SCOPE OF WORK**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section.

##### **1.1 SCOPE OF WORK**

- A. The work under this section includes all labor, materials, equipment, tools, transportation, and the performance of all work necessary and required for the furnishing and installation complete of all work as shown on the Contract Documents, including but not necessarily limited to the following:
  - 1. High efficiency condensing hot water heating boiler plant and related appurtenances.
  - 2. Steam to hot water boiler conversion and related appurtenances.
  - 3. Exhaust fans, supply fans and related appurtenances.
  - 4. Classroom unit ventilator units and related appurtenances.
  - 5. Roof mounted energy recovery units and related appurtenances.
  - 6. Packaged rooftop units and related appurtenances.
  - 7. Roof mounted condensing units and related appurtenances.
  - 8. All required piping, valves, and related specialties.
  - 9. Pumps and related specialties.
  - 10. Variable frequency drives.
  - 11. Ceiling and floor mounted unit ventilators with controls and related appurtenances.
  - 12. Convectors, cabinet heaters, unit heaters, perimeter fin tube radiation and related appurtenances.
  - 13. Sheetmetal ductwork and related accessories.
  - 14. Duct and pipe insulation.
  - 15. Registers, diffusers, and dampers.
  - 16. Rigging of equipment.

17. Furnish all combination motor starter/disconnects for equipment (with the exception of starters and electric items already mounted on equipment or equipment not requiring same). Fan motor starter/disconnects shall have contacts for ATC connection and a terminal block connection for Fire Alarm fan shutdown. Starters per manufacturers recommendations. Underwriters inspection and certificate required. Coordinate with Electrical Contractor.
  18. Air and Water Balancing.
  19. Automatic temperature controls with complete wiring (regardless of voltage).
  20. Testing, adjusting and start-up of equipment.
  21. Painting and identification of all equipment and piping.
  22. Firestopping per NFPA requirements (UL approved systems).
  23. Operating and maintenance instructions.
  24. As-Built Drawings - Refer to Division 1.
  25. Cutting and Patching - Refer to Front End Spec.
- B. Coordination Drawings: Attention is directed to Division 1 for coordination drawing requirements for this project. These drawings are critical to the proper execution of the work and failure to honor these requirements may become the basis for denial of any and all claims for either or both "time" and "money".
- 1.2 REMOVALS
- A. Removals should be coordinated with other trades affected.
  - B. Piping which penetrates the construction may be cut and capped provided capping is done beneath the finished surfaces so that construction over it can be achieved.
  - C. All removals shall be removed from the site.

### 1.3 ALTERATION WORK

- A. All equipment, piping, control components, etc. to be removed, shall be disposed of or salvaged as directed by the Owner. They shall not be removed from the premises without the Owner's approval.
- B. All piping to be removed shall be properly plugged or capped so that upon completion of all new work, all abandoned piping shall be concealed in finished areas.
- C. No dead ends shall be left on any piping upon completion of job. The existing system shall be left in perfect working order upon completion of new work.

- D. Location and sizes of existing piping, ductwork, equipment, etc. are approximate. Exact sizes and locations of all existing work shall be verified on the job.

END OF SECTION 230110



## **SECTION 230120**

### **GAS FIRED CONDENSING BOILERS**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section. Submit shop drawings for checking and approval.

##### **1.1 SUMMARY**

- A. This Section includes packaged, factory-fabricated and assembled, gas-fired, firetube duplex stainless steel ultra-high efficiency condensing boilers, trim and accessories for generating hot water.

##### **1.2 REFERENCES**

- A. ASME Section IV
- B. CAN-1.3.1-77, Industrial and Commercial Gas Fired Packaged Boilers
- C. CSD-1, Controls and Safety Devices
- D. XL GAPS
- E. NEC, National Electric Code
- F. UL-795 7th Edition
- G. AHRI, BTS-2000
- H. ASHRAE 90.1

##### **1.3 SUBMITTALS**

- A. Product Data: Include performance data, operating characteristics, technical product data, rated capacities of selected model, weights (shipping, installed and operating), installation and start-up instructions, and furnished accessory information.
- B. Shop Drawings: For boiler, standard boiler trim and accessories.
  - 1. End Assembly Drawing: Detail overall dimensions, connection sizes, connection locations, and clearance requirements.
  - 2. Wiring Diagrams: Detail electrical requirements for the boiler including ladder type wiring diagrams for power, interlock, and control wiring. Clearly differentiate between portions of wiring that are factory installed and portions to be field installed.
- C. Certificate of Product Rating: Submit AHRI Certificate indicating Thermal Efficiency, Combustion Efficiency, Materials of Construction, Input, and Gross Output conform to the design basis.
- D. Thermal efficiency curves: Submit thermal efficiency curves for a minimum of 5 input rates between and including minimum and maximum rated capacities, for return water temperatures ranging from 80°F to 180°F.
- E. Water side pressure drop curve.

- F. Flue gas temperature curves: Submit flue gas temperature curves for minimum and maximum boiler capacity, for return water temperatures ranging from 80°F to 160°F.
  - 1. If submitted flue gas temperatures, minimum or maximum inputs are different from that of the basis of design manufacturer and model, the manufacturer shall be responsible for draft calculations and reselection of the flue gas exhaust system.
- G. Source quality-control test reports.
- H. Field quality-control test reports: Start-up by a factory authorized service company.
- I. Operation and Maintenance Data: Data to be included in Installation and Operation Manual.
- J. Warranty: Standard warranty specified in this Section.

#### 1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Firms regularly engaged in the manufacture of condensing hydronic boilers with welded steel pressure vessels, whose products have been in satisfactory use in service for not less than twenty-five (25) years. The manufacturer must be privately owned and headquartered in North America. The specifying engineer, contractor and end customer must have the option to visit the factory during the manufacture of the boilers and be able to witness test fire and other relevant procedures.
- B. Aftermarket Support and Service: The manufacturer shall have a factory authorized service training program, where boiler technicians can attend a training class and obtain certification to perform start-up, maintenance, and basic troubleshooting specific to the product line.
- C. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code, Section IV "Heating Boilers", for a maximum allowable working pressure of 160 PSIG.
- E. CSD-1 Compliance: The boiler shall comply with ASME Controls and Safety Devices for Automatically Fired Boilers (CSD-1).
- F. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil-Fired Boilers - Minimum Efficiency Requirements."
- G. UL Compliance: Boilers must be tested for compliance with UL 795, "Commercial-Industrial Gas Heating Equipment." Boilers shall be listed and labeled by ETL.
- H. AHRI Compliance: Boilers shall be tested and rated according to the BTS-2000 test standard and verified by AHRI.

- I. NOx Emissions Compliance: Boiler shall be tested for compliance with SCAQMD and TCEQ.
- J. The equipment shall be of the type, design, and size that the manufacturer currently offers for sale and appears in the manufacturer's current catalog.
- K. The equipment shall fit within the allocated space, leaving ample allowance for maintenance and inspection.
- L. The equipment shall be new and fabricated from new materials. The equipment shall be free from defects in materials and workmanship.
- M. All units of the same classification shall be identical to the extent necessary to ensure interchangeability of parts, assemblies, accessories, and spare parts wherever possible.
- N. To provide unit responsibility for the specified capacities, efficiencies, and performance, the boiler manufacturer shall certify in writing that the equipment being submitted shall perform as specified.

#### 1.5 COORDINATION

- A. Mechanical contractor shall coordinate the size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete reinforcement and formwork requirements are specified in Division 03.

#### 1.6 WARRANTY

- A. Standard Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period for the Pressure Vessel and Heat Exchanger: The boiler manufacturer shall warranty against failure due to thermal shock, flue gas condensate corrosion, and/or defective material or workmanship for a period of 10 years, non-prorated, from the date of shipment from the factory provided the boiler is installed, controlled, operated and maintained in accordance with the Installation, Operation and Maintenance Manual.
  - 2. Warranty Period for the Burner: The boiler manufacturer shall warranty the burner against defective material or workmanship for a period of five (5) years, non-prorated, from the date of shipment from the factory.
  - 3. Warranty Period for all other components: The boiler manufacturer will repair or replace any part of the boiler that is found to be defective in workmanship or material within eighteen (18) months of shipment from the factory or twelve (12) months from start-up, whichever comes first.
  - 4. Warranties are only valid provided the boiler is installed, controlled, operated, and maintained in accordance with the Installation, Operation and Maintenance Manual.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. This specification is based on the Endura series boilers as manufactured by Fulton Heating Solutions, Inc. Equivalent units and manufacturers must meet all performance criteria and will be considered upon prior approval.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide Fulton Heating Solutions, Inc.; Endura model EDR 1000 duplex stainless steel firetube condensing boiler.
- C. The boiler manufacturer shall have the capability to construct an engineered hydronic system, skid mounted, for the above referenced boilers incorporating single point electrical, supply water, return water, freshwater make-up, fuel, and drain. The boiler manufacturer shall have the engineering capabilities for all aspects of the mechanical, electrical and control design aspects of the skid mounted system.



## 2.2 BOILER CONSTRUCTION

- A. Description: Factory-fabricated, -assembled, and -pressure tested, duplex stainless steel firetube condensing boiler with heat exchanger sealed pressure tight, built on a steel base; including flue gas vent; combustion air intake connections, water supply, water return, condensate drain, and controls. The boiler, burner and controls shall be completely factory assembled as a self-contained unit. Each boiler shall be neatly finished, thoroughly tested, and properly packaged for shipping. Closed-loop water heating service only.
- B. Heat Exchanger: The heat exchanger is defined as the surfaces of the pressure vessel where flue gases transfer sensible and latent heat to the hydronic fluid. The heat exchanger shall be a three-pass firetube design constructed using only duplex alloys of stainless steel.
  - 1. The boiler shall be a firetube design, such that all combustion chamber components are within water-backed areas. Water tube boilers will not be accepted.
  - 2. Furnace: First pass of the combustion chamber shall be constructed of duplex alloy stainless steel with a minimum wall thickness of 0.25" and a minimum bottom head thickness of 0.625".
  - 3. Firetubes: Second and third passes of the combustion chamber shall be constructed of duplex alloys of stainless steel having a minimum wall thickness of EDR-750/1000: 0.083".
  - 4. Furnace to tube connections shall be constructed with low weld intensity, a tube to tube minimum spacing of 2" center to center, minimum 5/8" tube to tube ligament, and shall not contain any overlapping welds.
  - 5. Heat exchange capability shall be maximized within the heat exchanger via the use of corrugated firetube technology. The corrugation process shall not remove any material from the tubes. Aluminum heat transfer enhancements are dissimilar metals and are unacceptable.
  - 6. Material: The heat exchanger shall have the following material characteristics and properties:
    - a. The metallic crystalline lattice microstructure shall contain approximately equal amounts of body center cubic (BCC) and face centered cubic (FCC) structures to offer high resistance to intergranular corrosion.
    - b. A minimum Pitting Resistance Equivalent Number (PREN) of 26.
    - c. A minimum Yield Strength of 65 ksi at 0.2% plastic strain.
    - d. A minimum Ultimate Tensile Strength of 94 ksi.
    - e. To minimize stresses caused by uneven expansion and contraction, the Coefficient of Thermal Expansion at 212°F shall not be less than 7.0 in/in °F 10<sup>-6</sup> and shall not be greater than 7.5 in/in °F 10<sup>-6</sup>.
    - f. To increase resistance to pitting and crevice corrosion, the Chromium content shall not be less than 21% by mass.
    - g. For high mechanical strength, the Nitrogen content shall not be less than 0.17% by mass.

- h. Boilers with heat exchangers constructed of austenitic stainless steels, such as 316L or 304, and ferritic stainless steels, such as 439, are unacceptable.
  - i. Boilers with heat exchangers constructed of cast aluminum, mild steel, cast iron or copper finned tube materials are unacceptable.
- C. Pressure Vessel: Design and construction shall be in accordance with Section IV of the ASME Code for heating boilers.
  - 1. The shell shall be minimum EDR-750/1000: 0.25" thick steel, SA-790 or SA-516 Grade 70.
  - 2. The top head shall be a minimum 0.375" thick steel, SA-790 or SA-516 Grade 70.
  - 3. The water side of the pressure vessel shall be a counter-flow design with internal water-baffling plates.
  - 4. The boiler return and supply water connections shall be EDR-750/1000: 2" threaded male NPT. The water connections shall not be designed to support an external structural load from the piping system.
  - 5. The water volume of the boiler shall not be less than EDR-750/1000: 50 Gallons.
    - a. For boilers with a lower water volume, the boiler manufacturer shall provide a buffer tank and all associated buffer tank ancillaries to make equivalent to the total volume of the design basis.
  - 6. The maximum water pressure drop across the boiler inlet and outlet connections, shall not exceed EDR-1000: 0.8 PSID at 100 GPM.
- D. Burner: Standard natural gas, forced draft.
  - 1. Burner Head: Shall be a woven fiber premix design.
  - 2. Excess Air: The burner shall operate at no greater than 7.0% excess O<sub>2</sub> over the entire turndown range. Due to significant reductions in combustion efficiency at high levels of excess O<sub>2</sub>, boilers exceeding 7.0% excess O<sub>2</sub> at any operating condition shall not be accepted.
  - 3. Emissions: When operating on natural gas, the boiler shall maintain a NO<sub>x</sub> level of <20 ppm, and CO emissions less than 50 ppm, over the complete combustion range at a 3% O<sub>2</sub> correction.
- E. Blower: Variable speed, non-sparking, hardened aluminum impeller centrifugal fan to operate during each burner firing sequence and to pre-purge and post-purge the combustion chamber.
  - 1. Motor: Brushless DC variable speed motor with hall effect sensor feedback; internal electronic commutation controller with built in speed control and protection features; long life, sealed, ball bearing with high temperature grease.

2. Variable speed blower: PWM signal input with tachometer output.

F. Main Fuel Train

1. The boiler shall have a pre-mix combustion system, capable of operating at a minimum 4" W.C. incoming natural gas pressure while simultaneously achieving emissions performance, full modulation, and full rated input capacity. Maximum natural gas pressure allowed to the inlet of the fuel train shall be no less than 28" W.C.
2. A factory mounted main fuel train shall be supplied. The fuel train shall be fully assembled complete with high and low gas pressure switches, wired, and installed on the boiler and shall comply with CSD-1 code. The fuel train components shall be enclosed within the boiler cabinet.
3. A lock up regulator upstream of the fuel train shall be furnished by the boiler manufacturer as a standard component integral to the boiler cabinet. Factory test fire of the boiler with the provided lock up regulator is required.
4. Standard CSD-1 fuel train shall comply with IRI, which has been replaced by XL GAPS.

- G. Ignition: Direct spark ignition with transformer. A UV scanner shall be utilized to ensure precise communication of flame status back to the flame programmer.

H. Boiler Enclosure

1. Sealed Cabinet: Jacketed steel enclosure with left hinged full height front access door, fully removable latching access panels, gasketed seams to maintain sealed combustion, mounted on a steel skid with steel plate decking.
2. Control Enclosure: NEMA 250, Type 1.
3. Finish: Internally and externally primed and painted finish.
4. Combustion Air: Drawn from the inside of the sealed cabinet, preheating the combustion air.

- I. Rigging and Placement: The boiler shall come with lifting eyes and fork hole accessibility for rigging.

- J. Exhaust Manifold: Shall be constructed of stainless steel, with an area for the collection and disposal of flue gas condensate.

K. Characteristics and Capacities:

1. Heating Medium: Closed loop hot water with up to 50% propylene or ethylene glycol by volume. Standard capacities shall be based on 100% water.
2. Design Water Pressure Rating: 160 psig.
3. Safety Relief Valve Setting: 160 psig.

4. Minimum Return Water Temperature: No minimum temperature required.
  5. Maximum Allowable Water Temperature: 210°F.
  6. Minimum Water Flow Rate: No minimum flow rate required to protect the heat exchanger.
  7. Maximum Water Flow Rate: No maximum flow rate requirement.
  8. Minimum Delta-T: No minimum delta-T required.
  9. Maximum Delta-T: 100°F
  10. Minimum Side Clearance: Shall not exceed 1" between any number of boilers.
  11. Maximum Allowable Operating Setpoint: 200°F
  12. Jacket Losses: External convection and radiation heat losses to the boiler room from the boiler shall comply with IAW ASHRAE 103-2007 and shall not exceed 0.2% of the rated boiler input at maximum capacity.
- L. The boiler shall have its efficiency witnessed and certified by an independent third party, and the efficiency must be listed on the AHRI directory ([www.ahridirectory.org](http://www.ahridirectory.org)) for natural gas operation. The test parameters for efficiency certification shall be the BTS-2000 standard. The certified thermal efficiency for natural gas firing shall not be less than EDR-1000: 95.3%.
- M. A zero flow or low flow condition shall not cause any harm to the pressure vessel or heat exchanger of the boiler. Flow switches, dedicated circulator pumps, or primary-secondary arrangements shall not be required to protect the boiler from thermal shock. Boilers requiring the use of flow switches or primary-secondary piping arrangements are unacceptable.
- N. The dimensions of the boiler shall not be more than (Height x Width x Depth) EDR-750/1000: 68" x 28" x 38".
- O. The dry weight of the boiler shall not be less than EDR-750/1000: 1,430 lbs.
- P. The equipment shall be in strict compliance with the requirements of this specification and shall be the manufacturer's standard commercial product unless specified otherwise. Additional equipment features, details, accessories, etc. which are not specifically identified but which are a part of the manufacturer's standard commercial product, shall be included in the equipment being furnished.
- 2.3 TRIM
- A. Safety Relief Valve: ASME Rated.

- B. Pressure and Temperature Gauge: Minimum 3-1/2" diameter, combination pressure and -temperature gauge. Gauges shall have operating-pressure and -temperature ranges so normal operating range is about 50 percent of full range.
  - 1. Mounted in the field in the boiler supply water piping prior to the first isolation valve by the boiler installer.
- C. Combustion Air Inlet Filter: 50 Micron.
- D. Flue Gas Condensate Drain Trap: A flue gas condensate drain trap shall be provided to prevent positive pressure exhaust gases from entering the boiler room.
- E. Flue Gas Condensate Neutralization: pH neutralization accommodations available upon request.

## 2.4 CONTROLS

- A. The boiler electrical control panel shall include the following devices and features:
  - 1. 7" color touch screen control display factory mounted on the front cabinet panel door. The control display shall serve as a user interface for programming parameters, boiler control and monitoring; and shall feature a screen saver, screen disable for cleaning, contrast control, volume control for alarm features, boiler status, configuration, history and diagnostics.
  - 2. The boiler control panel shall be constructed in a UL 508 approved panel shop.
  - 3. 24 VAC control transformer.
  - 4. Control relay for 120 VAC motorized isolation valve control.
  - 5. The flame safeguard control on the boiler shall be integrated with temperature control and lead/lag sequencing modular boiler plant functionality.
  - 6. All controls are to be cabinet, vessel or panel mounted and so located on the boiler as to provide ease of servicing the boiler without disturbing the controls. All controls shall be mounted and wired according to UL requirements.
- B. Burner Operating Controls: To maintain safe operating conditions, factory mounted, and wired burner safety controls limit burner operation:
  - 1. High Limit: A single UL 353 temperature probe shall function as a dual-element outlet temperature sensor and shall comply with CSD-1 CW-400 requirements for 2 independent temperature control devices.
    - a. High limit sensor shall be NTC resistive 10KOhm +/- 1% at 77°F. Sensor shall have brass material bulb with 1.181 +/- 0.015" insertion and 0.370 +/- 0.005" bulb diameter.
    - b. Manual reset stops burner if operating conditions rise above maximum boiler design temperature.
  - 2. Low-Water Cut Off: Electronic probe type mounted in the pressure vessel shall prevent burner operation on low water alarm.
  - 3. Air Safety Switch: Prevent operation unless sufficient combustion air is proven.

4. High Condensate Probe: Prevent operation in the event of a blocked condensate drain.
5. Blocked Exhaust: Prevent operation in the event of a blocked flue gas exhaust stack.

C. Boiler Operating Controls and Features:

1. Proportional Integral Derivative (PID) temperature load control capability for up to two loops, central heat and domestic hot water.
2. Operating temperature limit for automatic start and stop.
3. Flue gas exhaust temperature monitoring.
4. Return water temperature monitoring.
5. Time of day display.
6. Customizable boiler name display.
7. Alarm history for 15 most recent alarms including equipment status at time of lockout.
8. Password protection options.
9. Indirect domestic hot water priority.
10. Outdoor air temperature (OAT) reset controls with warm weather shutdown:
  - a. OAT reset shall automatically adjust the setpoint according to changes in the outdoor temperature.
  - b. The boiler manufacturer shall provide an OAT sensor and module.
  - c. The sensor shall have +/- 1.5°F accuracy at 70°F, field installed in an outdoor area not exposed to direct sunlight or the exhaust of other mechanical equipment, and field wired to the master boiler.
  - d. The control shall be field programmed with the outdoor reset schedule.
  - e. The control shall have the ability to disable the entire hydronic boiler system on warm weather shutdown based on a programmable OAT.

D. Sequencing Control of Modular Boiler Plants: Sequencing capabilities (lead/lag) shall be integral to the boiler controller for up to 8 boilers installed in the same hydronic loop and shall not require an external panel.

1. The boiler manufacturer shall provide a supply water header temperature sensor. The sensor shall be NTC resistive 10KOhm +/- 1% at 77°F, field installed in the common supply water piping, and field wired to the master boiler.
2. One (1) boiler in the system shall be field programmed as the master and subsequent boilers will be programmed as lag units.

3. Sequence of Operation:

- a. Upon call for heat and demand in the system, a boiler will be enabled at low fire and will modulate according to demand and PID settings up to the base load common value. The base load common shall be field adjustable with a default setting of 40%.
- b. If the heating load exceeds the output at the base load common firing rate, the next boiler in the sequence will be enabled at low fire. Modular boilers will modulate up and down in parallel as a cohesive unit with infinite modulation points to meet heating load requirements.
- c. This process continues until all available boilers are enabled, at which point they are released to modulate up to full fire if required.
- d. As the load decreases, the boilers will be sequentially disabled.
- e. Boiler sequence order shall be rotated on a programmable number of run hours.
- f. A boiler in lockout alarm shall be automatically removed from the sequence order.
- g. Lag boilers shall default to local control if the master boiler is fully powered off or removed.
- h. Each individual boiler shall enable and disable a water circulation control device. The enable of the device, for example a motorized isolation valve or boiler circulator, will be simultaneous with the heat demand for that boiler. The disable of each device will be based on a programmable time delay when the heat demand is no longer present. In variable primary arrangements, the control shall hold the lead boiler isolation valve open at all times.

E. Building Automation System Interface: Hardware and software to enable building automation system (BAS) to monitor, control, and display boiler status and alarms.

1. Hardwired Contacts

- a. Monitoring: Boiler Status, Burner Demand, General Alarm, Firing Rate.
- b. Control with Factory Installed Jumper: Safety Interlock for External Device, Remote Boiler Enable, Remote Lead/Lag Enable, Emergency Stop (E-Stop)
- c. Remote Setpoint Signal: 4-20 mA.

2. Communication Protocol: A communication interface with BAS shall enable BAS operator to remotely enable and monitor the boiler plant from an operator workstation.

- a. The boilers will communicate with each other and the Building Automation System via a daisy chain addressed Modbus network. Field wiring between nodes shall be twisted pair low voltage with shielded ground.
- b. A BACnet MSTP and IP protocol communication gateway shall be provided. The BACnet gateway is field installed on the MASTER boiler. Lag boilers shall not require a dedicated BACnet gateway for the BAS to monitor status. The BAS shall only be required to communicate through the MASTER boiler. A communication point mapping list shall be provided.

## 2.5 ELECTRICAL POWER

- A. Single-Point Field Power Connection: Factory-installed and factory-wired switches, transformers, control and safety devices and other devices shall provide a single-point field power connection to the boiler.
- B. Electrical Characteristics
  - 1. Voltage: 120 V.
  - 2. Phase: Single.
  - 3. Frequency: 60 Hz.

## 2.6 VENTING

- A. The boiler shall be capable of operating with a stack effect not exceeding -0.04" W.C. and a combined air intake and exhaust venting pressure drop not exceeding +1.50" W.C.
- B. Combustion Air Intake: It shall be acceptable to either direct vent the boiler using sealed combustion by drawing combustion air in from the outdoors or by drawing air from the mechanical space itself.
  - 1. Sealed Combustion: Schedule 40 PVC pipe or smooth-walled galvanized steel, vent termination with 1/2" x 1/2" mesh bird screen.
  - 2. Mechanical Space: Adequate combustion air and ventilation shall be supplied to the boiler room in accordance with local codes.
- C. Flue Gas Exhaust: The flue gas exhaust stack shall be AL 29-4C or 316L stainless steel, listed and labeled to UL-1738 / C-UL S636 for use with Category II/IV appliances, guaranteed appropriate for the application by the manufacturer and supplier of the venting.
- D. The boiler shall be capable of common exhaust and intake venting. The draft system shall be designed to prevent the backflow of exhaust gases through idle boilers.
- E. Condensate drain piping must be galvanized, stainless steel, or Schedule 40 CPVC. Copper, carbon steel, or PVC pipe materials are not accepted.

## 2.7 SOURCE QUALITY CONTROL

- A. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.
- B. Each boiler shall be installed and operated in a functioning hydronic system, inclusive of venting, as part of the manufacturing process. A factory test fire report corresponding to the boiler configuration shall be included with each boiler.

## 2.8 MODSYNC SE SEQUENCING SYSTEM

- A. When multiple hydronic boilers are to be installed in a common loop, a boiler sequencing control system shall be used. The sequencing system will monitor, enable/disable and control the firing rate of each boiler in the loop. To ensure accurate temperature control and optimized boiler operating efficiencies, a ModSync Sequencing System shall be used.



1. The hydronic boilers shall be controlled as follows to maximize their operating efficiency:
  - a. The sequencing system shall monitor the outdoor temperature and calculate a hydronic loop temperature setpoint based on touchscreen selectable user-defined values. The boiler sequencing system will stage operation of the hydronic boilers based on the difference between the actual hydronic loop temperature and the calculated (outdoor air reset) hydronic loop temperature setpoint.
  - b. When a requirement for heat is determined by the boiler sequencing system, the lead boiler is energized, and its firing rate is maintained at low fire.
  - c. If the hydronic loop temperature continues to decrease, the boiler sequencing system will enable a lag boiler. The first lag boiler is energized, and the lag boiler's firing rate is maintained at low fire.
  - d. As additional heat is required, the boiler sequencing system will enable the remaining lag boiler stages individually until all of the available boilers in the hydronic loop have been energized. Each boiler will remain at low fire until all of the stages have been enabled.
  - e. If all of the hydronic boilers are enabled and additional heat is required, the boiler sequencing system will release the boilers to modulate. Operating hydronic boilers at lower firing rate levels provides significant efficiency gains. Therefore, hydronic boilers will modulate together as a single unit to keep the hydronic boiler system at the lowest possible firing rate, while satisfying the building load demands.
  - f. As the hydronic loop temperature increases, the boiler sequencing system will decrease the firing rate of the hydronic boilers to maintain the hydronic loop temperature. If all of the hydronic boilers are at low fire and the hydronic loop temperature continues to rise, the boiler sequencing system will begin to stage the boilers off. The first lag boiler stage energized will be the last stage to be disabled. The hydronic boilers will continue to be disabled by the boiler sequencing system based on the temperature rise of the hydronic loop.
  - g. The lead boiler is disabled when the hydronic loop temperature reaches a selectable value referenced around the hydronic loop setpoint.
- B. The boiler sequencing system will be a microprocessor based process controller with a graphical user interface and touchscreen capabilities. Boiler sequencing systems designed with alpha-numeric displays will not be acceptable due to their limited functionality.
- C. The active touchscreen display area will be a minimum of 5.7" with a color TFT display resolution of 256 colors.

- D. The boiler sequencing system enclosure will be NEMA 4X construction. The enclosure shall be designed with the ability of be located in outdoor environments. Mounting of the boiler sequencing system inside another panel to provide an outdoor rating will not be acceptable due to the increased access time requirements to view and modify the system parameters. Power requirements for the boiler sequencing panel will be 120/60/1.
- E. The boiler sequencing system will be a wall mounted, stand-alone unit. Local boiler controls with integrated lead/lag logic are not acceptable due to their limited logic capabilities and rewiring requirements in the event of a sensor or local controller error.
- F. Password requirements will prevent access to any of the screens where system configuration parameters can be adjusted, while maintaining the ability of viewing the system performance.
- G. Outdoor and Supply Header Temperature sensors supplied with the boiler sequencing system shall be PT-100 RTD type for precise temperature monitoring. Return Temperature monitoring capabilities shall be available and used when BTU calculation is used. The boiler sequencing system will also have the ability to receive temperature values from the Building Management System through a communication protocol. Each temperature input shall have a selection button that allows for independent configuration of where the temperature value will be received from.
- H. The boiler sequencing system will provide a series of "Question and Answer" screens to simplify the commissioning process.
- I. Multiple Status and Configuration Screens will be available for easy interpretation of the hydronic loop status and simplified control configuration of the multiple hydronic boiler system.
  - 1. Minimum screens available shall include:
    - 1. Outdoor Reset Configuration
    - 2. Setback Schedule
    - 3. Lead/Lag Configuration
    - 4. Boiler Configuration
    - 5. System Status
    - 6. Alarm Status
    - 7. Alarm History
- J. Outdoor Reset - The ability to adjust the hydronic loop temperature setpoint based on the outdoor temperature is a key element of hydronic system efficiency. As the outdoor temperature increases, the hydronic loop setpoint can decrease while still maintaining the desired building temperature. Lower return water temperatures can significantly increase the hydronic boiler system efficiency.
  - 1. The boiler sequencing system shall provide Outdoor Reset Configuration Screens that include all of the parameters required to effectively configure the hydronic loop setpoint based on the outdoor temperature.
    - a. The boiler sequencing system will provide an adjustable reset schedule based on the outdoor temperature. A linear outdoor reset ratio will be

determined based on user-defined hydronic loop temperatures at 50°F and 0°F outdoor temperatures. Outdoor temperature configuration variables shall be adjustable through the touchscreen to match designed reset schedule requirements. A reference graphic detailing the calculated reset ratio will be displayed on the Outdoor Reset Configuration screen.

- b. Minimum and maximum loop temperature parameters will prevent the outdoor reset schedule from operating outside of a user-defined temperature range.
- c. A user-defined Outdoor Temperature Disable parameter will be provided to disable the hydronic loop if a predetermined outdoor temperature is reached. A hysteresis variable will prevent the hydronic system from re-enabling until the outdoor temperature decreases a user-defined amount.
- d. To meet multiple system control configurations, setpoint mode adjustment capabilities will be included as standard with the boiler sequencing system. Setpoint Modes will include Outdoor Reset, 4-20mA Remote Setpoint, BMS Communication or Manual. The setpoint mode shall be field adjustable by a touchscreen selection button on the Setpoint Configuration screen.
- e. Provisions for Domestic Hot Water Priority shall be available if required. A temperature aquastat input is monitored and will automatically adjust the hydronic loop setpoint to meet the Domestic Hot Water demand. When the domestic load is satisfied, the boiler sequencing system will automatically switch the setpoint mode to outdoor reset.

K. Setback Configuration Screens shall be provided to adjust the hydronic loop setpoint based on Day of the Week/Time of Day variables.

- 1. Multiple setback schedules shall be available based on whether the building is in Occupied or Unoccupied mode. Building Mode selection shall be determined by a user-defined Time of Day / Day of Week touchscreen entry. The Building Mode will automatically change between Occupied and Unoccupied based on the user programmed day and times. Manual Building Mode control shall also be available via a Setup menu. Building Mode shall be indicated on the Loop Status Screen for ease of reference.
- 2. An Anticipation Mode feature shall be provided to automatically switch to Occupied Mode a selectable number of hours earlier than scheduled if the outdoor temperature lowers below a user-defined temperature during the Unoccupied Mode.

L. Lead/Lag Configuration screens shall be used to configure how the hydronic boilers will be assigned and enabled in the control sequence.

- 1. The boiler sequencing system will include automatic rotation of the lead boiler based on a user configured lead boiler cycle count or run hours; whichever setting occurs first.

2. When the lead cycle or run hours rotation value is reached, the boiler sequencing system will assign each boiler's position in the lead/lag sequence based on their previous operating history. Boiler sequencing systems that simply rotate the lead position to the next boiler in the sequence will not be acceptable due to their ineffective ability of maintaining an even cycle count across all of the boiler stages in the hydronic loop.
  3. The boiler sequencing system will stage the boilers based on a PID generated control variable value. The Proportional, Integral and Derivative values shall be user-defined through the Lead/Lag Configuration screen. Each lag boiler stage will be enabled and disabled based on a user-defined control variable percentage. Properly tuned loops will provide temperature control accuracy up to +/- 2°F, based on load demand. The lead boiler start and stop parameters shall be user-defined through the touchscreen operator interface. A Manual Reset parameter will allow the Proportional Band to be shifted around setpoint.
  4. A user-defined time delay parameter will be provided that delays enabling and disabling of the lag boiler stages. This helps to decrease cycling of the lag stages when the building load is close to being satisfied.
  5. The boiler sequencing system will have the ability to monitor the outlet temperature of each hydronic boiler in the system. This feature is beneficial for systems that will incorporate variable flow designs. If the boiler outlet temperature exceeds setpoint by a user-defined amount, the boiler sequencing system will automatically lower the firing rate of the boiler to help prevent a high limit trip at the boiler. As the boiler outlet temperature decreases below a defined variable, the boiler sequencing system will allow the firing rate of the boiler to increase.
- M. Boiler Configuration screens will display information regarding each boiler stage in the hydronic loop.
1. The boiler configuration screens will detail and provide:
    - Hydronic Boiler Status.
    - Hydronic Boiler Cycles, Run Hours and Cycle/Hour Ratio calculation.
    - Hydronic Boiler Outlet Temperature.
    - Hydronic Boiler Enable/Disable touchscreen selection.
    - Hydronic Boiler Auto/Manual touchscreen control mode selection.
    - Hydronic Boiler Manual touchscreen Start/Stop and Firing Rate control.
  2. The boiler sequencing system shall include capabilities to enable/disable the boilers through the operator interface. Boilers that are disabled will not be included in the sequencing logic.
- N. The boiler sequencing system will monitor the operation and status of all temperature sensors and hydronic boilers in the loop. Sensor errors will be annunciated on the boiler sequencing systems alarm screen. If an outdoor temperature sensor error occurs, the boiler sequencing system will automatically switch to manual setpoint mode and will annunciate the alarm condition.

- O. The boiler sequencing system will start a timer when each boiler stage is enabled to run. If the main gas valves do not energize within the user-defined timeframe then a local limit is preventing the boiler from operating. The boiler sequencing system will immediately remove the boiler from the lead/lag sequence and announce that a local boiler error exists. An automatic reset option will allow the boiler to be re-enabled after a user-defined timeframe has elapsed.
- P. An Alarm Status screen will give a text description of any current alarm conditions. Boiler sequencing systems that use codes or symbols to detail alarm conditions will not be acceptable. The boiler sequencing system will automatically adjust the boiler sequencing status and remove the boiler from the sequencing logic if an alarm occurs. The boiler will automatically be added back into the rotation loop as soon as the boiler sequencing system senses that the alarm has been cleared.
- Q. The boiler sequencing panel will include an Alarm History screen that allows for the last 100 alarm conditions to be viewed. A Date/Time stamp and text description of each alarm condition in the history will be available.
- R. A System Status screen will detail current outdoor, hydronic system and control variable values. The status screen will also display enable/disable and firing rate information for each of the boilers in the hydronic loop.
- S. Trending of the supply temperature, system setpoint and outdoor temperature will be displayed to provide system operational history for tuning of the PID and lead/lag parameters.
- T. The boiler sequencing system will have the ability to communicate to a Building Management System using multiple protocols including Modbus RTU, BACnet, LonWorks or N2. Standard point mapping will be provided with the boiler sequencing system. Selection of ModBus serial connectivity (RS-232/RS-485) and baud rate will be field-adjustable using a configuration screen on the boiler sequencing system.
- U. The ModSync SE will be field configurable for different features. Configurable features include:
  - 1. Lead/Lag up to eight Fulton boilers with I/O, LMV3, LMV5, Sola, and EDR+ controls.
  - 2. Boiler Isolation Valve or Boiler Pump Control (constant speed and VFD pump control available)
  - 3. Boiler Isolation Valve or Boiler Pump Interlock
  - 4. General Alarm Contact
  - 5. E-Stop Status Input
  - 6. Boiler Alarm Output
  - 7. Boiler Status Output
  - 8. 2-4 system pump control (Constant speed and VFD pump control available)

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Before boiler installation, examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, and piping and electrical connections to verify actual locations, sizes, and other conditions affecting boiler performance, maintenance, and operations.
  - 1. Final boiler locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.
- B. Examine mechanical spaces for suitable conditions where boilers will be installed.
- C. Proceed with installation only after satisfactory conditions have been verified.

### 3.2 BOILER INSTALLATION

- A. Install boilers level on concrete base, minimum 4 inches high. Concrete base is specified in Division 23 Section "Common Work Results for HVAC," and concrete materials and installation requirements are specified in Division 03.
- B. Install gas-fired boilers according to NFPA 54. Equipment and materials shall be installed in an approved manner and in accordance with the boiler manufacturer's installation requirements.
- C. Assemble and install boiler trim.
- D. Install electrical devices furnished with the boiler but not specified to be factory mounted.
- E. Install control wiring to field-mounted electrical devices.

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.
- C. Connect gas piping to boiler gas train inlet with isolation valve and union. Piping shall be at least full size of gas train connection. Provide a reducer if required.
- D. Connect hot water supply and return water connections with shutoff valve and union or flange at each connection.
- E. Install piping from safety relief valves to the nearest floor drain.
- F. Install piping from flue gas condensate drain connection to the condensate drain trap and to the nearest floor drain.

G. Boiler Venting

1. Install flue venting and combustion air-intake.
2. Connect to boiler connections, flue size and type as recommended by the manufacturer.

H. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

I. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. After boiler installation is completed, the manufacturer shall provide the services of a field representative to inspect components, assemblies, and equipment installations, including connections and provide startup of the boiler and training to the operator.
2. Arrange with National Board of Boiler and Pressure Vessel Inspectors for inspection of boilers and piping. Obtain certification for completed boiler units, deliver to Owner, and obtain receipt.

B. Tests and Inspections

1. Perform installation and startup checks according to manufacturer's written instructions.
2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
  - a. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level and water temperature.
  - b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
  - c. Remove and replace malfunctioning units and retest as specified above.
  - d. Occupancy Adjustments: When requested within 12 months of startup, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to 2 visits to Project during other than normal occupancy hours for this purpose.

END OF SECTION 230120





## **SECTION 230130**

### **BOILER START-UP AND TESTING**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section. Submit shop drawings for checking and approval.

##### **1.1 BOILER START-UP AND TESTING**

- A. Before any water is added to the boiler for testing or other purposes, a sufficient amount of sodium sulphite (to provide a residual of 100 p.p.m.) shall be added to the boiler water to prevent deterioration due to dissolved oxygen in the boiler water. When ready for firing the Contractor shall clean the boiler internal surfaces in the following manner:
- B. Fill the boiler with fresh water.
- C. Dissolve Metro Boiling Out Compound (or mixture of equal parts of trisodium phosphate, caustic soda and soda ash) at the rate of 1 pound per 20 gallons.
- D. Dosage: 50 pounds per 1000 gallons of water content of the boiler.
- E. Connect 2" full size blow offline to blow off tapping located near the boilers normal water line. The discharge of this shall be piped full size to a suitable drain.
- F. Heat the boiler for a period of 16-24 hours without generating steam.
- G. Open the blow off valve and feed the boiler with fresh water, maintaining a "normal" water line while "skimming" all oil and grease from the top blow offline.
- H. Continue this procedure until the water is clear and free of any oil or grease.
- I. Drain the boiler and flush thoroughly with a hose through the manhole opening until all signs of debris, oil, grease and mill scale are removed.
- J. Fill with fresh water, treated either with Chem Aqua 999 boiler treatment (hot water systems), or sufficient quantity of sodium sulphite to raise the level to 100 p.p.m. (steam systems).
- K. Raise the level of the water to the steaming point to remove as much dissolved oxygen as possible.
- L. Re-test the level of sodium sulphite or boiler water treatment, adding sufficient to raise protection to the proper level.
- M. Note: In the event of a boiler contaminated with large quantities of oil or grease it may be required to repeat this procedure. Procedure shall be repeated until ALL traces of oil and grease are removed from the boiler.

- N. Contractor shall operate the boiler for a minimum of eight hours, following the above procedure, during which time valves to system and terminal units shall be in the open position and all returning water shall be wasted to drain. The purpose to remove as much scale and dirt from the piping system. During this period of operation, the residual level of water treatment of sodium sulphite shall not be allowed to fall below 100 p.p.m.
- O. Upon completion of the above, the Contractor shall close manholes and handhole mating surfaces.

END OF SECTION 230130

## **SECTION 230140**

### **DOUBLE WALL INSULATED BOILER BREECHING SYSTEM**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

#### **PART 2 - PRODUCTS**

##### **2.1 DOUBLE WALL INSULATED BOILER BREECHING SYSTEM**

- A. Factory built modular breeching shall be laboratory tested and listed by the Underwriters Laboratories, for use with building heating equipment burning gas, solid or liquid fuels as described in NFPA 211, which produce exhausted flue gases at a temperature not exceeding 1400 degrees under continuous operating conditions. UL listing shall be for both temperature and pressure. The breeching and the stack shall be sealed and pressure tight at the operating pressures of the boiler outlet
- B. The breeching and the stack shall be sealed and pressure tight at the opening pressures of the boiler outlet. Double wall vent system shall be as manufactured by Metal-Fab IPIC-2 pressurized system or approved equal.
- C. The double wall breeching shall have an inner gas carrying pipe of type 304 stainless steel. The inner wall shall be .035" minimal thickness. The outer jacket shall be aluminum coated steel .25" nominal thickness for 6" through 24" diameters. A 2" thick layer of insulation shall occupy the space between the inner and outer walls, of the entire section of the breeching and stack.
- D. Inner pipe joints shall be sealed by use of V Bands and RTV Silicone Sealant.
- E. Roof penetrations shall be suitable for a non-combustible roof and shall be according to the Drawings. Provide stainless steel rain cap and any required firestops and flashing.
- F. The breeching shall be warranted against functional failure due to defects in material and workmanship for a period of ten (10) years from date of delivery. Functional failure is defined as any failure of the system or a component to perform its intended function without adverse leakage. During this period any defective system or component shall be repaired or replaced. Three actions are required by the Contractor to place the warranty in effect.
  - 1. Shop drawings showing the actual layout and drawn to scale shall be provided by the manufacturer. The system shall be installed as designed by the manufacturer and in accordance with the terms of the manufacturer's 12-year warranty.
  - 2. The inner diameter for breeching and stack shall be verified by the manufacturer's computer. The computer program shall be technically sound, shall follow ASHRAE calculation methods, and incorporate the specific flow characteristics of the inner pipe.

3. The Contractor shall furnish the exact boiler model and operating characteristics to the factory representative. Operating characteristics shall include flue gas flow rate, temperature, velocity and available external static pressure at boiler outlet, at maximum and minimum levels of burner turndown range.
- G. Aluminized steel surfaces exposed to the elements shall be protected by a minimum of one base coat of primer and one finished coat of corrosion resistant paint such as series 4200 or 4300 as manufactured by Rust-o-leum. Paint to be supplied by the installing Contractor.
- H. Technical Services
1. The factory built modular breeching system shall be furnished and coordinated by a vendor organization which specialized in the application of packaged boiler systems, to assure design, installation and service coordination and to provide in-warranty and post-warranty unified responsibility for Owner, Architect, consulting Engineer and Contractor.
  2. Breeching vendor organization shall obtain boiler operating characteristic for the manufacturer as input for developing system configuration and parameters. Vendor shall transmit detailed stack/breeching design diagrams to Architect and consulting Engineer and shall provide periodic supervision of installation for the trade Contractor.
  3. Vendor shall provide inspection report to consulting Engineer, after completion of installation, verifying proper condition of breeching system.
- I. Gas Flue: Furnish and install where shown on the Drawings, flue/breeching vent pipe for gas burning equipment equal to Metal-Fab type "B" or approved equal, including all fittings, brackets, support plates and fittings, all as required to carry out the full intent. Install flue vent in accordance with the National Fuel Gas Code, NFPA No. 54.
- J. Equipment and components shall be in compliance with all standards of Air Movement and Control Association (AMCA), which apply to the various air moving equipment types, and with requirements of AMCA Certified Rating Program.
- K. Equipment shall be in compliance with ANSI/AMCA Standard 210-85 laboratory methods of testing fans.
- L. Compliance with ASHRAE Standard 111-1988 practices for measurement, testing, adjusting and balancing of building heating, ventilating, air conditioning and refrigeration systems.
- M. Submit shop drawings for approval that shall include dimension drawings, catalog cuts, performance, and construction schedules.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Inspect equipment space locations before beginning installation. Verify that the space is correct for entry and access. Do not proceed with installation of the equipment until unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation of equipment, accessories and components.
- B. All heating, ventilating and air conditioning equipment shall be carefully designed, constructed and installed so as to prevent any objectionable noise or vibration reaching any part of the building outside of the mechanical equipment room. Care shall also be taken to prevent transmission of noise or odor through ductwork into other spaces. The Contractor shall be required to rectify or replace at his own expense, any equipment not complying with the foregoing requirements.

### 3.3 CLEANING

- A. Clean interior and exterior surfaces promptly after installation of equipment and components. Take care to avoid damage to protective coatings and finishes. Remove excess sealants, lubrication, dirt and other foreign substances.

END OF SECTION 230140



## **SECTION 230190**

### **PUMPS**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

#### **PART 2 - PRODUCTS**

##### **2.1 IN-LINE PUMPS**

- A. Furnish and install where indicated on Drawings, ITT Bell & Gossett pumps of model and size indicated on Drawing schedule.
- B. The pumps shall be of the horizontal oil lubricated type specifically designed and guaranteed for quiet operation and suitable for minimum 125-psig working pressure.
- C. The pumps shall have a ground and polished steel shaft with a hardened integral thrust collar. The shaft shall be supported by two (2) horizontal sleeves bearing designed to circulate oil. The pumps are to be equipped with a watertight seal to prevent leakage. Mechanical seal faces to be carbon on ceramic. The motor shall be non-overloading at any point on pump curve.
- D. The motor shall be of the drip-proof, sleeve bearing, quiet operation, and rubber mounted construction.
- E. The Contractor shall furnish and install a magnetic starter for each booster pump with at least two (2) thermal overload protectors. The starter shall be equipped with manual reset buttons.

##### **2.2 FLOOR MOUNTED PUMPS**

- A. The pumps shall be model series 1510 as manufactured by ITT Bell & Gossett with performances noted on the Drawing schedule.
- B. The pumps shall be single stage, vertical split case design in cast iron and bronze construction. The pump's internals shall be capable of being serviced without disturbing piping connections or motor. The impeller shall be of the enclosed type, dynamically balanced and keyed to shaft and secured with a suitable locknut.
- C. Pump seal shall be standard single mechanical seal with carbon seal ring and Remite (or equal) seat. A replaceable shaft sleeve shall be furnished to cover the wetted area of the shaft under the seal of packing.
- D. The bearing frame assembly of the pump shall be fitted with re-greaseable ball bearings equivalent to electric motor bearing standards for quiet operation. The pump and motor shall be mounted on a common baseplate of heavy structural steel design with securely welded cross members and open grouting area.

- E. The pumps shall be factory tested at the operating conditions, thoroughly cleaned and painted with one coat of machinery enamel prior to shipment. A set of installation instructions shall be included with the pump at the time of shipment.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Inspect equipment space locations before beginning installation. Verify that the space is correct for entry and access. Do not proceed with installation of the equipment until unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation of equipment, accessories and components.
- B. All heating, ventilating and air conditioning equipment shall be carefully designed, constructed and installed so as to prevent any objectionable noise or vibration reaching any part of the building outside of the mechanical equipment room. Care shall also be taken to prevent transmission of noise or odor through ductwork into other spaces. The Contractor shall be required to rectify or replace at his own expense, any equipment not complying with the foregoing requirements.

### 3.3 CLEANING

- A. Clean interior and exterior surfaces promptly after installation of equipment and components. Take care to avoid damage to protective coatings and finishes. Remove excess sealants, lubrication, dirt and other foreign substances.

END OF SECTION 230190



## **SECTION 230200**

### **HYDRONIC SPECIALTIES**

#### **PART 1 - GENERAL**

Applicable provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

#### **PART 2 - PRODUCTS**

##### **2.1 AIR VENTS**

- A. Install at all high points automatic air vents to eliminate air binding. All automatic air vents shall be approved heavy duty type equipped with petcocks and tubing for manual venting. All vents installed in coils, etc. shall be of manual key operated type.
- B. All vents concealed from view shall be accessible through access doors. Vents shall be by Hoffman, Anderson or ITT Bell & Gossett, 125 psig rated.

##### **2.2 PRESSURE GAUGES**

- A. Furnish and install pressure gauges on suction and discharge sides of each pump and as required to check operation of equipment; pressure gauges shall have 4-1/2" diameter dials, Ashton, Ashcroft or approved equal.

##### **2.3 THERMOMETERS**

- A. Install thermometers at all locations in piping system as noted on Drawings and as required to check system performance. Thermometers shall be installed at the supply and return of coils and 3-way diverting valves as manufactured by Trerice, Weksler or Moeller, with 4-1/2 inch face, cast aluminum case, chrome plated steel ring, white background with black embossed markings, glass window, stainless steel pointer, brass movement, 316 stainless steel bulb. Provide separable, universal angle sockets for all thermometers.

##### **2.4 COMBINATION BALANCING / SHUT-OFF VALVES (Circuit Sensors /Setters and Flow Meters)**

- A. Provide Circuit Sensor/Setter balance valves as manufactured by Bell & Gossett or approved equal.
- B. Circuit Sensors: Furnish and install as shown on Drawings, a cast iron wafer-type flow meter designed for low pressure drop operation.
  - 1. The flow meter will be equipped with brass readout valves (with integral check valve) for taking differential pressure readings across the orifice of the flow meter.
  - 2. The flow meter shall be designed to operate at a maximum working pressure of 300 psig at 250 degrees F.
  - 3. The flow meter must be furnished with a calibrated nameplate for determining an accurate system flow rate.

4. Each flow meter shall be ITT Bell & Gossett Circuit Sensor Flow Meter model no. OP.
- C. Circuit Setters: Furnish and install as shown on Drawings and with manufacturer's recommendations model no. CB calibrated balance valves.
1. Valves to be designed to allow installing Contractor to pre-set balance points for proportional system balance prior to system start-up.
  2. All valves 1/2 inch to 3 inch pipe size to be of bronze body/brass ball construction with glass and carbon filled TFE seat rings.
  3. Valves to have differential pressure read-out ports across valve seat area. Read-out ports to be filled with internal EPT inert and check valve.
  4. Valve bodies to have 1/4 inch NPT tapped drain/purge port.
  5. Valves to have memory stop feature to allow valve to be closed for service and then reopened to set point without disturbing balance position. All valves to have calibrated nameplate to assure specific valve settings. Valves to be leak-tight at full rated working pressure. Valves 4 inch pipe size to be of cast iron body/brass vane construction with differential pressure read-out ports fitted with internal EPT insert and check valve.
- D. Readout Meters: Provide a portable Readout Meter with provision for hanging, capable of indicating pressure differential across a system component. Unit to be complete with all necessary hoses, shut-off and vent valves, and carrying case. Reading range to be .5" to .16" Read Out Kits to be ITT Bell & Gossett model no. RO-3.

## 2.5 CHEMICAL FEEDING EQUIPMENT

- A. Provide automatic chemical by-pass pot feeder for new boiler heating plant.
1. Axiom industries Ltd. model SF100-DS. System shall include 55 us gallon storage/mixing tank with cover; pump suction hose with inlet strainer; two pressure pumps with thermal cut-out, pump isolation valves, integral pressure switches; integral check valve; cord and plug; pre-charged accumulator tank with EPDM diaphragm, manual diverter valve for purging air and agitating contents of storage tank, pressure regulating valve adjustable (5 – 55 psig) complete with pressure gauge, integral replaceable strainer, built-in check valve; union connection, 12 mm (1/2") x 900 mm (36") long flexible connection hose with check valve; low level pump cut-out. pressure pumps shall be capable of running dry without damage. power supply 115V/60Hz/1Ph, 0.7 Amps. Unit shall be completely pre-assembled and certified by a recognized testing agency to CSA standard c22.2 no 68. If indicated a manual By-pass Feeders shall be equal to Griswold DB-5-SB-CS-2, 5-gallon pot feeder, domed bottom, ASME rated, 600 psi @ 250 degrees F.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Inspect equipment space locations before beginning installation. Verify that the space is correct for entry and access. Do not proceed with installation of the equipment until unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation of equipment, accessories and components.
- B. All heating, ventilating and air conditioning equipment shall be carefully designed, constructed and installed so as to prevent any objectionable noise or vibration reaching any part of the building outside of the mechanical equipment room. Care shall also be taken to prevent transmission of noise or odor through ductwork into other spaces. The Contractor shall be required to rectify or replace at his own expense, any equipment not complying with the foregoing requirements.

### 3.3 CLEANING

- A. Clean interior and exterior surfaces promptly after installation of equipment and components. Take care to avoid damage to protective coatings and finishes. Remove excess sealants, lubrication, dirt and other foreign substances.

END OF SECTION 230200



## **SECTION 230210**

### **STEAM AND STEAM CONDENSATE SPECIALTIES**

#### **PART 1 - GENERAL**

Applicable provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

##### **1.1 SECTION INCLUDES**

- A. Steam traps.
- B. Steam air vents.
- C. Pressure reducing valves.
- D. Steam safety valves.
- E. Steam condensate meters.

##### **1.2 REFERENCES**

- A. ASME - Boiler and Pressure Vessel Codes, SEC 8-D - Rules for Construction of Pressure Vessels.
- B. ASME B31.9 - Building Services Piping.
- C. ASTM A105 - Forgings, Carbon Steel, for Piping Components.
- D. ASTM A126 - Grey Iron Castings for Valves, Flanges, and Pipe Fittings.
- E. ASTM A216 - Steel Castings, Carbon, Suitable for Fusion Welding for High Temperature Service.
- F. ASTM A395 - Ferric Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
- G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volt Maximum).
- H. NFPA 70 - National Electrical Code.

##### **1.3 SYSTEM DESCRIPTION**

- A. Use Float and Thermostatic Traps for: Low pressure drips, medium and low pressure condensate drainage of modulating type equipment.
- B. Use Inverted Bucket Steam Traps for: High and Medium pressure drips, high pressure condensate drainage.
- C. Use thermostatic steam traps for various radiation types.

#### 1.4 PERFORMANCE REQUIREMENTS

##### A. Steam Traps

1. Select to handle minimum of two times maximum condensate load of apparatus served.
2. Pressure Differentials:
  - a. Low Pressure Systems (15 psi maximum): 2 psi.
  - b. Medium Pressure Steam (60 psi maximum): size trap to yield 20-psig outlet pressure.
  - c. High Pressure Steam (150 psi maximum): Traps discharging to medium pressure system shall be sized for 50-psig outlet pressure. Traps discharging to low pressure system shall be sized for 20-psig outlet pressure.

#### 1.5 SUBMITTALS

- A. Submit under provisions of Contract requirements.
- B. Product Data: Submit Product Data for manufactured products and assemblies required for this project.
  1. Provide for manufactured products and assemblies required for this project.
  2. Include product description, model, dimensions, component sizes, rough-in requirements, service sizes and finishes.
  3. Submit schedule indicating manufacturer, model number, size, location rated capacity, load served and features for each specialty.
  4. Include electrical characteristics and connection requirements.
- C. Manufacturer's Installation Instructions: Indicate application, selection and hookup configuration. Include pipe and necessary elevations.

#### 1.6 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Contract.
- B. Operation and Maintenance Data: Include installation instructions, servicing requirements and recommended spare parts lists.

#### 1.7 QUALITY ASSURANCE

- A. Perform Work in accordance with New York State standards for installation of boilers and pressure vessels.
- B. Maintain one copy document on site.

## 1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

## 1.9 REGULATORY REQUIREMENTS

- A. Conform to ASME B31.9 code for installation of steam and steam condensate piping and specialties.
- B. Product Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose intended.

## 1.10 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Contract.
- B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- C. Provide temporary protective coating on cast iron and steel valves.
- D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- E. Protect piping systems from entry of foreign materials by temporary covers, completing section of the work, and isolating parts of completed system.

## 1.11 EXTRA MATERIALS

- A. Provide two service kits for each size and type of steam trap.

# PART 2 - PRODUCTS

## 2.1 INVERTED BUCKET TRAPS

- A. Manufacturers
  - 1. Armstrong
  - 2. Other acceptable manufactures offering equivalent products.
    - a. Spirax/Sarco, Inc.
    - b. Dunham
- B. Trap
  - 1. Construction: ASTM A126, cast iron body with bolted cover, stainless steel bucket, stainless steel bucket, stainless steel seats and plungers and stainless steel lever mechanism with knife edge operating surfaces.
  - 2. Rating: 250-psig WSP.
  - 3. Features: Access to internal parts without disturbing piping, top test plug, bottom drain plugs.
  - 4. Accessories: Integral inlet strainer of stainless steel, integral inlet check valve, integral bimetal air vent.

## 2.2 FLOAT AND THERMOSTATIC TRAPS

### A. Manufacturers

1. Spirax/Sarco, Inc.
2. Other acceptable manufactures offering equivalent products.
  - a. Mueller
  - b. Dunham

### B. Trap

1. Construction: ASTM A126, cast iron body with bolted cover, stainless steel or bronze bellows type air vent, stainless steel or copper float, stainless steel lever and valve assembly.
2. Rating: 125-psig 150-psig 300-psig WSP.
3. Features: Access to internal parts without disturbing piping bottom drain plug.
4. Accessories: Gauge glass with shut-off cocks.

## 2.3 THERMODYNAMIC TRAPS

### A. Manufacturers

1. Armstrong
2. Other acceptable manufactures offering equivalent products.
  - a. Spirax/Sarco, Inc.
  - b. Dunham

### B. Trap

1. Construction: Stainless steel body, disc and cap.
2. Rating: 300-psig.
3. Features: Stainless steel insulating cap 1/4" steel blow down valve, integral strainer.

## 2.4 THERMOSTATIC TRAPS

### A. Pressure Balanced

1. Manufacturers
  - a. Spirax/Sarco, Inc.
  - b. Mueller
  - c. Armstrong
2. Trap: ASTM A395 cast iron body and bolted or screwed cover for 125-psig or 300-psig WSP; as required to suit pressures, stainless steel bellows, stainless steel valve and seat; integral stainless steel strainer.



## PART 3 - EXECUTION

### 3.1 INSTALLATION OPERATION

- A. Install specialties in accordance with manufacturer's instructions.
- B. Steam Traps
  - 1. Provide minimum 3/4" size on steam mains and branches.
  - 2. Install with union or flanged connections at both ends.
  - 3. Provide gate valve and strainer at inlet and gate valve, check valve at discharge.
  - 4. Provide minimum 10" long, line size dirt pocket between apparatus and trap.
- C. Remove thermostatic elements from steam traps during temporary and trial usage, until system has been operated and dirt pockets cleaned of sediment and scale.
- D. In high pressure and medium pressure mains, provide 3/4" nipple in bottom of main, extending 3/4" into and above bottom of pipe. Provide dirt pocket with 1/2" high pressure thermostatic trap.
- E. Remove and recondition pressure reducing valve, pressure controllers, air filter regulators and transfer valve as noted on Drawings. Reconditioned equipment shall have new full warranty.

END OF SECTION 230210



## **SECTION 230230**

### **FLOOR MOUNTED VERTICAL UNIT VENTILATORS**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

##### **1.1 SYSTEM DESCRIPTION**

###### **A. General Specifications**

1. The energy recovery ventilator shall be a vertical design with a small footprint. The unit shall be free-blow through a top acoustical plenum. The unit shall be provided with 100% economizer and 100% powered exhaust as well as an energy recovery wheel. The unit shall be as manufactured by Temspec Inc. of model numbers and capacities noted on the drawing schedule.
2. The unit shall be fully assembled and tested prior to shipment. It shall comply with ASHRAE 90.1 – 2010 and 62.1 – 2010 and be constructed in accordance with UL 1995 / CSA C22.2 No. 236 Standard (Heating and Cooling Equipment). A label shall be affixed to the unit listing the product code under which it is registered.
3. The unit shall be constructed in accordance with ETL and CSA standards, and a label shall be affixed to the unit listing the product code under which it is registered.
4. The unit shall be a product of ISO: 9001 quality control program and be fully assembled and tested prior to shipment.
5. The unit's noise criteria shall not exceed NC 35. A copy of a sound test completed by an independent laboratory must be submitted by the unit manufacturer.
6. The unit shall be fitted with a condensate pump when DX coil is provided. The pump shall be located in the condenser drain tray. The pump shall be 1/30 hp motor capable of 20 gph at 15 feet of lift rustproof, ABS plastic tank with built-in full flow check valve and safety overflow switch.
7. Unit ventilator manufacturer's representative shall instruct the contractor regarding the proper unloading, uncrating and storage of the equipment.

## PART 2 - PRODUCTS

### 2.1 Unit Ventilator with Energy Recovery Wheel and Powered Exhaust

#### A. Cabinet:

1. Cabinets shall utilize a formed uni-body design for superior rigidity. The VER 1200 cabinet shall be 14-gauge corrosion resistant steel, with 1" closed cell insulation. The VER cabinet shall be 18ga steel with ½" closed cell insulation. The internal bulkheads are to be securely fastened and sized to slightly compress the internal insulation layer such that the bulkhead is sealed to prevent air by-pass and reduce vibration transmissions through the side panels. The cabinet shall have a powder coat finish, color selected from the manufacturer's standard color chart.
2. The coil and filter access panels shall have concealed hinges to allow for ease of maintenance through the front of the unit. Phillips head fast lead captive screw type fasteners shall be provided for each access panel for a superior seal. A minimum of two fasteners per access panel shall be provided. Units must have the access door installed in such a fashion as to allow the side of the unit ventilator to be installed directly against the wall.
3. The unit shall have an up-flow configuration and shall have top supply air openings suitable for discharge into ceiling ductwork.

#### B. Coil:

1. Hot water coil shall have 1/2" copper tube of minimum wall thickness 0.015" and shall have aluminum fins. The coil supply and return headers shall be 3/4" copper pipe, stubbed out for sweat connection. The coil shall be factory pressure tested at not less than 350 p.s.i. A manual air vent and ball valves shall be factory installed. The coil capacity shall be as shown in the schedule. A stainless steel pitched drain pan shall be provided and insulated with closed cell foam. Provide a condensate overflow switch.

- C. Drain Pan: For all units with cooling coils an acrylic coated galvanized steel (optional stainless steel), double sloped drain pan shall be provided. The drain pan shall be insulated on the underside with ½" closed cell insulation. A "P" trap will be included below the drain pan.

#### D. Motors:

1. The internal supply fan assembly shall include two direct drive electronically commutated motors (ECM) and blowers (one blower for units <1200 c.f.m.) mounted on rubber isolation grommets. The ECM motors shall be programmed for high efficiency and low audible sound. The motors shall consist of a brushless, permanently lubricated ball bearing construction for maintenance free operation.

2. The unit shall incorporate a 100% powered exhaust fan capable of exhausting the scheduled minimum outside air (max nominal airflow = 600 cfm). The exhaust fan shall consist of a direct drive centrifugal fan with permanent split capacitor thermally protected motor mounted on rubber isolation grommets. Backdraft dampers shall be provided to prevent air infiltration when the motor is not in use. A barometric relief damper shall be incorporated in the back of the unit to relieve additional pressure during economizer mode.
- E. Disconnect Switch: The unit shall be fitted with a power disconnect switch located on the control panel, sized for the full load amperage of the unit to enable the unit to be disconnected from the power supply prior to any maintenance. In the off position the switch can be locked out.
- F. Freeze Protection: The unit shall be fitted with a freeze protection sensor to prevent any freezing of the hot water coil assembly. When the sensor detects a freeze up condition it shall shut the damper and force the flow control valve open and prevent the unit supply fan from running.
- G. Outdoor / Return Air Mixing Dampers, ERV Dampers, Exhaust Dampers:
  1. The outdoor air (OA) and exhaust air (EA) dampers shall have airfoil section extruded aluminum blades with flexible seal blade tips and jamb seals. Leakage shall not exceed 4 c.f.m. per sq. ft. at 3" W.G. differential pressure as determined by a recognized testing laboratory. The return air damper shall modulate and balance the airflow through the unit. Flap dampers exposed to outside air are NOT acceptable.
  2. A modulating, spring return mixed air damper actuator with minimum torque of 35 lb-in shall be supplied, mounted, and wired by unit manufacturer prior to shipment.
- H. Energy Recovery Module:
  1. The ER module shall include an AHRI certified energy recovery enthalpy wheel with a desiccant coating for energy efficiency and dehumidification. Supply and exhaust fans shall provide up to a nominal 600 c.f.m. of fresh air. OA and EA disposable filters shall be removable from the front of the unit. Also included are a set of actuated aluminum dampers that close when the wheel is not active to ensure air leakage does not occur between the building exterior and interior of the cabinet.
- I. Filters: The filters shall be of the manufacturer's standard high capacity 2" MERV 13, pleated type made with 100% synthetic media that does not support microbial growth. A spare set of filters shall be provided for each unit.
- j. Line Voltage Wiring: All internal line voltage wiring shall be by the unit manufacturer. A suitably rated unfused disconnect switch shall be factory installed within the unit. Internal wiring and fusing in accordance with UL 1995 / CSA C22.2 No. 236.

- K. Discharge Duct Flange: The 1" inch factory fitted discharge duct flange shall be supplied to allow for easy installation of a discharge duct to the unit. Actual duct connections to be coordinated with actual soffit locations.
- L. Top Extension: The unit manufacturer shall provide a minimum 20 inch tall acoustical plenum with double deflection supply air grilles. For superior sound attenuation, the acoustical plenum shall incorporate a perforated core and transition piece along with acoustically lined internal deflectors.
- M. Custom Outside Air Rear Extension: Unit manufacturer shall provide a custom rear extension that allows for two separate louvers, one for fresh air intake and one for classroom relief. The rear extension will also allow for the fresh air intake and relief louvers to be located a minimum of 24" apart vertically.
- N. Louver: The unit manufacturer shall provide a wall louver for the outdoor air intake and exhaust air discharge. The louver shall be two inches deep, manufactured with heavy gauge aluminum and 45 deg. blades. The blade profile shall be designed to prevent water penetration. The louver shall include 1/2" bird screen. The finish shall be polyester baked enamel selected from the manufacturers standard color chart. The manufacturer shall provide a painted wall sleeve to suit the wall thickness, including an OA/EA airflow separator to prevent mixing the airstreams.
- O. Side Pipe Cover: The unit manufacturer shall provide a pipe cover assembly, color matched to the unit. The cover shall be the depth of the unit, height to suit new ceiling heights.
- P. Controls: Unit controls shall be factory installed.
- Q. Hot Gas Reheat:  
For DX Units hot gas reheat coil and solenoid valve shall be provided, and factory installed.
- R. Hot Gas By-Pass:  
For DX units hot gas bypass device shall be factory installed for capacity unloading in cooling mode.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Inspect equipment space locations before beginning installation. Verify that the space is correct for entry and access. Do not proceed with installation of the equipment until unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation of equipment, accessories and components. The unit ventilator shall be installed plumb. Foam sealing tape shall be installed around the perimeter of the opening in the back of the unit before moving the unit into position against the wall. The exterior louver shall be caulked.

- B. All heating, ventilating and air conditioning equipment shall be carefully designed, constructed and installed so as to prevent any objectionable noise or vibration reaching any part of the building outside of the mechanical equipment room. Care shall also be taken to prevent transmission of noise or odor through ductwork into other spaces. The Contractor shall be required to rectify or replace at his own expense, any equipment not complying with the foregoing requirements.

### 3.3 CLEANING

- A. Clean interior and exterior surfaces promptly after installation of equipment and components. Take care to avoid damage to protective coatings and finishes. Remove excess sealants, lubrication, dirt and other foreign substances.

END OF SECTION 230230





## **SECTION 230231**

### **CONSOLE AND CEILING MOUNTED UNIT VENTILATORS**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section. Submit shop drawings for checking and approval.

##### **1.1 SECTION INCLUDES**

- A. Magic Aire MAUV (Vertical), MAUH (Horizontal) (or approved equal) unit ventilators are designed for floor (vertical) or ceiling (horizontal) mounting. Units shall incorporate chilled water or direct expansion cooling and hot water, steam or electric heat as specified. Units are available with Direct Digital Controls (DDC) that provide stand-alone operation or can be incorporated into a LonWorks or BACnet network. Indoor air quality is assured with dehumidification and ventilation options.

##### **1.2 REFERENCES**

- A. United Electric Company designs and builds its Magic Aire products to comply and perform to the following standards:
  - 1. Units shall be tested and certified in accordance with AHRI Standard 840.
  - 2. Unit shall be constructed and listed in accordance with ETL and ETL, Canada standards (ANSI/UL 1995-1999, second edition) (CAN/CSA C22.2 NO 2 36-95).
  - 3. Unit insulation and adhesive shall meet the requirements for flame spread rating of lower than 25 per ASTM E84 and smoke generation rating of lower than 50 per ASTM E84. Only closed cell insulation shall be used. The use of fiberglass insulation is not acceptable.
  - 4. Each coil shall be factory tested for leakage at 350-psig air pressure with coil submerged in water.

##### **1.3 SUBMITTALS**

- A. Confirm product application requirements in sufficient detail to specify product as it is to be manufactured. Critical characteristics include:
  - 1. Family of Product
  - 2. CFM
  - 3. External Static Pressure (ESP) include dirty filter factor.
  - 4. Elevation / Altitude
  - 5. Horizontal / Vertical
  - 6. Entering Water Temp and GPM
  - 7. Heating: Hot Water
  - 8. Heating: pre-heat or re-heat position
  - 9. Filter: Basic Throw-away, Renewable, Permanent
  - 10. Supply Voltage and phase
  - 11. Other items, unique requirements, or accessories

#### 1.4 DELIVERY, STORAGE AND HANDLING

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.
- B. Inspection: Inspect all items for transit damage or any indication of re-pack. Follow manufacturer directions for filing freight claims.
- C. Storage: Store materials in a dry, sheltered area, protected from damage and in accordance with manufacturer's instructions.
- D. Handling: Handle and lift products in accordance with manufacturer's instructions. Protect materials and finishes during handling and installation to prevent damage.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURER

- A. Basis of design Magic Aire (United Electric Company) Fan Coils, 501 Galveston Street, Wichita Falls, TX 76301. Phone (940)397-2100. Web Site [www.magicaire.com](http://www.magicaire.com).
- B. Alternates are considered for approval if submitted in advance with complete ratings and accessory detail.

#### 2.2 UNIT VENTILATOR

- A. The unit shall be a factory-assembled bolt-together unit ventilator. Contained within the unit enclosure shall be factory-installed motor, wiring, blowers, coil(s), bearing, outdoor/return air damper, optional face/bypass damper and optional controls. Unit shall have a draw-thru design for uniform air distribution across the coil and even discharge temperatures.

#### 2.3 CONSTRUCTION AND COMPONENTS

- A. Construction
  - 1. Unit frame shall be constructed of heavy gauge galvanized steel components that form a rigid foundation and resist corrosion.
  - 2. Unit composed of three main sub-assembled modules: Blower Module, Coil Module and Damper Module. Modules shall be removable without disassembling the unit.
  - 3. Modules shall be externally insulated using closed cell insulation.
  - 4. Unit back shall be insulated using closed cell insulation.
  - 5. Exterior access panels shall be constructed of heavy gauge galvanized steel that has been cleaned and pretreated before painting to maximize corrosion resistance. Exterior service access panels shall be retained by tamper-resistant fasteners. Panels are electro-statically coated with polyester powder baked on textured paint.

B. MAUV (Vertical unit)

1. Unit standard depth of 16 5/8 in. (21 7/8 in. depth optional), 30-in. tall cabinet with three standard 16-gauge exposed front panels, and service access panels with tamper-resistant hex socket head threaded fasteners and retainer chains for safety and ease of service. 14-gauge panels are optional.
2. Cabinet models shall have standard textured baked powder finished panels. Cabinet tops shall be charcoal bronze as standard with a steel bar-stock discharge grille. Optional textured baked power paint colors to match panels will be available for cabinet top. Unit top shall be easily removed for routine maintenance.
3. External access panels shall be easily removed from outside of the unit for easy access to filters and routine maintenance. End panel corners shall be welded and ground smooth for appearance and durability.
4. Unit shall include leveling legs to compensate for floor irregularities.

C. MAUH (Horizontal unit)

1. Rated 750 to 1500 CFM units shall have standard bar-stock steel linear discharge grille, anodized aluminum double deflection discharge grille, or discharge duct collar only.
2. Rated 2000 CFM units shall have an anodized aluminum double deflection discharge grille or optional discharge duct collar.
3. Unit shall have two hinged bottom access panels for easy access to filters and routine maintenance.
4. Retaining chains shall be furnished for both panels to ensure maximum safety.

D. Components

1. Coils
  - a. Hot water coils shall be constructed of mechanically expanded copper tubing with a minimum wall of 0.016 in., inside aluminum fins shall have a minimum thickness of 0.045 in. Coils shall have a factory-mounted low limit device mounted on the leaving side of the heating coil. The device shall be single-pole, double-throw and shall activate at 38 F if the capillary device senses a temperature change along any 6 in. of the device.
  - b. All coils shall be pressure tested at no less than 350 psig at the factory to ensure that they are leak tight.
  - c. Dual capillary type thermal sensing elements, one automatic reset and one manual reset, shall be employed to protect the unit from overheating in the event of abnormal operation.
  - d. Each circuit above 48 amps shall be protected by its own fuses rated for the duty and voltage to which they are applied.
  - e. The unit must be constructed such that troubleshooting or adjustment of the controls can be done while the unit is operating normally.
2. Pipe Tunnel: Rated 500 to 1500 CFM vertical units and rated 750 to 1500 CFM horizontal units shall have an integral pipe tunnel that can be used for piping across the unit. This tunnel shall be insulated, with closed cell insulation, from the unit and accessible from each end compartments to allow maximum flexibility of crossover piping installation.

3. Drain Pans

- a. Unit drain pan shall be double sloped welded galvanized steel or stainless steel to prevent standing water.
- b. Drain pan will be coated to prevent external condensation during cooling.
- c. Drain connections shall be supplied on both ends of pan for field conversion of slope and drain hand connection if required.
- d. Drain pan slope shall be field convertible without removing the coil module.
- e. Heating only units shall come equipped with a double sloped drain pan for future cooling needs.
- f. Horizontal units shall have drain pan connection centerline located 4.5 in. above the bottom to provide easy piping to condensate disposal system.

4. Fans and Motor

- a. Fan and motor assembly shall be direct driven. One end of drive shaft shall be mounted in a sleeve-type or ball bearing, with other end of shaft supported by motor bearings.
- b. Fan wheels shall be double-width, double-inlet with forward-curved blades, and shall operate at low speed. Fan wheels shall be mounted on a hollow one piece steel shaft.
- c. Fan wheels shall be statically and dynamically balanced.
- d. Fan (blower) housings shall be constructed from heavy-gauge steel and mounted to a heavy-gauge galvanized steel fan deck.
- e. To prevent vibration transmission to the unit frame, motor and shaft bearing shall be resiliently mounted. The drive shaft shall be connected to motor with a flexible coupling.
- f. Fan motors shall be mounted outside of the airstream on a heavy-gauge steel partition and removable without removing the blower module.
- g. Standard shall be supplied with permanently split capacitor (PSC) multi-tap transformer motors. Units that are used in high-static applications or that require higher efficiency shall be supplied with 3-speed, 120, 240 or 277 volt, single-phase, 60 Hz, electronically commutated motors (ECM). Units without controls shall be supplied with permanently split capacitor (PSC) multi-tap transformer motors. All motors shall have integral high temperature reset and shall be protected with cartridge-type fuse(s).

5. Filters

- a. Unit shall be supplied with a one piece 2-in. throwaway filter. For even loading, filter shall be positioned to filter mixed outdoor and return air.
- b. Filter track shall be field adjustable to accept 1-in. or 2-in. permanent or renewable media replacement filters.

6. Dampers

- a. Unit shall contain a single outdoor-air/return-air damper with a continuous seal the length of the damper. The Damper shall be constructed of extruded aluminum that has an integral curved web to afford maximum rigidity. External closed cell insulation shall be applied. The damper assembly shall include an anti-draft plate to prohibit outdoor air from penetrating the classrooms through the damper assembly.

- b. A single face and bypass damper with a continuous seal the length of the damper constructed of extruded aluminum shall be available.

## 7. Controls and Safeties

- a. The manufacturer shall furnish, install, wire and factory test a complete control package suitable for the unit type(s) selected. The control package shall be capable of stand-alone operation and shall have all of the necessary sensors and accessories to monitor, control and ensure complete and safe operation of the unit.
- b. The minimum position of the outdoor-air/ return-air actuator shall be adjustable by the installing contractor and/or the owner/ operator.
- c. ASHRAE Cycles II shall be available.

## 8. Special Features

- a. Cabinet full adapter back shall be available with an open space behind the back of cabinet for piping and electrical conduits. Cabinet will be properly gusseted to support the top of unit over the false back area.
- b. Valve package options shall include all valves required for both 2-way and 3-way cooling and heating applications. Valve package options shall include wye strainers, flow setters, P/T (pressure/temperature) ports, ball valve and unions. The valve package shall include all valves required to match to the ASHRAE II control cycle.
- c. End panels with cutouts to match adapter backs or custom needs. End panels shall be available in 1 in. standard sizes with 2"-4" sizes available.
- d. Subbases shall be available as an option for vertical units in sizes 2" to 12".
- e. Utility Cabinets shall be available to install alongside of the vertical units. The cabinets will be available for in 16 5/8" and 21 7/8" depths and 12", 18", and 24" widths. The cabinets shall be available with colors to match unit cabinet and top.
- f. Units shall be capable of accepting a field installed CO2 sensor with the factory installed IAQ DDC Control packages.
- g. Outdoor Air Louvers shall be available in vertical and horizontal blade styles with decorative lattice.
- h. Trim flanges shall be available for horizontal units.
- i. Touch-up paint shall be available to match cabinet color.
- j. Architectural accessories shall be available to install together with vertical units. Cabinets in standard sizes 2' to 5' available with custom options.
- k. Pipe Enclosures

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Inspect equipment space locations before beginning installation. Verify that the space is correct for entry and access. Do not proceed with installation of the equipment until unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation of equipment, accessories, and components.
- B. All heating, ventilating and air conditioning equipment shall be carefully designed, constructed, and installed so as to prevent any objectionable noise or vibration reaching any part of the building outside of the mechanical equipment room. Care shall also be taken to prevent transmission of noise or odor through ductwork into other spaces. The Contractor shall be required to rectify or replace at his own expense, any equipment not complying with the foregoing requirements.

### 3.3 CLEANING

- A. Clean interior and exterior surfaces promptly after installation of equipment and components. Take care to avoid damage to protective coatings and finishes. Remove excess sealants, lubrication, dirt and other foreign substances.

END OF SECTION 230231

## **SECTION 230235**

### **ROOFTOP ENERGY RECOVERY UNITS**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

##### **1.1 SYSTEM DESCRIPTION**

- A. This specification is based on an Energy Recovery Unit model ERP-E as manufactured by Annexair Inc. Manufacturers of alternate equipment must be approved prior to bid via addendum, in writing by the specifying Engineer, at least two weeks prior to Bid time in order for their Bid to be accepted by the Contractor. If the equipment is not pre-approved then under no circumstances shall the Contractor invest any time or money in receiving submittals or considering the equipment. Costs associated with dimensional, performance or other deviations from the specified equipment, including engineering costs to evaluate such deviations, shall be paid by the Contractor.
- B. The unit(s) shall be installed in strict accordance with the specifications. Unit(s) shall be complete with all components and accessories as specified.
- C. All units shall be factory assembled, internally wired, and 100% run tested to check operation, fan and blower rotation and control sequence before leaving the factory. Wiring internal to the unit shall be numbered for simplified identification. Units shall be ETL listed and labeled, classified in accordance with ANSI-UL 1995 / CAN/CSA C22.2 No.236.

##### **1.2 QUALITY ASSURANCE**

- A. All unit(s) shall be factory tested before shipping. A proof copy of the test shall be placed in the unit control panel. Unit(s) shall bear the ETL label, tested in accordance to UL 1995. Electrical components shall be UL listed; fans shall be tested in an AMCA certified laboratory; insulation shall comply with NFPA 90A; coils shall be tested in accordance to ARI 410 and filters shall be tested in accordance to ASHRAE 52.
- B. The unit manufacturer shall have an independent testing agency test the air leakage, panel deflection and sound pressure levels for a typical unit providing at minimum the supply airflow of units in question and not exceeding 20,000 CFM. The air leakage of the unit(s) shall not exceed 1% at 8" inches H<sub>2</sub>O positive static pressure and a copy of the report must be submitted upon request. Unit shall be constructed to limit frame and panel deflection to 1/200<sup>th</sup> of the panel length at 8" inches H<sub>2</sub>O positive static pressure and a copy of the report must be submitted upon request.
- C. The unit shall also be tested in accordance with ANSI S12.34-1998 and instrumentation used must be in compliance with the requirements of AMCA 300 for sound readings. The sound tests conducted shall report overall sound power and pressure readings for supply air outlet, return air inlet and casing radiated.

## PART 2 - PRODUCTS

### 2.1 HOUSING

- A. The unit housing shall be constructed from a frame, base and panel assembly. Unit shall be completely factory assembled and shipped in one piece. Frame shall be made from robust aluminum die cast corners and extruded aluminum profiles shall be welded together for reinforcement. The base structure shall be fully welded galvanized with cross members specifically positioned to allow for a complete walking type floor. Base structure shall have integral lifting lugs which can be removed once the unit is installed. All panels shall be made from G-90 galvanized steel, minimum 18-gauge. Fixed panels shall be fastened from the interior and gasketed to reduce thermal transmission.
- B. Access doors shall be provided to all major components to facilitate quick and easy access. Each access door shall be latched with Ventlok latches, heavy duty aluminum butt hinges and designed to open against air pressure where indicated. Access doors shall be sealed with a full "U-Shaped" gasket for superior air tightness along the door edge. BULB TYPE GASKETS SHALL NOT BE ACCEPTABLE SINCE THEY DO NOT RETURN TO THEIR ORIGINAL FORM ONCE COMPRESSED.
- C. Fixed panels shall be removable without affecting the housing integrity. All panels and access doors shall be double wall construction with (R-4.3) one-inch thick or (R-8.6) two-inch thick, minimum 1.8 PCF fiberglass insulation and lined with 20-gauge G-90 galvanized. The airflow separation wall between the outside air intake and exhaust air outlet shall be insulated with the same insulation thickness as the exterior panels when the winter design temperature is below 35 F. All roof and sidewall seams shall be positively sealed to prevent water and air leakage.
- D. Outdoor units shall have a rain gutter above each access door and a domed roof with a slope no less than 0.25 inch per linear foot. Outdoor type units shall have the entire exterior finished with chromate-free epoxy primer and two coats of acrylic urethane enamel, Annexair standard gray color. Paint shall pass ASTM B117 500 hour salt fog resistance test and ASTM D-4585 500 hour moisture condensation resistance test.
- E. Weather Hoods (Exterior Units): Outside air intake shall be designed for maximum 350 FPM air velocity. The exhaust outlet hood shall contain a bird-screen and shall have a non-restricting design.

### 2.2 ENTHALPY WHEEL

- A. Enthalpy Wheel shall recover both sensible and latent heat. The matrix shall be constructed from corrugated aluminum and specifically treated and coated with Silica Gel desiccant to assist and enhance latent heat transfer. Any other type desiccants, including 3A or 4A Molecular Sieves, will not be accepted for HVAC applications.
- B. Seals shall be full contact, low bleed type, made from dual band Ultra High Molecular Weight Polyethylene. Any seal that is non-contact is not to be considered a seal and will not be acceptable. Labyrinth type seals do not operate properly under different air stream pressures therefore shall not be acceptable in any circumstances.



- C. Drive system shall be operated by a fractional horsepower motor (maximum 1 HP), reducing gearbox, pulley and v-belt. The wheel bearing shall be permanently sealed and press fitted into the wheel matrix for long life operation. A double purge sector (2 x 5°) shall be factory installed to reduce cross contamination to under 0.1%.
- D. Frost control prevention shall be accounted for if outdoor air temperatures are below 10 degrees F at equal airflows and return relative humidity below 30%. Frost control shall be accomplished by a variable speed drive and controlling the leaving air condition of the exhaust air. Other methods of frost control will not be considered for this application. Wheel speed shall not rotate faster than 20 rpm. Any rotational speed above 20 rpm will be unacceptable.

## 2.3 FANS

- A. The fans shall be carefully positioned and installed at an optimal distance to respect uniform airflow across the heat exchanger & coil(s).
  - 1. Scroll Fans: The fan housing shall be fully constructed from galvanized steel, with double width, double inlet and forward curved impellers for constant airflow applications below 3.5" TSP and airfoil impellers for VAV applications with greater than 3.5" TSP. Impeller wheels shall be staggered for reduced sound transmission. Painted housing shall not be acceptable. Fans shall be belt-driven with adjustable sheaves. Bearings shall be selected for an average life in excess of 200,000 hours at maximum cataloged operating speeds. Fan assembly shall be isolated from the unit housing and all fan wheels shall be statically and dynamically balanced for quiet operation. Fans shall be tested for Class I & II operating limits and rated in an AMCA certified laboratory.
  - 2. Plenum Fans: Fans shall be constructed of low carbon steel, painted with an industrial air-dried alkyd enamel finish prior to assembly. Plenum fans shall be certified in accordance with standards adopted by AMCA for non-overloading fans. Plenum wheel blades shall be backward inclined for 16" diameter wheels and under, airfoil for 18" diameter wheels and above. Shafts shall be AISI C-1045 hot rolled steel turned, ground and polished. The shafts first critical speed shall be at least 142% (Class I, II and III) of the fans maximum operating speed. Bearings shall be designed for heavy-duty service with an average life of 200,000 hours, minimum. Bearing ratings shall be based on the fans maximum catalogued operating speed and horsepower. Pillow block bearings shall either be single row ball or double row spherical roller type. Bearing bars shall be rigidly supported to the base. Bearing supports shall consist of two or more full-length structure uprights. Sheaves will be adjustable type up to 15 HP motor sizes and fixed type for larger sizes. The fan housing and motor shall be mounted on a sub-base assembly, isolated from the unit cabinetry with 1" deflection spring isolators that are designed to withstand ultimate seismic forces in excess of 1g horizontally and vertically (Standard on Plenum fans). Isolation base shall be isolated with rubber mounts for scroll type fans under 18" wheel diameter, and spring isolation for larger wheel sizes. In addition, units with spring isolation shall have flexible duct canvas installed on fan outlets for reduced vibration transmission.

- B. The fan housing and motor shall be mounted on a sub-base assembly, isolated from the unit cabinetry with RIS spring isolators. In addition, units shall have flexible duct canvas installed on their fan outlets for reduced vibration transmission.

## 2.4 FAN MOTORS

- A. The fan motors shall meet NEMA standard dimensions and comply with the Energy policy Act of 1997. Motors shall have high efficiencies with low noise and vibration output. Motors shall be certified and built in accordance to ISO 9001 quality control system. Motors shall have TEFC (Totally Enclosed Fan Cooled) enclosures. MOTORS SHALL BE DESIGNED FOR SINGLE SPEED APPLICATION UNLESS OTHERWISE NOTED.

## 2.5 FILTERS

- A. Filters shall be factory installed upstream of the heat exchanger and coils, in both airstreams. Filters shall be throwaway type with extended surface pleats to increase dust-holding capacity. Filters shall be 2□MERV-8 efficiency. Filters shall be placed in a completely sealed, galvanized holding frame with quick release latches for easy replacement. Maximum air velocity through filters shall be 500 FPM.

## 2.6 DAMPERS

- A. Dampers shall be installed were shown on the drawings. Dampers shall be low leak type with rubber edges, opposed blades, and constructed in Aluminum. DAMPER ACTUATORS SHALL BE 24V, TWO POSITION OR MODULATING TYPE, WITH SPRING RETURN MECHANISM AND AUXILIARY SWITCHES.
- B. Dampers shall be installed in the following compartments with linkage rod for actuators:
  - 1. Outdoor air intake damper
  - 2. Return/Recirculation air damper
  - 3. Exhaust outlet damper

## 2.7 DX COILS

- A. Coils shall be are factory installed in the unit. Primary surface shall be round seamless (5/8"O.D.) copper tube on 1½" centers, staggered in the direction of airflow. Secondary surface shall consist of rippled aluminum plate fins for higher capacity and structural strength.
- B. Fins shall have full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Tubes shall be mechanically expanded into the fins to provide a continuous primary to secondary compression bond over the entire finned length for maximum heat transfer rates.

- C. Casing shall be constructed of continuous galvanized steel. Headers shall have intruded tube holes to provide a large brazing surface for maximum strength and inherent flexibility. The complete coil shall be tested with 315 pounds air pressure under warm water and be suitable for operation at 250 psig working pressures. Maximum finned coil height shall be 45" and shall not exceed 500 fpm face velocity. Stacked coils shall be provided for larger airflows and intermediate drain pans shall be provided for each coil bank.
- D. Drain pans shall be stainless steel with drain connections on one side only. Pan shall be sloped in two planes. All coils shall be certified in accordance with ARI standard 410.

## 2.8 WATER SOURCE HEAT PUMP SECTION

- A. Provide integral water source heat pump section(s), where indicated on the schedule. The section shall be contained in the same housing as the rest of the unit (see housing details). All units over 7 tons shall have multiple refrigeration circuits and shall have a minimum of 2-stages capacity control. The heat pump section shall be factory piped to the direct expansion coil (air side coil). The water connections (in and out) will be connected by the mechanical contractor.
- B. Compressors shall be scroll type. Each refrigeration circuit shall contain a Bi-flow TXV valve, bi-flow drier, sight glass, dual pressure control (hi & low), Schrader type service fittings (hi & lo), loss of charge switch, accumulators, reversing valve, freeze stat and anti short cycle timer, fault indicator lights, random start, one-time auto reset on fault then hard lockout and 90 second low pressure over ride for low temperature starting. Refrigeration suction piping shall be factory insulated. The entire section shall be factory piped, wired, charged with R-22 and ARI certified.
- C. The DX coil shall have a galvanized frame, copper tubes 3/8" OD and 0.016" thick, with mechanically bonded aluminum fins, 0.0045" thick. Coil shall be selected for single or dual circuit application. Fins shall be coated (Mount Holly Gold) in lieu of heresite coating. A distributor shall be provided for each refrigeration circuit. An IAQ type stainless steel drain pan will be installed under each DX Coil.

## 2.9 ELECTRIC RE-HEAT

- A. Electric re-heat coils shall be provided where indicated. Coils shall be iron-free, 80% nickel 20% chrome and shall be insulated by floating ceramic bushings from the galvanized steel frame. Coil terminal pins shall be insulated by means of non-rotating ceramic bushing. Cut-offs shall be shielded from accidental impact, and will de-energize the entire heater in case of over heating. All controls shall be pre-wired to the unit control panel. An airflow switch shall be provided to prevent the heater from operating when there is no airflow. Control shall be 1 or 2 stage, energized when outdoor air falls below the setpoint temperature. Supply air temperature shall be field adjustable.

## 2.10 ROOF CURB

- A. A non-insulated, pre-fabricated roof curb shall be provided and shipped knocked down. The roof curb will be made of 16 gauge galvanized steel with 4 inch flanges, minimum 17 inches high with a factory installed 2 x 3 inch wood nailor strip.

## 2.11 POWER AND CONTROL

- A. The power and control center shall be integral to the unit housing and rated NEMA 4X. All wiring shall be accomplished by the manufacturer and must be tested under a high pot test. UNDER NO CIRCUMSTANCES SHALL ANY WIRING OR PARTS BE FIELD INSTALLED. Panels that are externally mounted to the unit shall not be accepted, regardless of the NEMA rating they may have. A separate access door shall be provided with an approved locking device. All electrical components contained in the panel shall be UL/CSA certified and labeled. The unit shall be complete with motor starters, fuses, cascading overloads, relays, terminal interface for ON/OFF and step-down transformer. All components shall be factory wired for single point power connection by the manufacturer of the unit. A fused safety disconnect switch shall be factory installed for on/off servicing.
- B. Any power or control wiring that is field installed shall not be accepted under any circumstances. IF UNITS SHOW UP AT THE JOB SITE WITHOUT WIRING BY THE MANUFACTURER, THE CONTRACTOR WILL HAVE TO SEND BACK UNITS TO THE MANUFACTURER AT THE CONTRACTORS' EXPENSE TO GET THEM FACTORY WIRED AND RE-TESTED. A terminal interface shall be provided for remote control. Phase and brown out protection is provided per unit and One (1) 115 volt, 13 amp ground fault service receptacle provided per unit by taking one line from a three (3) phase power supply, but a neutral must be brought up with the main power line (by others).

## 2.12 AIR TEMPERATURE CONTROL PACKAGE

- A. The unit shall be delivered with factory installed control system to provide the sequence of operation recommended for the applications. Under no circumstances shall control be provided by other than the manufacturer of the equipment. Field installed control package by the ATC will not be acceptable. The control system shall consist of a microprocessor with LCD display and scroll buttons to change settings. The microprocessor shall be capable of communicating with the following protocol languages: Bacnet, Modbus or Lonwork. Sensors shall be factory installed within the unit to provide desired leaving air unit conditions. A terminal interface for remote control shall be provided: entire unit on/off and alarm contact.

## PART 3 - EXECUTION

### 3.1 FIELD INSPECTION

- A. The manufacturer who is basis of design will reserve the right to field inspect the units, whether they are awarded the job or not, and shall provide a written report to the engineer noting any deficiencies to the bid specifications. If there are any deficiencies or missing items on the units shipped which are clearly mentioned in the bid documents, regardless of what is approved by the engineer on the submittals, the units shall be returned to the manufacturer for them to be corrected at the contractor's expense.

### 3.2 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation of equipment, accessories and components.

- B. All heating, ventilating and air conditioning equipment shall be carefully designed, constructed and installed so as to prevent any objectionable noise or vibration reaching any part of the building outside of the mechanical equipment room. Care shall also be taken to prevent transmission of noise or odor through ductwork into other spaces. The Contractor shall be required to rectify or replace at his own expense, any equipment not complying with the foregoing requirements.

### 3.3 CLEANING

- A. Clean interior and exterior surfaces promptly after installation of equipment and components. Take care to avoid damage to protective coatings and finishes. Remove excess sealants, lubrication, dirt and other foreign substances.

END OF SECTION 230235



## **SECTION 230237**

### **FIXED PLATE ENERGY RECOVERY UNIT**

#### Part 1 – GENERAL

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

##### 1.1 SUMMARY

- A. This section includes Energy Recovery Ventilators for indoor installation.

##### 1.2 SUBMITTALS

- A. Product Data: For each type or model include the following:
  - 1. Complete fan performance curves for both Supply Air and Exhaust Air, with system operating conditions indicated, as tested in an AMCA Certified Chamber.
  - 2. Energy core performance data for both summer and winter operation.
  - 3. Motor ratings, electrical characteristics and motor and fan accessories.
  - 4. Material types and gauges of all component pieces and assemblies.
  - 5. Dimensioned drawings for each type of installation, showing isometric and plan views, to include location of attached ductwork and service clearance requirements.
  - 6. Estimated gross weight of each installed unit.
  - 7. Installation, Operating and Maintenance manual (IOM) for each model.
  - 8. Remote Control Panel description to include all functions.
  - 9. Color chart including a palette of available standard paint finishes.

##### 1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain unit with all appurtenant components or accessories from a single manufacturer.
- B. For the actual fabrication, installation and testing of work under this section use only thoroughly trained and experienced workers completely familiar with the items required and with the manufacturer's current recommended methods of installation.
- C. Product Options: Drawings must indicate size, profiles and dimensional requirements of Energy Recovery Units and are to be based on the specific system indicated. Refer to Division 1 Section "Product Requirements".
- D. Certifications:
  - 1. Entire unit shall be ETL Certified per U.L. 1812 and bear an ETL sticker.
  - 2. Energy Core shall be AHRI Certified, per Standard 1060.

#### 1.4 COORDINATION

- A. Coordinate size and location of all building penetrations required for installation of each unit and associated plumbing and electrical systems.
- B. Coordinate sequencing of construction of associated HVAC, electrical supply.

#### 1.5 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Filters: Provide 2 sets of MERV 13 disposable filters for each unit.
  - 2. One set of fan belts (when applicable)

### PART 2 – PRODUCTS

#### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with specifications contained within this document, manufacturers offering products that may be incorporated into the work include, but are not limited to:
  - 1. Greentek Fan Corporation, Energy Wall or approved equal.

#### 2.2 MANUFACTURED UNITS

- A. Unit shall be fully assembled at the factory and consist of an insulated metal cabinet, energy core, gravity dampers, speed control, motion detector, frost control, filter assembly for intake and exhaust air, supply air blower assembly, exhaust air blower assembly and an electrical control center. All specified components and internal accessories factory installed and tested and prepared for single-point high voltage connection.

#### 2.3 CABINET

- A. Materials: Formed single wall insulated metal cabinet, fabricated to permit access to internal components for maintenance.
- B.
  - 1. Outside casing: 18 gauge, galvanized (G90) steel meeting ASTM A653 for components that do not receive a painted finish. Pre-painted components as supplied by the factory shall have polyester urethane paint on 18 gauge G60 galvanized steel. Components that receive a painted finish per A/E specification shall be of 18 gauge type A60 galvalume steel and shall be painted with a baked industrial enamel finish. Components that receive a painted finish per A/E specification shall be painted with a polyester urethane powder coat.
  - 2. Internal assemblies: 24 gauge, galvanized (G90) steel. Direct drive motor provided with a fabricated belly band for motor support.



- C. Access doors shall be hinged.
- D. Shall have factory-installed duct flanges on all duct openings.
- E. Cabinet Insulation: Comply with NFPA 90A and NFPA 90B and erosion requirements of UL 181.
  - 1. Materials: Fiberglass insulation. If insulation other than fiberglass is used, it must also meet the Fire Hazard Classification shown below.
    - a. Thickness: 0.5 inch
    - b. Fire Hazard Classification: Maximum flame spread of 25 and smoke developed of 50, when tested in accordance with ASTM C 411.
    - c. Location and application: Full coverage of entire cabinet exterior to include walls, roof and floor of unit. Insulation shall be of semi-rigid type and installed between inner and outer shells of all cabinet exterior components.
- F. Fixed plate core: The heat recovery section must be of the fixed plate air-to-air type. The heat recovery section must recover sensible heat only. The heat recovery fixed plated core must be made of polypropylene or aluminum per specifications in the project schedule. The fixed plate air-to-air heat recovery core must be easily cleanable. Energy transfer ratings must be ARI Certified to Standard 1060 and bear the ARI certification symbol for ARI Air-to-Air Energy Recovery Ventilation Equipment Certification Program based on ARI 1060. Ratings "in accordance with 1060" without certification are not acceptable. Energy recovery device shall transfer moisture entirely in the vapor phase. The energy cassette is to have a two-year warranty. Performance criteria are to be as specified in AHRI Standard 1060.
- G. Supply Air and Exhaust Air blower assemblies: Blower assemblies consist of an electric motor as specified by A/E and a direct driven blower. Assembly shall be mounted on heavy gauge galvanized rails and further mounted on 1.125-inch-thick neoprene vibration isolators.
- H. Control panel / connections: Energy Core Ventilator shall have an electrical control center where all high and low voltage connections are made. Control center shall be constructed to permit single-point high voltage power supply connections.
- I. Frost control: Proportional defrost sequences.
- J. Economizer Control: None
- K. Gravity dampers / Exhaust Air, Intake Air: Dampers of low leakage type shall be factory installed.
- L. Variable speed control is considered to be part of various optional operational modes or device controllers and are to be factory supplied and installed as specified by the A/E.

## 2.4 BLOWER

- A. Blower section construction, Supply Air and Exhaust Air: Motor and blower shall be assembled onto a 14-gauge galvanized steel platform and must have neoprene vibration isolation.
- B. Blower assemblies: Shall be statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and horsepower.
- C. Centrifugal blower housing: Formed and reinforced steel panels to make curved scroll housing with shaped cutoff.
- D. Forward curved blower (fan) wheels: Galvanized or aluminum construction with inlet flange and shallow blades curved forward in direction of airflow. Mechanically attached to shaft with set screws.
- E. Blower performance shall be factory tested for flow rate, pressure, power, air density, rotation speed and efficiency. Ratings are to be established in accordance with AMCA 210, "Laboratory Methods of Testing Fans for Rating".

## 2.5 MOTORS

- A. General: Blower motors greater than  $\frac{3}{4}$  horsepower shall be "NEMA Premium™" unless otherwise indicated. Minimum compliance with EP Act minimum energy-efficiency standards for single speed ODP and TE enclosures is not acceptable. Motors shall be heavy-duty, permanently lubricated type to match the fan load and furnished at the specified voltage, phase and enclosure. Drives shall be sized for a minimum of 150% of driven horsepower and pulleys shall be fully machined cast-type, keyed and fully secured to the fan wheel and motor shafts. Electric motors of ten horsepower or less shall be supplied with an adjustable drive pulley. Comply with requirements in Division 23 05 13, matched with fan load.
- B. Motors shall be 60 cycle, 1 phase 115 volts.

## 2.6 UNIT CONTROLS:

- A. The unit shall be constructed so that it can be controlled by field installed standalone controllers, thermostats, and sensors. Provide a remote-control panel. with control switches in the remote panel to run the unit based on an occupied / un-occupied schedule.
- B. Sensors
  - 1. Room Temperature Sensor
  - 2. Dirty Filter Sensor
  - 3. Unit Temperature Sensors- OAI, OAD

## 2.7 FILTERS

- A. Unit shall have field installed filter box with MERV 8 disposable pleated filters 1" thick located in the outdoor air intake and return air intake and shall be accessible from the exterior of the unit.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Prior to start of installation, examine area and conditions to verify correct location for compliance with installation tolerances and other conditions affecting unit performance. See unit IOM.
- B. Examine roughing-in of electrical and HVAC services to verify actual location and compliance with unit requirements. See unit IOM.
- C. Proceed with installation only after all unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Installation shall be accomplished in accordance with these written specifications, project drawings, manufacturer's installation instructions as documented in manufacturer's IOM, Best Practices and all applicable building codes.

### 3.3 CONNECTIONS

- A. In all cases, industry Best Practices shall be incorporated. Connections are to be made subject to the installation requirements shown above.
  - 1. Duct installation and connection requirements are specified in Division 23 of this document.
  - 2. Electrical installation requirements are specified in Division 26 of this document.

### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory authorized service representative to inspect field assembled components and equipment installation, to include electrical and piping connections. Report results to A/E in writing. Inspection must include a complete startup checklist to include (as a minimum) the following: Completed Start-Up Checklists as found in manufacturer's IOM.

### 3.5 START-UP SERVICE

- A. Engage a factory authorized service representative to perform startup service. Clean entire unit and install clean filters. Measure and record electrical values for voltage and amperage. Refer to Division 23 "Testing, Adjusting and Balancing" and comply with provisions therein.

3.6 DEMONSTRATION AND TRAINING:

- A. Engage a factory authorized service representative to train owner's maintenance personnel to adjust, operate and maintain the entire unit. Refer to Division 01 Section Closeout Procedures and Demonstration and Training.

END OF SECTION 230237

## **SECTION 230240**

### **COMMERCIAL AIR-COOLED CONDENSING UNITS**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

##### **1.1 SYSTEM DESCRIPTION**

- A. Outdoor-mounted, air-cooled condensing unit suit-able for on-the-ground or rooftop installation. Unit shall consist of a semi-hermetic reciprocating compressor, an air-cooled coil, propeller-type condenser fans, and a control box. Unit shall discharge supply air upward as shown on contract drawings. Unit shall be used in a refrigeration circuit to match a packaged fan coil unit.

##### **1.2 QUALITY ASSURANCE**

- A. Unit shall be rated in accordance with ARI Standard 365, latest edition and shall be certified and listed in the latest ARI directory.
- B. Unit shall be manufactured in a facility registered to the ISO 9002 manufacturing quality standard.
- C. Unit construction shall comply with latest edition of ANSI/ASHRAE and with NEC.
- D. Unit shall be constructed in accordance with UL standards and shall carry the UL label of approval. Unit shall have CSA approval.
- E. Unit cabinet shall be capable of withstanding Federal Test Method Standard No. 141 (Method 6061) 500-hour salt spray test.
- F. Air-cooled condenser coils shall be leak tested at 150 psig and pressure tested at 480 psig.

##### **1.3 DELIVERY, STORAGE AND HANDLING**

- A. Unit shall be shipped as single package only and shall be stored and handled per unit manufacturer's recommendations.

#### **PART 2 - PRODUCTS**

##### **2.1 EQUIPMENT**

- A. General: Factory assembled, single piece, air-cooled condensing unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, compressor, holding charge (R-410a), and special features required prior to field start-up.

B. Unit Cabinet

1. Unit cabinet shall be constructed of galvanized steel, bonderized and coated with a pre-painted, baked enamel finish.
2. End unit access panel shall be hinged for compressor and control box service access.
3. Lifting holes shall be provided to facilitate rigging.

C. Fans

1. Condenser fans shall be direct-drive propeller type, discharging air vertically upward.
2. Condenser fan motors shall be totally enclosed, 3-phase type with class B insulation and permanently lubricated bearings.
3. Shafts shall have inherent corrosion resistance.
4. Fan blades shall be statically and dynamically balanced.
5. Condenser fan openings shall be equipped with PVC-coated steel wire safety guards.

D. Compressor

1. Compressor shall be serviceable, reciprocating, semi-hermetic type.
2. Compressor shall be equipped with an automatically reversible oil pump, operating oil charge, suction and discharge shutoff valves, and an insert-type, factory-sized crankcase heater to control oil dilution.
3. Compressor shall be mounted on spring vibration isolators with an isolation efficiency of no less than 95%.
4. Compressor speed shall not exceed 1750 rpm.
5. Compressor shall unload using suction cutoff unloading (electrical solenoid unloading shall be available as an accessory).

E. Condenser Coil

1. Condenser coil shall be air cooled, circuited for integral sub cooler.
2. Coil shall be constructed of aluminum fins mechanically bonded to internally grooved, seamless copper tubes which are then cleaned, dehydrated, and sealed.
3. Coil shall be protected by a sheet metal casing to eliminate the need for wind baffles for low ambient temperature operation.

4. Coil shall be protected to avoid damage due to the elements and vandalism.

F. Refrigeration Components:

1. Refrigeration circuit components shall include hot gas muffler, high-side pressure relief device, liquid line shut-off valve, suction and discharge shutoff valves, holding charge of refrigerant R-410a, and compressor oil.

G. Controls and Safeties

1. Minimum control functions shall include:
  - a. Power and control terminal blocks.
  - b. Five-minute anti-short-cycling timer to pre-vent compressor short-cycling.
  - c. Lockout on auto-reset safety until reset from thermostat.
  - d. Compressor suction pressure. Electric solenoid unloading shall be available as an accessory.
  - e. A 115-v solenoid shall be provided for solenoid drop control.
  - f. Head pressure control to 35 F by fan cycling. One condenser fan shall be cycled by discharge pressure to maintain proper head pressure.
  - g. Winter start control to prevent nuisance tri-pouts at low ambient temperatures.
2. Minimum safety devices shall include:  
Automatic reset (after resetting first at control circuit power supply) —
  - a. High discharge-pressure cutout.
  - b. Low suction-pressure cutout.
  - c. Condenser fan motors to be protected against overload or single-phase condition by internal overloads.  
Manual reset at the unit —
  - a. Low oil-pressure cutout.
  - b. Compressor electrical overload protection through the use of definite-purpose contactors and calibrated, ambient-compensated, magnetic-trip circuit breakers. Circuit breakers shall open all 3 phases in the event of an overload in any one of the phases or a single-phase condition.

H. Electrical Requirements

1. Nominal unit electrical characteristics shall be 208V, 3-ph, 60 Hz.

2. Unit electrical power shall be single point connection.
3. Unit control circuit shall contain a 24-v transformer for unit control, with capacity to operate an indoor fan interlock.

I. Special Features

1. Solid-State Head Pressure Control: Control shall regulate fan motor speed in response to the saturated condensing temperature of the unit. The control shall be capable of maintaining a condensing temperature of  $100\text{ F} \pm 10^{\circ}\text{ F}$  with outdoor temperatures at  $-20\text{ F}$  (motor change required).
2. Digital compressors for variable speed operation.
3. Hot-Gas Bypass: A hot-gas bypass valve and a 115-v pilot line solenoid valve shall be provided for low-load operation of the refrigeration system.
4. Part-Winding Start: Part-winding start shall be provided to reduce in-rush current and locked rotor amps on start-up.
5. Gage Panel: A gage panel package shall be provided which includes a suction and discharge pressure gage for the refrigerant circuit.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect equipment space locations before beginning installation. Verify that the space is correct for entry and access. Do not proceed with installation of the equipment until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation of equipment, accessories and components.
- B. All heating, ventilating and air conditioning equipment shall be carefully designed, constructed and installed so as to prevent any objectionable noise or vibration reaching any part of the building outside of the mechanical equipment room. Care shall also be taken to prevent transmission of noise or odor through ductwork into other spaces. The Contractor shall be required to rectify or replace at his own expense, any equipment not complying with the foregoing requirements.

3.3 CLEANING

- A. Clean interior and exterior surfaces promptly after installation of equipment and components. Take care to avoid damage to protective coatings and finishes. Remove excess sealants, lubrication, dirt and other foreign substances.

END OF SECTION 230240



## **SECTION 230250**

### **PACKAGED ROOFTOP COOLING UNIT WITH GAS HEAT**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

##### **1.1 SYSTEM DESCRIPTION**

- A. Unit is an outdoor, rooftop-mounted, heating-cooling unit utilizing scroll hermetic compressor(s) for cooling duty and gas combustion for heating duty and gas combination for heating duty. Supply air is discharged vertically or horizontally (with horizontal supply/return adapter assembly or roof curb) as shown on contract drawings.

##### **1.2 QUALITY ASSURANCE**

- A. Unit (016-024) shall be rated in accordance with ARI Standards 270 and 360 and designed in accordance with latest UL Standards.
- B. Unit shall be manufactured in a facility registered to ISO 90002/BS5750, Part 2.
- C. Unit shall be ETL and Warnock Hersey listed and certified in accordance with ANSI Z21.47 Standards as a total package.
- D. Roof curb shall be designed to conform to NRCA Standards.
- E. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.
- F. Unit casing shall be capable of withstanding 500-hour salt spray test exposure per ASTM B117 (scribed specimen).

##### **1.3 DELIVERY, STORAGE AND HANDLING**

- A. Unit shall be stored and handled per manufacturer's recommendations.

#### **PART 2 - PRODUCTS**

##### **2.1 EQUIPMENT (STANDARD)**

- A. General: The unit shall be a factory-assembled, single piece heating and cooling unit. Contained within the unit enclosure shall be all factory-installed wiring, piping, controls, refrigerant charge (R-410A), and special features required prior to field startup.
- B. Unit Cabinet:
  - 1. Unit cabinet shall be constructed of galvanized steel, bonderized and precoated with a baked enamel finish.

2. Indoor blower compartment interior surfaces shall be insulated with a minimum 1/2 in. thick, 1-lb. density neoprene cooled fiberglass insulation coated on the air side. Aluminum foil faced fiberglass insulation shall be used in the gas heat compartment.
3. Cabinet panels shall be easily removable for servicing.
4. Filters shall be accessible through an access panel.
5. Holes shall be provided in the base rails for rigging shackles to facilitate overhead rigging.
6. Unit shall have a factory-installed internal condensate drain connection and a sloped condensate pan.

C. Fans:

1. Indoor Blower (Evaporator Fan)
  - a. The fan shall be belt driven with adjustable motor pulleys.
  - b. The fan wheel shall be made from steel, be of the double inlet type with forward-curved blades and have a corrosion-resistant finish. It shall also be dynamically balanced.
  - c. Fan bearings shall be of the pillow block or ball-bearing type.
2. The condenser fans shall be of the direct driven, propeller type, with corrosion-resistant blades riveted to corrosion-resistant steel spiders. They shall be dynamically balanced and discharge air vertically.
3. Induced draft blower shall be of the direct-driven, single inlet, forward curved, centrifugal type. It shall be made from steel with a corrosion-resistant finish and shall be dynamically balanced.

D. Compressor(s):

1. The scroll hermetic compressor(s) shall have factory-installed external spring vibration isolation or shall be factory rubber shock mounted and internally spring mounted for vibration isolation.
2. On electrically and mechanically independent circuits.

E. Coils:

1. Evaporator and condenser coils shall have aluminum or copper plate fins mechanically bonded to seamless, internally grooved copper tubes with all joints brazed. Provide stainless steel drain pan for coils.

F. Heating Section:

1. Induced draft combustion type with energy saving direct-spark ignition system and redundant main gas valve.
2. The heat exchanger shall be of the tubular section type constructed of stainless steel for corrosion resistance.
3. Burners shall be of the in-shot type constructed of stainless steel.
4. All gas piping shall enter the unit at a single location.

G. Refrigerant Components - Refrigerant circuit components shall include:

1. Filter driers and fixed expansion devices.
2. Service gage connection on suction, discharge, and liquid lines.

H. Filter Section:

1. Standard filter section shall consist of 2 sizes of factory-installed, 2-in. thick MERV pleated, throwaway fiberglass filters of commercially available sizes.

I. Controls and Safeties

1. Unit Controls shall perform the following functions:

- a. Capacity control (2-step).
- b. Economizer operation.
- c. Self-contained low-voltage control circuit.

2. Safeties

- a. Should any of the following safety devices trip and shut off the compressor, the unit shall incorporate a solid-state compressor lockout which will provide reset capability at the space thermostat.

1. Compressor overtemperature, overcurrent.
2. Low-pressure switch.
3. High-pressure switch.
4. Freeze protection thermostat.

- b. Supply air thermostat shall be located in the unit.

- c. Heating section shall be provided with the following minimum protections:

1. High-temperature limit switches.
2. Induced-draft motor speed sensor.
3. Flame rollout switch.
4. Flame proving controls.
5. Redundant gas valve.

J. Operating Characteristics

1. Unit shall be capable of starting and running at 120 F ambient outdoor temperature, exceeding maximum load criteria of ARI Standard 360.
2. Unit shall have standard controls and will operate in cooling to 40 F.
3. Unit shall be provided with fan time delay to prevent cold air delivery.

K. Electrical Requirements: All unit power wiring shall enter unit cabinet at a single location.

L. Motors

1. The compressor motors shall be cooled by refrigerant passing through motor windings and shall have line break thermal and current overload protection.
2. All fan motors shall have permanently lubricated, sealed bearings and inherent automatic reset thermal overload protection or manual reset calibrated circuit breakers.
3. All indoor fan motors 5 hp and larger shall meet the minimum efficiency requirements as established by the Energy Policy Act of 1992 (EPACT) effective October 24, 1997.

M. Special Features

1. Direct Digital Controls:
  - a. Shall actively monitor all modes of operation, as well as evaporator-fan status, filter status, indoor-air quality, supply-air temperature, and outdoor-air temperature.
  - b. Shall have built in diagnostics for thermostat commands for both staged heating and cooling, evaporator-fan operation, and economizer operation.
  - c. Shall be equipped with a 5-minute time delay between modes of operation.
2. Roof Curbs (Horizontal and Vertical)
  - a. The roof curb shall be formed of 16-gauge steel with wood nailer strip and shall be capable of supporting unit's entire weight.
  - b. Permits installing and securing ductwork to curb prior to mounting unit on the curb.
3. Horizontal Adapter: Includes factory-assembled adapter and duct and substantially improves evaporator-fan static performance.
4. Integrated Economizer
  - a. Integrated type capable of simultaneous economizer and compressor operation to provide cooling with outdoor air.
  - b. Equipped with low-leakage dampers not to exceed 3% leakage at 1.0 in. wg pressure differential.
  - c. Capable of introducing up to 100% outdoor air.
  - d. Equipped with dry-bulb temperature control to govern economizer changeover.
  - e. Equipped with a mixed air sensor that controls the economizer to a 55 F (30.5 C) control point.
5. Head Pressure Control Package: Package shall consist of an accessory outdoor-air package and a solid-state control with condenser coil temperature sensor for controlling condenser fan motor speed to maintain condensing temperature between 90 F and 100 F at outdoor ambient temperatures down to -20 F.

6. Power Exhaust Package: Package shall include an exhaust fan, motor, and damper for vertical flow units with economizer to assure proper building pressurization.
7. Barometric Relief Damper Package
  - a. Package shall include damper, seals, hardware, and hoods to relieve excess internal pressure.
  - b. Damper shall close due to gravity upon unit shutdown.
8. Thermostat and Subbase Assembly: To provide staged heating and cooling in addition to automatic (or manual) changeover and fan control.
9. Two-Position Damper: The two-position damper package shall include a single-blade damper and motor. It admits up to 25% outdoor air and shall close upon unit shutoff.
10. Accessory Compressor Cycle Delay: The compressor cycle delay prevents rapid cycling of the compressor by preventing it from restarting for a minimum of 5 minutes after shutdown.
11. Low Ambient Kit: When used, allows units to operate at lower outdoor ambient temperatures.
12. Differential Enthalpy Sensor
  - a. For use with economizer only.
  - b. Capable of comparing enthalpy content (temperature and humidity) of outdoor and indoor air and controlling economizer cut-in point at the most economical level.
13. Remote Control Panel shall be a decorative, indoor, wall-mounted panel consisting of:
  - a. Two-stage heat/2-stage cool thermostat.
  - b. Automatic changeover.
  - c. System switch with HEAT-COOL-AUTO-OFF settings.
  - d. Fan switch with ON-AUTO settings.
  - e. Ventilation control for remote variation of the amount of outdoor-air intake.
  - f. Indicator lights for HEAT-COOL-FAN operation.
  - g. Three unused indicator lights for field use.
14. Electronic Programmable Thermostat: Capable of using deluxe full-featured electronic thermostat.
15. Winter Start Time-Delay Relay: Used in conjunction with the accessory low-ambient kit or head pressure control device on 020-028 units to permit operation in cooling at lower outdoor ambient temperatures.

16. Liquid Propane Conversion Kit: Kit shall contain all the necessary hardware and instructions to convert a standard natural gas unit for use with liquefied propane gas.
17. Service Option Package
  - a. Hinged access panels for the filter, compressor, evaporator fan, and controls box area. Filter hinged access panels permit tool-less entry for changing filters. Evaporator fan hinged access panel shall be field-convertible to a tool-less entry by removing and discarding screws. Each external hinged access panel shall be permanently attached to the rooftop unit.
  - b. Convenience Outlet: Shall be factory-installed and internally mounted with an externally accessible 115-volt, 15 amp. GFI female receptacle with hinged cover. Voltage required to operate convenience outlet shall be provided by a field installed separate branch circuit.
  - c. Non-fused disconnect switch shall be factory installed, internally mounted, NEC and UL approved non-fuse switch shall provide unit power shutoff. The control access door shall be interlocked with the non-fused disconnect. The disconnect switch must be in the OFF position to open the control box access door. Shall be accessible from outside the unit and shall provide power off lockout capability.
18. Service Valves: Shall provide positive isolation ball-type suction and discharge valves with gauge port connections.
19. Alternate Drive: Shall provide higher static drive capability to enhance evaporator-fan performance rpm range.
20. Hail Guard, Condenser Coil Grill: Shall protect the condenser coil from hail, flying debris and damage by large objects without increasing unit clearances.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Inspect equipment space locations before beginning installation. Verify that the space is correct for entry and access. Do not proceed with installation of the equipment until unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation of equipment, accessories and components.

- B. All heating, ventilating and air conditioning equipment shall be carefully designed, constructed and installed so as to prevent any objectionable noise or vibration reaching any part of the building outside of the mechanical equipment room. Care shall also be taken to prevent transmission of noise or odor through ductwork into other spaces. The Contractor shall be required to rectify or replace at his own expense, any equipment not complying with the foregoing requirements.

### 3.3 CLEANING

- A. Clean interior and exterior surfaces promptly after installation of equipment and components. Take care to avoid damage to protective coatings and finishes. Remove excess sealants, lubrication, dirt and other foreign substances.

END OF SECTION 230250





## **SECTION 230260**

### **VARIABLE REFRIGERANT FLOW OUTDOOR UNITS**

#### **PART 1 - GENERAL**

Applicable provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

##### **1.1 SYSTEM DESCRIPTION**

- A. Indoor units are matched with heat pump or heat recovery VRF (variable refrigerant flow) outdoor unit.

##### **1.2 DELIVERY, STORAGE AND HANDLING**

- A. Units shall be stored and handled per unit manufacturer's recommendations.

#### **PART 2 - PRODUCTS**

##### **2.1 MULTI V™ 5 HEAT RECOVERY AND HEAT PUMP SYSTEM(S) – (6 to 42 tons nominal)**

MULTI V™ S HEAT PUMP AND HEAT RECOVERY SYSTEM(S) – (2 to 5 tons nominal)

##### **A. Multi 5 Heat Product Design**

1. LG Multi V 5 heating and cooling system shall be an air cooled system allowing user to configure in the field a heat pump or a heat recovery system consisting of one to three outdoor unit modules, conjoined to make a 6-42 ton single refrigerant circuit.
  - a. Heat recovery systems, employing three pipes, shall be connected to Heat recovery (heat recovery) unit(s) and indoor unit(s). Multi-port heat recovery units shall allow simultaneous heating and cooling of individual zone(s) at various capacities as required to satisfy their zone requirements.
  - b. Heat pump systems shall require two pipes, simultaneous heating and cooling shall not be supported. The heat recovery system shall consist of three pipes, liquid, suction and hot gas pipes. Heat recovery systems operating at 0°F that cannot deliver single phase superheated refrigerant vapor at a minimum of 162°F while operating in the heating mode shall not be acceptable.
2. All three-phase VRF heat pump and heat recovery outdoor units shall be from the same product development generation. Mixing of outdoor units from different development generations is not acceptable.

B. Multi S Product Design

1. Variable Refrigerant Flow (VRF) HVAC outdoor unit shall be a variable capacity, direct expansion (DX), Heat Pump or Heat Recovery engineered system. The VRF system shall consist of a single frame outdoor unit, interconnecting piping, multiple indoor units (ducted, non-ducted or mixed combinations), onboard, self-contained, stand-alone communication and controls. Heat recovery systems also include intermediary heat recovery units.
2. LG Multi V S outdoor unit shall be manufactured as either a Heat Pump or a Heat Recovery model capable of heating and/or cooling. Heat pump models shall be able to heat OR cool separate thermal zones. Heat recovery models shall be able to heat AND cool separate thermal zones simultaneously.
3. Heat pump systems shall require two pipes, between the outdoor unit and indoor units. Simultaneous heating and cooling is not supported. One pipe shall support bidirectional flow single state liquid refrigerant. The other pipe shall support bidirectional flow of single state refrigerant gas. In heating mode the gas shall be super-heated high pressure. In cooling mode the gas shall be low pressure, low temperature.
4. Heat recovery system shall require three pipes between the outdoor unit and the heat recovery unit and two pipes between the heat recovery unit and each indoor unit to support simultaneous heating and cooling. Between the outdoor unit and heat recovery unit, one pipe shall support bidirectional flow single state liquid refrigerant. The second pipe shall deliver flow of low pressure, low temperature refrigerant gas from the heat recovery unit to outdoor unit. The third pipe shall deliver single state, super-heated, refrigerant hot gas during simultaneous and 100% heating operations from the outdoor unit to heat recovery unit. Heat Recovery systems using two pipes that deliver mixed state (hot gas and liquid) with separation occurring in heat recovery unit shall not be accepted.
5. Heat pump and Heat recovery outdoor units shall be designed to communicate directly with all VRF indoor units manufactured by the same supplier over a field supplied stranded, twisted and shielded pair wire. Systems requiring intermediary protocol translators, signal boosters, integration with a third party building management systems (BMS) or any other device required for communication possible shall not be accepted.
6. Indoor unit connectivity: The system shall be designed to accept connection up to 12 indoor units of various configurations and capacity. Number of indoor units allowed:
  - a. ARUN024GSS4 (2 ton) HP 4 IDUs
  - b. ARUN038GSS4 (3 ton) HP 6 IDUs
  - c. ARUN048GSS4 (4 ton) HP 8 IDUs
  - d. ARUN053GSS4 (4.4 ton) HP 9 IDUs
  - e. ARUN060GSS4 (5 ton) HP 12 IDUs
  - f. ARUB060GSS4 (5 ton) HR 12 IDUs

7. Combination Ratio (CR) is defined as sum of nominal cooling capacity of proposed indoor units/nominal cooling capacity of the outdoor unit. The maximum allowable system combination ratio shall be 130%. Systems designed with combination ratio above 130% are not acceptable. The total nominal capacity of all indoor units shall be no less than 50%.

C. Multi 5 Heat Operating Conditions

1. Outdoor Unit shall be capable of continuous compressor operation between the following operating ambient air conditions, operation outside of these conditions are possible and may involve non-continuous operations.
2. Operating Ambient Air Conditions:
  - a. Cooling: 5°F DB to 122°F DB With optional low ambient kit from -9.9°F DB to 122°F DB
  - b. Heating: -22°F WB to 61°F WB
  - c. Cooling Based (ODU reversing valve in cooling position) Synchronous: 14°F DB to 81°F DB (Heat Recovery Operation Only)
  - d. Heating Based (ODU reversing valve in heating position) Synchronous: 14°F WB to 61°F WB (Heat Recovery Operation Only)

D. Multi S Operating Conditions

1. The VRF systems shall be capable of providing continuous compressor operation over the required ambient operating range. Submittal or technical performance data that indicates the required operating ambient range includes data points that do not guarantee continuous compressor operation, noted or footnoted as reference data, shall not be accepted. The required ambient operating range is defined as follows:
  - a. Cooling
    - i. Heat Pump & Heat recovery System: 23°F DB to 122°F DB
    - ii. With optional low ambient kit from -9.9°F DB to 122°F DB
  - b. Heating
    - i. Heat Pump ARUN024 ~ARUN053GSS4: - 4°F WB to 61°F WB
    - ii. Heat Pump ARUN060GSS4: -13°F WB to 61°F WB
    - iii. Heat Recovery ARUB060GSS4: -13°F WB to 61°F WB
  - c. Heat Recovery Synchronous (Simultaneous heating and cooling)
    - i. Cooling based: 14°F DB to 81°F
    - ii. Heating-based: 14°F WB to 61°F WB

E. Electrical

1. All air source heat pump and heat recovery frame(s) shall be designed and electrically protected to maintain stable continuous compressor operation when provided with Multi S- 208-230/60/1 power and can withstand: Multi 5 Heat 208-230/60/3 power with the following specifications:

- a. 208-230/60/3 power and can withstand a voltage fluctuation of  $\pm 10\%$ 
  - i. Multi S -Voltage tolerance between 187V to 253V
- b. Multi 5 Heat - Voltage imbalance of up to two percent.
- c. Power surge of up to 5kA RMS Symmetrical.

#### F. General Features

1. The air-conditioning system shall use R410A refrigerant. Multi-S - The factory shall supply the following charge of refrigerant R410a:
  - a. ARUN024GSS4 (2 ton) HP 4.0 lbs.
  - b. ARUN038GSS4 (3 ton) HP 6.6 lbs.
  - c. ARUN048GSS4 (4 ton) HP 6.6 lbs.
  - d. ARUN053GSS4 (4.4 ton) HP 6.6 lbs.
  - e. ARUN060GSS4 (5 ton) HP 7.7 lbs.
  - f. ARUB060GSS4 (5 ton) HR 7.7 lbs.
2. Multi 5 Heat- Each system shall consist of one, two or three air source outdoor unit modules conjoined together in the field to result in the capacity specified elsewhere in these documents.
3. Dual and triple frame configurations shall be field piped together using manufacturer's designed and supplied Y-branch kits and field provided interconnecting pipe to form a common refrigerant circuit.
4. System shall have following frame configurations vs. capacity.
  - a. 6 to 20 ton units shall be a single frame only.
  - b. 22 to 34 ton units shall be dual frame only.
  - c. 36 to 42 ton heat recovery units shall be triple frame only
5. System shall employ self-diagnostics function to identify any malfunctions and provide type and location of malfunctions via fault alarms.>
6. Multi S - All outdoor units, regardless of the Heat Pump or Heat Recovery models, shall be the same generation and provide with most up to date firmware version at the time of delivery. Manufacturers commissioning agents shall assure the owner in the commissioning report that the latest software version.
7. If the specifications include both heat pump and heat recovery outdoor models, the manufacturer shall provide the most recent generation equipment only. Old stock or obsolete models will not be accepted. Products purchased over the internet and not from the manufacturer's authorized local mechanical representative or authorized distributor will not be accepted.>
8. Field Provided Refrigerant Piping:
  - a. Multi 5 Heat- The refrigerant circuit shall be constructed using field provided ACR copper, de-hydrated, refrigerant rated copper pipe, piped together with manufacturer supplied Heat recovery unit(s) and Y- branches, as may be required, connected to multiple (ducted, non-ducted or mixed combination) indoor units to effectively and efficiently control the heat pump operation or simultaneous heating and cooling operation of the heat recovery VRF system. Other pipe materials, if used, shall perform, at a minimum, as well as that specified above, shall not have any adverse reactions, for example galvanic corrosion, to any other components or

materials also in use in the system and shall be installed per manufacturer's instructions.>

- b. The unit shall be shipped from the factory fully assembled including internal refrigerant piping, inverter driven compressor(s), controls, temperature sensor, humidity sensor, contacts, relay(s), fans, power and communications wiring as necessary to perform both Heat Pump and Heat recovery operations.
  - c. Each outdoor unit refrigeration circuit shall include, but not limited to, the following components:
    - i. Refrigerant strainer(s)
    - ii. Check valve(s)
    - iii. Inverter driven, Multi 5 Heat- medium pressure vapor injection>, high pressure shell compressors
    - iv. Multi 5 Heat- Liquid refrigerant cooled inverter PCB>
    - v. Oil separator(s)
    - vi. Accumulator /controlled volume receiver(s)
    - vii. 4-way reversing valve(s)
    - viii. Multi 5 Heat - Vapor injection valve(s)
    - ix. Variable path heat exchanger control valve(s)
    - x. Oil balancing control
    - xi. Oil Level sensor(s)>
    - xii. Electronic expansion valve(s)
    - xiii. Double spiral tube sub-cooler (s) and EEV
    - xiv. Multi 5 Heat- Vapor Injection Valve(s)>
    - xv. High and low side Schrader valve service ports with caps
    - xvi. Multi S – High/low> Service valves
    - xvii. Multi S – Threaded fusible plug>
    - xviii. Multi S – High pressure switch>
9. Multi-5 Heat>Field Insulation:
- a. All refrigerant pipe, y-branches, elbows, and valves shall be individually insulated with no air gaps. Insulation R-value (thickness) shall not be less than the minimum called for by the local building code, local energy code or as a minimum per manufacture installation requirements. In no case shall the insulation be allowed to be compressed at any point in the system.
    - i. All joints shall be glued and sealed per insulation manufactures instructions to make an air tight assembly.
10. Microprocessor:
- a. Multi 5 Heat- Factory installed microprocessor controls in the outdoor unit(s), heat recovery unit(s), and indoor unit(s) shall perform functions to optimize the operation of the VRF system and communicate in a daisy chain configuration between outdoor unit and heat recovery unit(s) and indoor unit(s) via RS485 network. Controls shall also be available to control other building systems as required from the VRF control system. DIO/AIO capabilities shall be available as well as a central controller to perform operation changes, schedules and other duties as required by this specification. Addition of separate building control system shall not be required. Other control devices and sequences shall be as specified in other sections of this project specification. Multi S- Factory installed microprocessor control in the outdoor unit, heat recovery unit(s), and indoor

unit(s) shall communicate using the same protocol. Translators of any kind are not allowed. Communication between VRF system components shall be via field supplied stranded, shielded and twisted wire pair in a RS 485 network configuration. Integrated control system shall perform functions to optimize the operation of the VRF system.

- b. Multi S- Power and communication interruption: The system shall be capable of performing continuous operation when an individual or several indoor units are being serviced; communication wire cut or power to indoor unit is disconnected. Systems that alarm and/or shut down because of a lack of power to any number of indoor units shall not be acceptable or allowed.
  - c. Multi S- Main microprocessor shall include human interface capability that provides a visual code that reports systems operation status. If any malfunction occurs, or system is operating with an unstable refrigerant cycle sensors shall report the malfunction to the visual display.>
  - d. Multi S- Main processor shall provide the commissioning agent the ability to customize the VRF systems operation based on the environment in which it is installed. Customization function to include defrost operation, modifying target superheat, sub-cooling, low pressure and high pressure values , and invoke other algorithms such as smart load control to optimize system operating efficiency. The main processor board shall include the following features:
    - i. Service tool connection
    - ii. DIP switches
    - iii. Auto addressing
    - iv. Error codes
    - v. Main microprocessor
    - vi. Inverter PCB>
11. Multi S- Outdoor unit microprocessor shall have the capability of reporting malfunction and diagnostic codes to remote control devices such as the VRF manufacturer's central controller, Zone controllers, and Building Management System (BMS).>
12. Multi 5 Heat- Inverter PCB Cooling:
- a. Cooling of the inverter PCB shall be conducted by way of high pressure, sub-cooled liquid refrigerant via heat exchanger attached to the inverter PCB. The full capacity flow of refrigerant shall pass through the heat exchangers to maximize the cooling effect of the PCBs and to aid in the evaporation process and capacity of the outdoor coil during the heating mode. The recovered heat of the PCBs must be used to enhance the overall heating process, other uses or dissipation of heat to ambient shall not be permitted.
13. Compressor Control:
- a. Multi 5 Heat - Fuzzy control logic Multi S- The refrigerant cycle operation core logic shall establish and maintain target evaporating temperature (Te) to be constant on cooling mode and condensing temperature (Tc) constant on heating mode Multi 5 Heat- by Fuzzy control logic to ensure the stable

system performance. Multi S- heating mode and maintain system stable operation while operating compressors across the range of environmental conditions guaranteeing continuous compressor operation. VRF system core logic shall be able to dynamically modify the target evaporator and condenser temperatures to maximize energy savings when system is operating at part load conditions.

14. Initial Test Run (ITR) (Heating or Cooling) / Fault Detection Diagnosis (FDD) Code:
  - a. Multi 5 Heat- This control mode shall monitor and display positive or negative results of system initial startup and commissioning. Heating or Cooling ITR mode will be automatically selected. It shall monitor and provide performance metrics for the following, but not be limited to, refrigerant quantity charge, auto-charge, stable operations, connection ratios, indoor unit status, error status, and number of indoor units connected. This control mode shall not replace the system error monitoring control system.
15. BMS Integration:
  - a. Multi 5 Heat- The VRF system shall be able to integrate with Building Management Systems via BACnet™ IP gateway. This gateway converts between BACnet™ IP or Modbus TCP protocol, and RS-485 LGAP (LG Aircon protocol) allowing third party control and monitoring of the LG A/C system, or LonWorks™ gateways. See controls specification for points list.
  - b. Multi S- The VRF system manufacturer's central controls platform shall be able to communicate with third party building management systems (BMS) via BACnet IP, Modbus TCP, or LonWorks™ protocol allowing third party BMS system control and/or monitoring of the LG air conditioning and heating system. See controls specification for more detailed description of integration and points to be controlled and monitored.
  - c. The VRF system manufacturer shall have available off-the shelf devices that allows on/off binary interfaces between third party ancillary devices such as fans, door locks, photo eyes, key card switches, motion sensors, exhaust fans, dampers, and a single (or group of) VRF indoor units. Indoor units shall have the ability to start/stop the third party device, receive a contact closure signal from the third party device, or have the third party device change the operating conditions of the VRF indoor unit. Operating conditions shall include one or more of the following indoor unit functions: fan speed, fan on/off, thermal on/off cooling or heating, or indoor unit start/stop
16. Wi-Fi Communication:
  - a. The outdoor unit shall be Wi-Fi enabled and capable. Wi-Fi shall allow service or maintenance personal access to the Multi 5 Heat- complete operating system, via LGMV mobile, without need of tools other than smart phone or tablet. Active live system review, collection of all system data for a field determined duration presented in a .csv file format or collection of all operating conditions, including all indoor units, valves, sensors, compressor speeds, refrigerant pressures, etc., by snapshot of conditions and placing that snapshot into a power point slide to be reviewed at another time. Multi S- operating system diagnostics and monitoring functions, via the manufacturer's provided maintenance and diagnostic software over a mobile device or personal computer. Communication between devices

shall include: 1) Real-time system operation monitoring with the ability to capture all system operating data for a field determined period of time into a downloadable csv file format to a wireless connected device; 2) Collection of point in time (snapshot) information including all current outdoor unit operating conditions and each indoor unit, system EEV and solenoid valves, sensors, compressor speed, and refrigerant operating pressures.> Systems that require computers, hard wire only connection or other devices to collect, review or record operating conditions shall not be allowed.

17. Indoor Unit Connectivity:
  - a. Multi 5 Heat- The system shall be designed to accept connection up to 64 indoor units of various configuration and capacity, depending on the capacity of the system.
18. Power and Communication Interruption:
  - a. Multi 5 Heat- The system shall be capable of performing continuous operation when an individual or several indoor units are being serviced; communication wire cut or power to indoor unit is disconnected. Systems that alarm and/or shut down because of a lack of power to any number of indoor units shall not be acceptable.
19. Connection Ratios:
  - a. Multi 5 Heat- The maximum allowable system combination ratio for all VRF systems shall be 130% and the minimum combination ratio shall be 50%.
20. Comfort Cooling Mode:
  - a. Multi 5 Heat- Comfort cooling shall be initiated via a field setting at the outdoor unit during commissioning or anytime thereafter. Comfort cooling shall allow user to select all or some of the zones on a system to adjust automatically their evaporator temperatures, independent of other zones, based on the impending total loads of that zone determined by using the zone controller temperature sensor.
21. Multi 5 Heat- The outdoor unit refrigerant circuit shall employ for safety a threaded fusible plug.
  - a. Multi 5 Heat- An active refrigerant control and multi section accumulator-receiver that dynamically changes the volume of refrigerant circulating in the system based on operating mode and operating conditions to ensure maximum system performance and efficiency.
  - b. Multi 5 Heat - Subcooler: The VRF outdoor unit shall include a factory provided and mounted sub-cooler assembly consisting of a shell and tube-type sub-cooling heat exchanger and EEV providing refrigerant sub-cooling modulation control by fuzzy logic of EEV and by mode of operation to provide capacity and efficiency as required. Braze plate heat exchangers shall not be allowed for this function. Multi S - The VRF outdoor unit shall use the sub-cooler while operating in cooling mode to sub-cool liquid refrigerant coming from the condenser coil well below saturation temperature to ensure that refrigerant remains in 100% liquid state when it reaches the farthest indoor unit's EEV valve. The amount of sub-cooling shall be modified by the microprocessor controller and minimized at all times to maximize efficiency by not overcooling the liquid.
  - c. Smart Load Control: Multi 5 Heat- The air source unit shall be provided with Smart Load Control (SLC) enhanced energy saving algorithm that reduces



compressor lift during off peak operation. Multi S- Smart load control operation shall enhance energy savings and increase indoor comfort by monitoring the real time ambient temperature, real time weighted mean average building load, and the outdoor relativity humidity (if enabled).

- i. Multi 5 Heat- The SLC algorithm shall be monitoring in real time, the rate of change of the outdoor ambient air temperature, either the outdoor ambient air relative humidity or the indoor air relative humidity [field selectable], and the rate of change of the building load.
- ii. Multi 5 Heat- The SLC algorithm shall foresee pending changes in the building load, outdoor temperature, and humidity (or indoor humidity) and proactively reset head and/or suction pressure targets in anticipation of the reduction/increase in building load.
- iii. Multi 5 Heat- The SLC algorithm shall provide no fewer than 3 field selection options to maximize the control of the VRF system operation during morning warm-up or cool-down following night-setback reset. The selection shall be set by the commissioning agent (or at any other time thereafter). Selectable algorithm choices include:
  1. Maximize energy savings
  2. Balance the rate of temperature change with energy consumed.
  3. Quickly cool/heat the building.>
- iv. Multi S- Smart load control shall be field selectable to optimize system operation for project location and building use. Smart Load Control field setting shall select one of three operating algorithms. The commissioning agent shall select at the time of commissioning and can be changed at any other time:>
- v. Multi S-The Smart Load Control available settings shall:
  1. The system shall be influenced by any one of the chosen algorithms
  2. Off mode: Smart load control algorithm shall be in off mode
  3. Smooth mode: Smart Load control shall maximize energy savings. The rate of temperature change shall be insignificant.
  4. Normal Mode: Smart Load Control shall balance the rate of temperature change with energy consumed.
  5. Peak Mode: Smart Load shall quickly cool/heat the building. The energy consumption shall not be the priority in this mode.
- vi. Multi S- For the first 20 minutes after the initial startup, the Smart Load Control will influence the outdoor unit operation for the chosen algorithm. This operation will be available at every start up.
- vii. Multi S- After 20 minutes of compressor operation
  1. Smart Load control will maintain the chosen logic and system will operate with the same core logic.

- viii. Multi S- Smart Load Control monitors two or three inputs:
      - 1. Weighted mean average building load
      - 2. Outdoor ambient dry bulb temperature
      - 3. Outdoor ambient relative humidity or indoor relative humidity (when enabled)
    - d. Multi S- Enhance energy savings
      - i. Multi S- Cooling Mode:
        - 1. Smart Load Control raises the system target low pressure during off-peak operation.
        - 2. Raising the operating low pressure shall reduce the compressor lift, reduce compressor's speed, and power consumption.
      - ii. Multi S- Heating Mode
        - 1. Smart Load control shall lower the system target high pressure during off-peak heating operation.
        - 2. Lowering the operating high pressure target shall reduce compressor lift, reduce compressor speed and power consumption.
        - 3. Energy saved is in addition to the energy savings basic VRF load control provides.
    - e. Multi S- Increased indoor comfort
      - i. Multi S- Smart Load control shall use one (or two) sensors to measure changing outdoor weather conditions and shall prepare the VRF system to operate under the revised weather conditions. This operation shall be activated before the changed ambient conditions have an impact on indoor units.
- 22. Multi 5 Heat Refrigerant Volume Management
  - a. Multi 5 Heat Active Refrigerant Charge
    - i. Multi 5 Heat The VRF system shall be able to operate at any and all published conditions year round in cooling or heating mode without the need of adding or removing refrigerant from the system.
    - ii. Multi 5 Heat The air source unit shall be provided with an isolated vessel to store spare refrigerant and actively pass refrigerant to (or from) the accumulator in real time as necessary to maintain stable refrigeration cycle operation.
    - iii. Multi 5 Heat The air source unit microprocessor shall be provided with an algorithm that monitors the VRF system head pressure, suction pressure, subcooling, superheat, compressor speed, high and low side temperatures and the load on the system to adjust the volume of refrigerant actively circulating.

- b. Multi 5 Heat Manual Seasonal Refrigerant Charge Adjustments  
(Applicable for VRF systems without Active Refrigerant Charge)
  - i. Multi 5 Heat Alternates: Systems that **CANNOT** passively and automatically modify the active refrigerant charge using the method(s) stated to maintain stable cycle operation shall clearly state so in bold capital letters in the proposal. VRF systems that cannot perform active refrigerant control may submit a proposal as an Alternate and must include as part of the equipment price the cost of to provide bi-annual refrigerant charging services for 15 years. Service shall be performed by the factory authorized agent only. Service shall include refrigerant, parts, labor, and fees necessary to analyze the current state of the system and perform the refrigerant charge adjustment. Service must occur one month before the winter season and one month before the summer season.
  - ii. Multi 5 Heat If the VRF system requires a charge adjustment more frequently to maintain stable operation, the VRF manufacturer shall provide additional services at no additional charge.
  - iii. Multi 5 Heat The 15-year period shall begin on the date the equipment is commissioned or the date the building occupancy permit was issued for the area(s) served by the system – whichever date is later.
  - iv. Multi 5 Heat This service shall be underwritten, warranted, and administered by the VRF equipment manufacturer – not the local distributor or applied representative.
  - v. Multi 5 Heat The selected service provider shall be mutually agreeable between the building owner (or owners' agent) and must be licensed, insured, and trained to work on the VRF system. No third-party service (subcontracted service) providers will be acceptable.
  - vi. Multi 5 Heat If the service provider is not an employee of the VRF manufacturer, the service provider shall be reimbursed for services rendered directly from the manufacturer. Labor rate for services shall be paid at the prevailing wage rate in place at the time of service.

- 23. Multi 5 Heat VRF Systems with Onboard Alternate Operating Mode Selection Capability>
  - a. Multi 5 Heat All VRF systems which provide field selectable Alternate Operating Modes, for example, High Heat or High Ambient Cooling, published data tables must be available to the public for all modes offered.
  - b. Multi 5 Heat Acceptable Alternate Operating Modes must ship with all models of the VRF product offering and must be factory embedded. Custom factory or field modifications to factory provided algorithms created to meet scheduled requirements are not acceptable.
  - c. Multi 5 Heat Provide a copy of instructions required to set the Alternate Operation Mode with the initial submittal.
  - d. Multi 5 Heat For systems that provide field selectable Alternate Operating Modes, ALL technical data provided in the submittal data sheets showing product rated condition performance data, must also provide separate data

sheets that show product performance data at each of the field selectable Alternate Operating Modes available. Capacity, power input, and acoustic performance data for each mode offered shall be reported separately. Mixing of ODU, IDU, or VRF system performance capability operating in one mode with for example the power consumption, sound power rating, or electrical requirements of the same system operating in another mode is not acceptable.

#### G. Field Supplied Refrigerant Piping Design Parameters

1. The outdoor unit shall be capable of operating at an elevation difference of up to Multi 5 Heat- 360 Multi S- 164> feet above or Multi S-131 below the lowest or highest indoor unit respectively without the requirement of field installed subcooler or other forms of performance enhancing booster devices.
2. The outdoor unit shall be capable of operating with up to Multi 5 Heat- 3280 <Multi S- 984 equivalent length feet of interconnecting liquid line refrigerant pipe in the network.
3. The outdoor unit shall be capable of operating with up to Multi 5 Heat- 656 Multi S- 592 actual feet or Multi 5 Heat- 738 Multi S- 574 equivalent length feet of liquid line refrigerant pipe spanning between outdoor unit and farthest indoor unit.
4. The piping system shall be designed with pipe expansion and contraction possibilities in mind. Required expansion devices shall be field designed, supplied and installed based on proper evaluation of the proposed piping design. In addition to these requirements, the piping system installation must conform to the VRF equipment manufacturer's published guidelines.
5. The installation of pipe hangers, supports, insulation, and in general the methods chosen to attach the pipe system to the structure must allow for expansion and contraction of the piping system and shall not interfere with that movement.
6. The elevation difference between indoor units on heat pump systems shall be Multi 5 Heat- 131 Multi S- 49 feet.
7. Multi 5 Heat- The elevation differences for heat recovery systems shall be:
  - a. Heat recovery unit to connected indoor unit shall be 49 feet
  - b. Heat recovery unit to heat recovery unit shall be 98 feet
  - c. Indoor unit to indoor unit connected to same heat recovery unit shall be 49 feet
  - d. Indoor unit to indoor unit connected to separate parallel piped heat recovery units shall be 131 feet.>
8. Multi 5 Heat- The acceptable elevation difference between two series connected heat recovery units shall be 16 feet.

#### H. Defrost Operations

1. Multi 5 Heat- The outdoor unit(s) shall be provided with a minimum of 4 independent field adjustable defrost cycle algorithms to maximize the effectiveness of the defrost cycle to the local weather conditions. Intelligent Defrost shall melt accumulated frost, snow and ice from the outdoor unit heat exchanger. The defrost cycle length and sequence shall be based on outdoor ambient temperatures, outdoor unit heat exchanger temperature, and various differential

pressure variables. Intelligent Heating Mode, when outdoor unit humidistat is engaged, shall extend the normal heating sequences by adjusting the outdoor unit coil target temperature to be above the ambient dew point temperature delaying the need for defrost operations, so long as heating demand is being met.

2. Multi 5 Heat- Smart Heating: This feature shall be capable of eliminating several defrost actions per day based on outdoor air temperature and humidity conditions. Smart heating shall extend the heating operation cycle by delaying the frost formation on the outdoor coil by adjusting the surface temperature to keep it above the current outdoor ambient dew point. The algorithm shall delay while maintaining indoor space temperature.
3. Multi 5 Heat- Defrost Mode Selection: The outdoor unit shall be provided with a minimum of three field selectable defrost operation modes: Normal, Fast, or Forced.
  - a. Multi 5 Heat- Normal Defrost: Operation intended for use in areas of the country that experience adverse winter weather with periods of heavy winter precipitation and extremely low temperatures. This strategy shall maximize the systems heating performance and maintain operational efficiency. When the ambient temperature is either: a) above 32°F or b) below 32°F with the humidity level below 60% RH, Intelligent Defrost shall continue heating regardless of ice build-up on the coil until the quality of the heated air (i.e. discharge air temperature) decreases. At temperatures below 4°F, a defrost cycle shall occur every two hours to optimize system heating efficiency.
  - b. Multi 5 Heat- Fast Defrost: Operation intended for use in areas of the country with mild winter temperatures and light to moderate humidity levels. The strategy minimizes defrost cycle frequency allowing frozen precipitation to build longer in between cycles. Minimum time between defrost cycles shall be 20 minutes. Intelligent Defrost shall choose between split coil/frame and full system methods based on current weather conditions to minimize energy consumption and maximize heating cycle time.
  - c. Multi 5 Heat- Forced Defrost: Operation shall be available for the service provider to test defrost operations at any weather condition and to manually clear frozen water from the outdoor coil surfaces.
4. Multi 5 Heat- Defrost Method Selection: The outdoor unit shall be provided with two field selectable defrost operation methods: Split Coil/Frame and Full System. Split Coil/Frame option provides continuous heating of the occupied space during defrost operation. >
  - a. Multi 5 Heat- Split Coil/Frame method shall be available when Normal Defrost mode is selected. Split Coil method shall be available on all Heat Pump and Heat recovery single-frame VRF systems. Split Frame defrost shall be available on all Heat Pump and Heat recovery multi-frame outdoor units.
  - b. Multi 5 Heat- Split Coil method shall remove ice from the bottom half of the outdoor unit coil first for a maximum time of six minutes, then the top half for a maximum of six minutes. Next the bottom coil shall be heated again for an additional three minutes to remove any frozen water that may have dripped onto the lower coil during the top coil defrost operation.

- c. Multi 5 Heat- When Split Coil/Frame method is selected, a Full System defrost shall occur every 1-9 (field selectable) defrost cycles to assure 100% of the frozen precipitation has been removed to maintain efficient performance.
  - d. Multi 5 Heat- Full System method shall be available as a field selectable option. All outdoor units located in areas of the country where large volumes of frozen precipitation are common, the commissioning agent shall be able to select the Full System only defrost method.
- 5. Multi 5 Heat- Indoor Unit Fan Operation During Defrost
  - a. Multi 5 Heat- During partial defrost operation indoor units operating in cooling or dry mode shall continue normal operation.
  - b. Multi 5 Heat- During partial defrost operation, indoor units that are commissioned with fans set for continuous operation shall maintain normal fan speed unless the leaving air temperature drops, then the fan speed will be reduced to low speed for the remainder of the defrost cycle.
  - c. Multi 5 Heat- During full system defrost operation indoor unit fans will cycle off and remain off during the remainder of the defrost cycle.
- 6. Multi S- Heat Pump
  - a. <Multi S- The outdoor unit(s) shall be capable of auto defrost operation to melt accumulated frost off the outdoor unit heat exchanger. The defrost cycle control shall monitor the outdoor ambient temperature and outdoor unit heat exchanger surface temperature.
  - b. Multi S- The frequency of operating the defrost cycle shall be determined by the system's ability to maintain sufficient system head pressure to deliver comfortable warm air to the building.
- 7. Multi S- Heat Recovery
  - a. Multi S- The outdoor unit(s) shall be capable of intelligent defrost operation to melt accumulated frost off the outdoor unit heat exchanger. The defrost cycle control shall monitor the outdoor ambient temperature, humidity (if enabled), building load, and outdoor unit heat exchanger surface temperature in real time.
  - b. Multi S- The frequency of operating the defrost cycle shall be determined by the system's ability to maintain sufficient system head pressure to deliver comfortable warm air to the building.
  - c. Multi S- The intelligent defrost algorithm shall be field selectable at the time of commissioning of the outdoor unit based on anticipated winter weather conditions. Intelligent defrost continuously calculates the dew point of the ambient air using the outdoor unit's temperature and humidity sensors (if enabled) and maintains the outdoor unit's coil surface temperature above the dew point delaying defrost operation while maintaining indoor space temperature.
  - d. Multi S- The intelligent defrost algorithm shall provide smart heating that will extend the system's heating operation and reduce the frequency of defrost cycles.

## I. Oil Management

1. Multi 5 Heat- The system shall utilize a high-pressure oil return system to ensure a consistent film of oil on all moving compressor parts at all points of operation. Oil is returned to compressor through a separate high-pressure oil injection pipe directly into the oil sump. Oil returned to the compressor via the suction port of the compressor shall not be allowed.
2. Multi 5 Heat- Each compressor shall be provided with a high efficiency independent centrifugal cyclone type oil separator, designed to extract oil from the oil/refrigerant gas stream leaving the compressor.
3. Multi 5 Heat- The system shall have an oil level sensor in the compressor to provide direct oil level sensing data to the main controller. The sensor shall provide data to main outdoor unit PCB to start oil return mode and balance oil levels between multiple compressors.
4. Multi 5 Heat- The system shall only initiate an oil return cycle if the sensed oil level is below oil level target values as determined by the microprocessor. The system shall display an error if the oil sensor signals low oil level for a period of 130 minutes or longer.
5. Multi 5 Heat- A default oil return algorithm shall automatically initiate the oil return mode if the system detects a failure of the oil sump sensor. A fault code shall be reported by the system.
6. Multi 5 Heat- Timed oil return operations or systems that do not directly monitor compressor oil level shall not be permitted.
7. Multi 5 Heat- Indoor Unit Fan Operation during Oil Return Cycle
  - a. During oil return cycle indoor units operating in cooling or dry mode shall continue normal operation.
  - b. During oil return, indoor units that are commissioned with fans set for continuous operation shall maintain normal fan speed unless the leaving air temperature drops, then the fan speed will be reduced to low speed for the remainder of the oil return cycle.
  - c. During oil return cycle indoor unit fans will cycle off and remain off during oil return cycle while operating in all modes.
8. Multi S- The system shall have an oil injection mechanism to ensure a consistent film of oil on all moving compressor parts.
9. Multi S- The system shall be provided with a factory installed oil separator at the discharge port of the compressor and designed to separate, condense, and collect oil vapor from the discharge refrigerant gas and return oil to the sump of the compressor. The oil separator shall have no moving parts in the separation chamber>
10. Multi S- The system oil return control algorithm shall operate every 8 hours at a minimum, for a 3-minute period. When activated, the algorithm shall operate the system with the reversing valve in the cooling position, open all electronic expansion valves at the indoor unit(s) and raise the compressor speed to flush oil back to the compressor.

J. Fan and Motor Assembly

1. Multi 5 Heat- 6-ton frames shall be equipped with one direct drive variable speed propeller fan with Brushless Digitally Controlled (BLDC) motor with a vertical air discharge. Multi S- Heat Pump ARUN024GSS4 unit shall be equipped with one direct drive, variable speed, and axial flow fan with a horizontal air discharge. The motors shall be Brushless Digitally Controlled (BLDC), variable speed, inverter driven motors.
2. Multi 5 Heat- 8 to 20-ton frames shall be equipped with two direct drive variable speed propeller fan(s) with BLDC motor(s) with a vertical air discharge. Multi S- Heat Pump ARUN038GSS4~ARUN060GSS4 and Heat Recovery unit ARUB060GSS4 shall be equipped with two direct drive variable speed axial flow fan(s) with a horizontal air discharge. Each fan shall be provided with an independent dedicated Brushless Digitally Controlled (BLDC), variable speed, inverter driven motors.
3. The fan(s) blades shall be made of Acrylonitrile Butadiene Styrene (ABS) material Multi 5 Heat- and incorporate biomimetic technology to enhance fan performance and reduce fan generated noise.
4. The fan(s) motor shall be equipped with permanently lubricated bearings.
5. Multi 5 Heat- The fan motor shall be variable speed with an operating speed range of 0-1150 RPM cooling mode and 0-1150 RPM heating mode. Multi S- The fan assembly(s) shall have a minimum operating speed range from 0 RPM to 850 RPM in cooling mode and heating mode.
6. The fan shall have a guard to help prevent contact with moving parts.
7. Multi 5 Heat- The cabinet shall have option to redirect the discharge air direction from vertical to horizontal with the addition of optional factory provided air guides
8. Multi 5 Heat- The fan controller shall have a DIP switch setting to raise external static pressure of the fan up to 0.32 inch of W.C. to accommodate ducted installations.
9. The fan control shall have a function setting to remove excess snow automatically.
10. Multi 5 Heat- The fan control shall have a function setting to remove access dust and light debris from the outdoor unit and coil.

K. Cabinet

1. Multi 5 Heat- Outdoor unit cabinet shall be made of 20-gauge galvanized steel with a weather and corrosion resistant enamel finish. Outdoor unit cabinet finish shall be tested in accordance with ASTM B-117 salt spray surface scratch test (SST) procedure for a minimum of 1000 hours.
2. Multi 5 Heat- Cabinet weights and foot prints shall vary between 430 lbs., 7.61 sq. ft. (1.27 sq. ft. per ton), for 6 ton cabinet to 666 lbs., 10.14 sq. ft. (.51 sq. ft. per ton), for 20 ton cabinet for single cabinet configurations. The front panels of the outdoor units shall be removable type for access to internal components.



3. Multi 5 Heat -A smaller service access panel, not larger than 7" x 7" and secured by a maximum of (2) screws, shall be provided to access the following: Multi S- A removable service panel, shall be provided to access the following internal components:>
  - a. Service tool connection
  - b. DIP switches
  - c. Multi 5 Heat- Auto addressing
  - d. Multi 5 Heat- Error codes
  - e. Main microprocessor
  - f. Inverter PCB
  - g. Multi S- Outdoor unit coil EEV valve
  - h. Multi S- Subcooling heat exchanger and EEV valve
  - i. Multi S- Reversing valve
4. The cabinet shall have piping knockouts to allow refrigerant piping to be connected at the front, right side, or through the bottom of the unit.
5. The cabinet shall have a factory installed coil guard Multi S- and shall have a baked enamel finish.

L. Outdoor Unit Coil

1. Multi 5 Heat- Outdoor unit coil shall be designed, built and provided by the VRF outdoor unit manufacturer.
2. Multi S- The outdoor unit coil shall have a minimum of 14 Fins per Inch (FPI).> Multi 5 Heat- The outdoor unit coil for each cabinet shall have lanced aluminum fins with a maximum fin spacing of no more than 17 Fins per Inch (FPI). All the outdoor unit coils shall be 2 or 3 rows consisting of staggered tubes for efficient air flow across the heat exchanger.
3. Outdoor unit coil shall be comprised of aluminum fins mechanically bonded to copper tubing with inner surfaces having a riffling treatment to expand the total surface of the tube interior
4. Multi S- The aluminum fin heat transfer surfaces shall have factory applied corrosion resistant GoldFin™ coating. The coils coating shall be tested per ASTM B-117 standard. The test shall be performed for a minimum of 1000 hours. The outdoor unit coil shall have a minimum of 2 rows. Multi 5 Heat- The aluminum fin heat transfer surfaces shall have factory applied corrosion resistant Black Fin coating. The copper tubes shall have inner riffling to expand the total surface of the tube interior.
  - a. ISO 21207 Salt Spray Test Method B – 1500 hours
  - b. ASTM B-117 Acid Salt Test – 900 hours
  - c. The Black Fin coating shall be certified by Underwriters Laboratories and per ISO 21207. The above conditions shall establish the minimum allowable performance which all alternates must comply.
5. Multi 5 Heat- Variable Path Heat Exchanger: System shall have a variable flow and path outdoor heat exchanger function to vary the refrigerant flow and volume and path. Control of the variable path circuits shall be based on system operating mode and operating conditions as targeted to manage the efficiency and minimize or maximize the circulating volume of the operating fluids of the system. This

feature allows MV 5 to maintain system head pressure that delivers “gas-furnace leaving air temperature” from the indoor unit at moderate and low ambient outdoor air temperatures.

6. The outdoor unit coil, all indoor units and pipe network shall be field tested to a minimum pressure of 550 psig. Multi S- Manufacturers that do not specify and/or specify field testing pressures at less than 550 psig shall not be acceptable.

M. Multi 5 Heat- Compressor(s)

1. Multi 5 Heat- Compressor shall be designed and assembled by the VRF manufacturer specifically for use in the air source VRF product line. Third party manufactured, branded, or designed to the VRF system’s OEM specifications by a third-party manufacturer shall not be acceptable.
2. Multi 5 Heat- Compressor shall be a hermetic, high-side shell (HSS), commercial grade, compliant scroll direct-drive design.
  - a. Multi 5 Heat- Compressor Design: The compressor design shall be of the high-pressure shell scroll type where the internal pressure below the suction valves of the compressor shall be at the same high pressure and high temperature. The motor shall be cooled by high pressure gas at temperatures above saturation conditions and minimize the mixing of refrigerant liquid with oil in the sump. The system shall employ a high-pressure oil return method returning recovered oil from the oil separator directly into the oil sump of the compressor; oil shall not be allowed to return via the suction line. Bearing surfaces are continually coated with oil. The compressor shall employ an Aero-bearing constructed with high lubricity materials increasing operation time in case of low sump oil level. Compressor shall have a nominal operating range from 12Hz to 150 Hz. >
3. Multi 5 Heat- The fixed and oscillating compressor scroll components shall be made of high grade (GC25) or denser steel material. All scrolls shall be heat treated and tempered.
4. Multi 5 Heat- The oscillating scroll shall be finely machined and polished. PVE refrigerant oil shall be used as the sole liquid used to maintain a seal between the high and low sides of the compression chamber. Compressors that requires the use of any type of mechanical or wearable sealant material between the moving surfaces of the compression chamber is NOT ACCEPTABLE.
5. Multi 5 Heat- Vapor Injection: System shall have a medium pressure gas vapor injection function employed in the heating and cooling modes to increase system capacity when the outdoor ambient temperatures are low and lower compressor lift when temperatures are high. The compressor vapor injection flow amount shall be controlled by the vapor injection sub-cooling algorithm reset by discharge gas temperatures of the compressor.
6. Multi 5 Heat- Bearing surfaces shall be coated with Teflon® equal. Bearings shall be lubricated using a constant flow of PVE refrigerant oil to the bearing surfaces. The film of oil separating the crankshaft journals and bearing surfaces shall be consistent at all times the crankshaft is in motion and shall be maintained irrelevant of crankshaft rotational speed.
7. Multi 5 Heat- An internal, integrated, mechanically driven gear pump shall draw oil from the compressor sump reservoir, pressurize the oil and inject the oil directly to

- the crankshaft journals maintaining a consistent film of oil between all moving parts. Auxiliary, indirect, or electronically driven pumps are not acceptable.
8. Multi 5 Heat- The viscosity property of the PVE oil in the compressor sump shall be maintained irrelevant of compressor operation and the surrounding ambient temperature.
    - a. Multi 5 Heat- The compressor shall be equipped with an external thermally protected electric crankcase heater that is automatically activated only when the ambient temperature is below freezing and the compressor is not running to maintain the temperature of the oil in the sump above the refrigerant boiling point.
    - b. Multi 5 Heat- During stable operation, irrelevant of ambient air temperature outside the water source unit, the temperature of refrigerant vapor in contact with the surface of the oil in the compressor sump shall be maintained above 140°F to prevent foaming and to eliminate refrigerant from mixing with the oil degrading the viscosity of the oil in the sump.
    - c. Multi 5 Heat- Low side shell (LSS) type compressors that use suction vapor to cool the compressor motor shall not be acceptable.
  9. Multi 5 Heat- The compressor motor shall be designed to operate at high temperatures. >
    - a. Multi 5 Heat- The motor winding insulation shall be designed to operate continuously at a minimum temperature of 180°F without deterioration.
    - b. Multi 5 Heat- The motor cooling system shall be designed to maintain acceptable operational temperature at all times and in all conditions using high pressure, hot refrigerant vapor as motor coolant.
    - c. Multi 5 Heat- Low side shell and compressors that use low pressure, low temperature refrigerant gas to cool the motor are not acceptable.
  10. Multi 5 Heat- Inverter Compressor Controller(s)
    - a. Multi 5 Heat- Each compressor shall be equipped with a dedicated inverter compressor drive. The control of multiple compressors using a single drive is not acceptable. >
    - b. Multi 5 Heat- The inverter drive shall vary the speed of the compressor crankshaft between zero (0) Hz and 140 Hz.
    - c. Multi 5 Heat- The inverter driver controller shall be matched with the physical properties of the compressor. The drive shall be manufactured by the VRF air source unit manufacturer. The inverter drive and matching compressor shall have been thoroughly tested as a matched pair. The inverter drive shall be programmed to avoid operating the compressor at any speed that results in harmonic vibration, nuisance noise, or mechanical damage to either the driver or the compressor with power provided that is within the tolerance specification.
    - d. Multi 5 Heat- The compressor inverter drive assembly and software must be designed, manufactured, and supplied by the VRF product manufacturer. Third party branded inverter driver hardware and/or driver software or inverter driver hardware and/or software provided by a third-party manufacturer to meet OEM specifications of the VRF water source manufacturer will not be acceptable.

Multi 5 Heat- All inverter drive hardware or software manufactured in, is a product of, or sourced from China, or using a broker or third party provider as an intermediary that obtains the product from CHINA shall not be acceptable.

11. Multi 5 Heat- Compressor(s)
  - a. Multi 5 Heat- Each 6, 8, 10 ton frames shall be equipped with a single hermetically sealed, inverter driven, High Side Shell (HSS) scroll compressor.
  - b. Multi 5 Heat- 12, 14, 16, 18 and 20 ton frames shall be equipped with dual hermetically sealed, inverter driven, High Side Shell (HSS) scroll compressors.
  - c. Multi 5 Heat- Each inverter driven, HSS scroll compressor shall be capable of operating from 12 Hz up to 150 Hz in any and all modes (cooling, heating or simultaneous modes).
  - d. Multi 5 Heat- The compressor shall be designed for a separate port for oil to be directly returned to the compressor oil sump.
  - e. Multi 5 Heat- The compressor bearing(s) shall have Teflon™ coating and shall be an aero type design using High lubricity materials.
  - f. Multi 5 Heat- The compressor(s) shall be protected with:
    - i. High Pressure switch
    - ii. Over-current /under current protection
    - iii. Oil sump sensor
    - iv. Phase failure
    - v. Phase reversal
    - vi. Compressor shall be capable of receiving injection of medium pressure gas at a point in the compression cycle where such injection shall allow a greater mass flow of refrigerant at lower outdoor ambient and achieving a higher heating capability. The VRF outdoor unit shall have published performance data for heating mode operation down to -13°F on both heat pump and heat recovery systems.
  - g. Multi 5 Heat- Standard, non-inverter driven compressors shall not be permitted nor shall a compressor without vapor injection or direct sump oil return capabilities.
12. Multi S- Heat Pump models ARUN024GSS4 ~ ARUN053GSS4:
  - a. The compressor shall be a high efficiency high-side shell rotary hermetic design. Bearing shall be manufactured using high lubricity material. Compressor shall be factory charged with Polyvinyl Ether (PVE) oil. Single or dual speed compressors charged with Polyolester oil (POE) shall not be acceptable. Compressor inverter drive shall allow modulation from 20Hz to 90Hz with control in 1.0 Hz increments depending on the nominal capacity. <ARUN060GSS4> The compressor shall be a high-side shell hermetic scroll design. Oil sump area and chamber housing the motor shall be operated at the same temperature and pressure of the gas leaving the compressor chamber to ensure that the low temperature low pressure refrigerant returning to the compressor does not mix with the oil in the sump. Bearing shall be manufactured using high lubricity material. Compressor shall be factory charged with Polyvinyl Ether (PVE) oil. Single

or dual speed compressors charged with Polyolester oil (POE) oil shall not be acceptable. Compressor motor shall be designed to operate at a frequency range of 0Hz to 160Hz. Compressor inverter drive shall allow modulation from 12Hz to 110Hz.

13. Multi S- Heat Recovery models ARUB060GSS4:

- a. The compressor design shall be of the high-pressure shell scroll type where the internal pressure below the suction valves of the compressor shall be at the same high pressure and high temperature. The motor shall be cooled by high pressure gas at temperatures above saturation conditions and minimize the mixing of refrigerant liquid with oil in the sump. The system shall employ a high-pressure oil return method returning recovered oil from the oil separator directly into the oil sump of the compressor; oil shall not be allowed to return via the suction line. Bearing surfaces are continually coated with oil. The compressor shall employ an Aero-bearing constructed with high lubricity materials increasing operation time in case of low sump oil level. Compressor shall have a nominal operating range from 12Hz to 110 Hz.>

N. Operational Sound Levels

1. Multi 5 Heat- Each single frame outdoor unit shall be rated with an operational sound pressure level not to exceed as listed on below chart when tested in an anechoic chamber under ISO 3745 standard at the highest field selectable heating operating modes available. Such documentation shall be presented in all submittals, manufactures who elect to rate their equipment at other than tested in an anechoic chamber under ISO 3745 standard at the highest field selectable heating operating modes available and the highest field selectable conditions shall not be allowed.
2. Multi 5 Heat- A field setting shall be available to program the outdoor unit to reduce sound levels at night, when desired, to a selectable level while still able to meet building load requirement. This mode is available in both cooling and heating modes.
3. Multi S- The compressor(s) shall be wrapped with heat resistant foil faced, sound deadening blanket that covers all exposed surfaces of the compressor. Sound deadening blankets shall be secured in place by use of a Velcro™ tool-less joint sealing system with a minimum of ½" of overlap along all seams. The sound deadening compressor blanket shall be engineered to leave no direct sound path between the outer surface of the body of the compressor and the surrounding environment.
4. Multi S- The compressor(s) shall be mounted on rubber isolation grommets. Compressor shall ship with removable clamps that secure the compressor in place while transported. The installing contractor shall remove and discard (or optionally adjust the clamps to allow the isolator to properly function) the clamps prior to commissioning the water source unit.

5. Multi S- Manufacturers' published data shall include sound pressure and sound power levels.
  - a. Sound pressure level shall not exceed 57 dB(A) during cooling operation for Heat Pump and Heat Recovery outdoor units when tested in an anechoic chamber under ISO3745 standard. Other testing conditions shall not be allowed.
  - b. Sound power level shall not exceed 69 dB(A) when tested in an anechoic chamber under ISO3745 standard. Other testing conditions shall not be allowed.

O. Sensors

1. Each outdoor unit module shall have:
  - a. Suction temperature sensor
  - b. Discharge temperature sensor
  - c. Multi 5 Heat - Oil level sensor>
  - d. High Pressure sensor
  - e. Low Pressure sensor
  - f. Outdoor temperature sensor
  - g. Multi 5 Heat - Outdoor humidity sensor>
  - h. Outdoor unit heat exchanger temperature sensors

P. Wind Load Installations for Outdoor Units

1. LG FL Wind load Installation Drawings meet the requirements of the 2017 Florida Building Code, 6th Edition and ASCE Standard 7-2010.

Q. Seismic Installations

1. Provide OSHPD Special Seismic Certification Preapproval (OSP) documents for certified product list of VRF equipment to be installed in high seismic risk areas. Provide LG supplemental installation documents in conformance with CBC 2013, 2016 and 2019 California Building Code and IBC 2012, 2015 and 2018 International Building Code.

R. Warranty

1. Limited Warranty Period
  - a. STANDARD ONE-YEAR PARTS WARRANTY FOR A QUALIFIED SYSTEM - The Part(s) of a qualified System, including the compressor, are warranted for a period (the "Standard Parts Warranty Period") ending on the earlier to occur of one (1) year after the date of original installation, or eighteen (18) months from the date of manufacture.
  - b. ADDITIONAL SIX (6) YEAR COMPRESSOR PART WARRANTY - The Compressor is warranted for an additional six (6) year period after the end of the applicable Standard Part Warranty Period (the "Compressor Warranty Period").

2. Extended Warranty

- a. The Standard Warranty Period and the Compressor Warranty Period are extended to a total of ten (10) years (the "Extended Warranty Period") for qualified Systems that have been (a) commissioned by a party that has completed the current Training Requirements, (b) such commissioning is pursuant to LG's current published instructions, and (c) the System commissioning results and supporting documents are entered correctly into LG's online commissioning system. Commissioning of a System requires one (1) hour of LG Monitoring View (LGMV) data. Commissioning results must be entered into LG's online commissioning system within sixty (60) days of System startup.

2.2 HEAT RECOVERY UNITS

A. General

1. Heat recovery unit shall be designed and manufactured by the same manufacturer of VRF indoor unit(s) and outdoor unit(s).
2. Heat recovery unit casing shall be constructed with galvanized steel.
3. Heat recovery unit shall require 208-230V/1-phase/60Hz power supply.
4. Heat recovery Unit shall be an intermediate refrigerant control device between the air source outdoor unit and the indoor units to control the systems cooling and heating operation.
5. Heat recovery unit shall be engineered to work with a three pipe VRF system comprising of:
  - a. High Pressure Vapor Pipe
  - b. Low Pressure Vapor Pipe
  - c. Liquid Pipe
6. Heat recovery units' main 3 pipe connections shall be capable of series or parallel pipe configuration.
7. The quantity of heat recovery units that can be piped in series shall be limited to 16.
8. A single string of series piped heat recovery units shall be capable of serving any combination of styles of VRF indoor units with a combined nominal capacity of up to 240 MBh.
9. Heat recovery unit shall have 2, 3, 4, 6 or 8 ports, each port supporting one or more indoor units with a maximum connected capacity of 60 MBH.
10. Each port shall be capable of operating in cooling or heating independently regardless of the operating mode of any other port on the heat recovery unit or in the system
11. Each port shall be capable of connecting from 1 to 8 indoor units.
12. Connection to indoor units totaling greater than 60MBh nominal capacity shall be twinned to two adjacent ports of the heat recovery unit using a reverse Y-branch connector supplied by manufacture
13. Heat recovery unit shall be internally piped, wired, assembled and run tested at the factory.
14. Heat recovery unit shall be designed for installation in a conditioned environment per specifications.

15. Heat recovery unit shall employ a liquid bypass valve.
16. Heat recovery unit shall have (2) electronic expansion refrigerant valves per port.
17. Heat recovery unit shall have a balancing valve to control the pressure between the high pressure and low pressure pipe during mode switching to minimize any change-over pressure related sounds.
18. Heat recovery unit shall employ an electronic expansion valve to ensure proper sub cooling of the refrigerant.
19. Heat recovery unit shall contain one double spiral sub-cooling heat exchanger per port.
20. Heat recovery unit shall not require a condensate drain or connection.
21. Heat recovery unit shall be internally factory insulated.
22. All field refrigerant lines between outdoor unit and heat recovery unit and from heat recovery unit to indoor unit shall be field ACR tubing, insulated per building or energy code and as instructed by the manufacture.
23. The heat recovery unit shall not exceed a net weight of 70 lbs.
24. Heat recovery units, for line length and pressure drop calculations, shall not exceed a maximum equivalent pipe length value of 8.2 feet.
25. The VRF manufacturer shall provide published documentation that specifically allows the installation of field provided isolation valves on all pipes connected to the Heat recovery unit to allow the servicing of heat recovery units, refrigerant circuit or the replacement of heat recovery unit without evacuating the balance of the piping system.

B. Controls

1. Heat recovery unit(s) shall have factory installed unit mounted control boards and integral microprocessor to communicate with other devices in the VRF system.
2. Heat recovery unit shall communicate with the indoor units via a 2-conductor stranded communications cable terminated using a daisy chain configuration.
3. The contractor is instructed to review the Electrical and ATC drawings and specifications for other items or tasks which this contractor is or may be responsible to provide materials and or labor under this contract. Failure to do so will not relieve this contractor of their responsibility to provide such materials and or labor and in no case shall this contractor be further compensated as a result.

C. Seismic Installations

1. Provide OSHPD Special Seismic Certification Preapproval (OSP) documents for certified product list of VRF equipment to be installed in high seismic risk areas. Provide LG supplemental installation documents in conformance with CBC 2013, 2016 and 2019 California Building Code and IBC 2012, 2015 and 2018 International Building Code.

D. Warranty

1. Please refer to the respective outdoor unit for applicable warranty.



## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Inspect equipment space locations before beginning installation. Verify that the space is correct for entry and access. Do not proceed with installation of the equipment until unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation of equipment, accessories and components.
- B. All heating, ventilating and air conditioning equipment shall be carefully designed, constructed and installed so as to prevent any objectionable noise or vibration reaching any part of the building outside of the mechanical equipment room. Care shall also be taken to prevent transmission of noise or odor through ductwork into other spaces. The Contractor shall be required to rectify or replace at his own expense, any equipment not complying with the foregoing requirements.

### 3.3 CLEANING

- A. Clean interior and exterior surfaces promptly after installation of equipment and components. Take care to avoid damage to protective coatings and finishes. Remove excess sealants, lubrication, dirt and other foreign substances.

END OF SECTION 230260



## **SECTION 230265**

### **VARIABLE REFRIGERANT FLOW INDOOR UNITS**

#### **PART 1 - GENERAL**

Applicable provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

##### **1.1 SYSTEM DESCRIPTION**

- A. Indoor units are matched with heat pump or heat recovery VRF (variable refrigerant flow) outdoor unit.

##### **1.2 DELIVERY, STORAGE AND HANDLING**

- A. Units shall be stored and handled per unit manufacturer's recommendations.

#### **PART 2 – PRODUCTS**

##### **2.1 CEILING CASSETTE**

###### **A. General**

1. Unit shall be manufactured by LG.
2. Unit shall be designed to be installed for indoor application.
3. Unit shall be designed to mount recessed in the ceiling and has a surface mounted grille 1 Way with air inlet and outlet. 2&4-Way on the bottom of the unit.
4. 4 Way The unit shall be available in both nominal 2' x 2' and 3' x 3' chassis.

###### **B. Casing/Panel**

1. Unit case shall be manufactured using galvanized steel plate.
2. The unit panel shall be provided with an off-white or black Acrylonitrile Butadiene Styrene (ABS) polymeric resin grille.
3. The grille shall have a tapered trim edge, and a hinged, spring clip (screw-less) return air filter-grille door.
4. Unit shall be provided with metal ears designed to support the unit weight on four corners.
5. Ears shall have pre-punched holes designed to accept field supplied all thread rod hangers.
6. 2&4-Way Unit shall be supplied with snap off access panels to facilitate leveling of unit without removing the grille.

C. Cabinet Assembly

1. Unit shall have 1-Way one 2-Way two> 4-Way four supply air outlets and one return air inlet.
2. The supply air outlet shall be through 1-Way single 2-Way two parallel 4-Way four directional slot diffusers each equipped with independent oscillating motorized guide vanes designed to change the airflow direction.
3. The grille shall have a discharge range of motion of 40° in an up/down direction with capabilities of locking the vanes. 2-Way The unit shall be provided with a factory perforated knockout for ventilation air.
4. 1-Way Unit shall have factory installed motorized louver to provide flow of air in up and down direction for uniform airflow. 2&4-Way The unit shall have a guide vane algorithm designed to sequentially change the predominant discharge airflow direction in counterclockwise pattern.
5. 2&4-Way Guide vanes shall provide airflow in all directions.
6. Unit shall be equipped with factory installed temperature thermistors for:
  - a. Return air
  - b. Refrigerant entering coil
  - c. Refrigerant leaving coil
7. Unit shall have a factory assembled, piped and wired electronic expansion valve (EEV) for refrigerant control.
8. Unit shall have a built-in control panel to communicate with other indoor units and to the outdoor unit.
9. 2&4-Way The unit shall have factory designated branch duct knockouts on the unit case.>
10. The unit shall have provision of fresh air ventilation through a knock-out on the cabinet.
11. 2&4-Way The branch duct knockouts shall have the ability to duct up to 1/2 the unit airflow capacity.
12. 2&4-Way The branch duct cannot be ducted to another room.
13. Unit shall have the following functions as standard:
  - a. Self-diagnostic function
  - b. Auto addressing
  - c. Auto restart function
  - d. Auto changeover function (Heat Recovery system only)
  - e. Auto operation function
  - f. Child lock function
  - g. Forced operation
  - h. Dual thermistor control
  - i. Sleep mode
  - j. Dual set point control
  - k. 2&4-Way Multiple aux heater applications>
  - l. Filter life timer
  - m. External on/off input

- n. Wi-Fi compatible
- o. Auto fan operation
- p. Leak detection logic

#### D. Fan Assembly

1. 1-Way The unit shall have a single, direct driven, crossflow tangential Sirocco fan made of high strength ABS GP-2305 polymeric resin. 2&4-Way The unit shall have a single, direct-drive turbo fan made of high strength ABS HT-700 polymeric resin.
2. The fan impeller shall be statically and dynamically balanced.
3. The fan motor is Brushless Digitally commutated (BLDC) with permanently lubricated and sealed ball bearings.
4. The fan motor shall include thermal, overcurrent and low RPM protection.
5. 2&4-Way The fan/motor assembly shall be mounted on vibration attenuating rubber grommets.
6. The fan speed shall be controlled using microprocessor based direct digitally controlled algorithm that provides a minimum of four pre-programmed fan speeds in the heating mode and fan only mode and five speeds in the cooling mode. The fan speed algorithm provides a field selectable fixed speed. 2-Way Each setting is also adjustable by field setting to compensate for a limited amount of additional resistance to airflow by adjusting the RPM of the fan motor.
7. 2&4-Way A field setting shall be provided to vary air throw pattern to compensate for high ceiling installations.
8. In cooling mode, the indoor fan shall have the following settings: Low, Med, High, 1&4-Way Super high, Power Cool, and Auto.
9. In heating mode, the indoor fan shall have the following settings: Low, Med, High, 1&4-Way Super high and Auto.
10. 2&4-Way Unit shall have factory installed motorized louver to provide flow of air in up and down direction for uniform airflow.

#### E. Filter Assembly

1. The return air inlet shall have a factory supplied removable, washable filter.
2. 4-Way The unit shall have the capability to accept a field provided MERV 1 to MERV 10 filter.
3. The filter access shall be from the bottom of the unit without the need for tools.
4. 4-Way The nominal 3'x3' cabinet unit shall have provision for an optional auto-elevating grille kit designed to provide motorized ascent/descent of the return air grille/pre filter assembly.
  - a. The ascent/descent of the return air grille shall be up to a distance of 14-3/4 feet allowing access to remove and clean the filter.
  - b. The auto-elevating grille shall have a control algorithm to accept up, down and stop control commands from the controller.
  - c. The auto-elevating grille shall have a control to stop the descent automatically if a contact is made with any obstacle.

F. Coil Assembly

1. Unit shall have a factory-built coil comprised of aluminum fins mechanically bonded on copper tubing.
2. The copper tubing shall have inner grooves to expand the refrigerant contact surface for high efficiency heat exchanger operation.
3. Unit shall have a minimum one or two row coil, 1-Way 21 2-Way 20 4-Way 18-19 fins per inch.
4. Unit shall have a factory supplied condensate drain pan below the coil constructed of EPS (expandable polystyrene resin).
5. Unit shall include an installed and wired condensate drain lift pump capable of providing minimum 27.5-inch lift from bottom surface of the unit.
6. 1-Way Unit shall have a 1.0" ID factory insulated drain hose to handle condensate.
7. The drain pump shall have a safety switch to shut off the unit if condensate rises too high in the drain pan.
8. Unit shall have provision of 45° flare refrigerant pipe connections.
9. The coil shall be factory pressure tested at a minimum of 550 psig.
10. All refrigerant piping from outdoor unit to indoor unit shall be field insulated. Each pipe should be insulated separately. Thickness and heat transfer characteristics shall be determined by the design engineer and shall meet all code requirements.

G. Microprocessor Control

1. The unit shall have a factory installed microprocessor controller capable of performing functions necessary to operate the system. 1&2-Way with or without the use of a wall mounted controller. The unit shall have a factory mounted return air thermistor for use as a space temperature control device. All operating parameters except scheduling shall be stored in non-volatile memory resident on the microprocessor. The microprocessor shall provide the following functions, self-diagnostics, auto re-start after a power failure and a test run mode.
2. The unit shall be able to communicate with other indoor units and the outdoor unit using a field supplied minimum of 18 AWG, two core, stranded, twisted and shielded communication cable.
3. The unit controls shall operate the indoor unit using one of the five operating modes:
  - a. Auto changeover (Heat Recovery System only)
  - b. Heating
  - c. Cooling
  - d. Dry
  - e. Fan only
4. The unit shall be able to operate in either cooling or heating mode for testing and/or commissioning.
5. The unit shall be able to operate with the fan turned off during system cooling thermal off.
6. The unit shall have adjustable, multi-step cooling and heating mode thermal on/off temperature range settings.

7. The system shall include a product check function to access and display indoor unit type and capacity from a wired programmable thermostat controller.
8. Unit shall have a field settable method to choose auto fan speed change operation based on mode of operation, on/off fan operation based on mode of operation, or continuous minimum set fan speed operation.

#### H. Electrical

1. The unit electrical power shall be 208-230/1/60 (V/Ph/Hz).
2. The unit shall be capable of operating within voltage limits of +/- 10% of the rated voltage.

#### I. Controls

1. Unit shall use controls provided by the manufacturer to perform all functions necessary to operate the system effectively and efficiently and communicate with the outdoor unit over an RS-485 daisy chain.

#### J. Seismic Installations

1. Provide OSHPD Special Seismic Certification Preapproval (OSP) documents for certified product list of VRF equipment to be installed in high seismic risk areas. Provide LG supplemental installation documents in conformance with CBC 2013, 2016 and 2019 California Building Code and IBC 2012, 2015 and 2018 International Building Code.

#### K. Warranty

1. Please refer to the respective outdoor unit for applicable warranty.

## 2.2 WALL MOUNTED – STANDARD

### A. General

1. Unit shall be manufactured by LG.
2. Unit shall be designed to be installed for indoor application.
3. Unit shall be attached to an installation plate/bracket that secures unit to the wall.
4. The depth of the unit shall not exceed 8.25 inches.

### B. Casing/Panel

1. Unit case shall be manufactured using Acrylonitrile Butadiene Styrene (ABS) polymeric resin and has a pearl white finish designed for mounting on a vertical surface and includes an installation mounting template and hanging bracket.

### C. Cabinet Assembly

1. Unit shall have one supply air outlet and one return air inlet with a manual or motorized sweeping guide vane that automatically changes the direction of airflow from side-to-side and up-and-down.
2. Unit shall be equipped with factory installed temperature thermistors for:
  - a. Return air
  - b. Refrigerant entering coil
  - c. Refrigerant leaving coil
3. Unit shall have a factory assembled, piped and wired electronic expansion valve (EEV) for refrigerant control.
4. Unit shall have a built-in control panel to communicate with other indoor units and to the outdoor unit.
5. Unit shall have the following functions as standard:
  - a. Self-diagnostic function
  - b. Auto addressing
  - c. Auto restart function
  - d. Auto changeover function (Heat Recovery system only)
  - e. Auto operation function
  - f. Auto clean function
  - g. Child lock function
  - h. Forced operation
  - i. Dual thermistor control
  - j. Sleep mode
  - k. Dual set point control
  - l. Filter life timer
  - m. External on/off control input
  - n. Wi-Fi compatible
  - o. Auto fan operation
  - p. Leak detection logic



6. Unit shall be capable of refrigerant piping in four different directions.
7. Unit shall be capable of drain piping in two different directions.

D. Fan Assembly

1. The unit shall have a single, direct driven crossflow tangential Sirocco fan made of high strength ABS BSN-7530 polymeric resin.
2. The fan impeller shall be statically and dynamically balanced.
3. The fan motor is Brushless Digitally commutated (BLDC) with permanently lubricated and sealed ball bearings.
4. The fan motor shall include thermal, overcurrent and low RPM protection.
5. The fan/motor assembly shall be mounted on vibration attenuating rubber grommets.
6. The fan speed shall be controlled using microprocessor based direct digitally controlled algorithm that provides a minimum of three pre-programmed fan speeds

- the heating mode and fan only mode and four speeds in the cooling mode. The fan speed algorithm provides a field selectable fixed speed.
7. In cooling mode, the indoor fan shall have the following settings: Low, Med, High, Power Cool, and Auto.
  8. In heating mode, the indoor fan shall have the following settings: Low, Med, High, and Auto.
  9. Unit shall have factory installed motorized louver to provide flow of air in up and down direction for uniform airflow.
  10. Unit shall have factory installed motorized guide vane to control the direction of flow of air from side to side.
  11. In the heating mode and fan only mode and four speeds in the cooling mode. The fan speed algorithm provides a field selectable fixed speed.
  12. In cooling mode, the indoor fan shall have the following settings: Low, Med, High, Power Cool, and Auto.
  13. In heating mode, the indoor fan shall have the following settings: Low, Med, High, and Auto.
  14. Unit shall have factory installed motorized louver to provide flow of air in up and down direction for uniform airflow.
  15. Unit shall have factory installed motorized guide vane to control the direction of flow of air from side to side.

E. Filter Assembly

1. The return air inlet shall have a factory supplied removable, washable filter
2. The filter access shall be from the front of the unit without the need of tools.

F. Coil Assembly

1. Unit shall have a factory built coil comprised of aluminum fins mechanically bonded.
2. The copper tubing shall have inner grooves to expand the refrigerant contact surface for high efficiency heat exchanger operation.
3. Unit shall have a minimum two row coil, 18 fins per inch.
4. Unit shall have a factory supplied condensate drain pan below the coil constructed of EPS (expandable polystyrene resin).
5. Unit shall be designed for gravity drain.
6. Unit shall have a 5/8" inside diameter factory insulated drain hose to handle condensate.
7. Unit shall have provision of 45° flare refrigerant pipe connections.
8. The coil shall be factory pressure tested at a minimum of 550 psig.
9. All refrigerant piping from outdoor unit to indoor unit shall be field insulated. Each pipe should be insulated separately.
10. Thickness and heat transfer characteristics shall be determined by the design engineer and shall meet all code requirements.

G. Microprocessor Control

1. The unit shall have a factory installed microprocessor controller capable of performing functions necessary to operate the system with or without the use of a wall mounted zone controller. The unit shall have a factory mounted return air thermistor for use as a space temperature control device. All operating parameters except scheduling shall be stored in non-volatile memory resident on the microprocessor. The microprocessor shall provide the following functions, self-diagnostics, auto re-start after a power failure and a test run mode.
2. The unit shall be able to communicate with other indoor units and the outdoor unit using a field supplied minimum of 18 AWG, two core stranded, twisted, and shielded communication cable (RS-485).
3. The unit controls shall operate the indoor unit using one of the five operating modes:
  - a. Auto changeover (Heat Recovery System only)
  - b. Heating
  - c. Cooling
  - d. Dry
  - e. Fan only
4. The unit shall be able to operate in either cooling or heating mode for testing and/or commissioning.
5. The unit shall be able to operate with the fan turned off during system cooling thermal off.
6. The unit shall have adjustable, multi-step cooling and heating mode thermal on/off temperature range settings.
7. The system shall include a product check function to access and display indoor unit type and capacity from a wired programmable thermostat controller.
8. Unit shall have a field settable method to choose auto fan speed change operation based on mode of operation, on/off fan operation based on mode of operation, or continuous minimum set fan speed operation.

H. Electrical

1. The unit electrical power shall be 208-230/1/60 (V/Ph./Hz).
2. The unit shall be capable of operating within voltage limits of +/- 10% of the rated voltage.

I. Controls

1. Unit shall use controls provided by the manufacturer to perform all functions necessary to operate the system effectively and efficiently and communicate with the outdoor unit over an RS485 daisy chain.

J. Seismic Installations

1. Provide OSHPD Special Seismic Certification Preapproval (OSP) documents for certified product list of VRF equipment to be installed in high seismic risk areas. Provide LG supplemental installation documents in conformance with CBC 2013, 2016 and 2019 California Building Code and IBC 2012, 2015 and 2018 International Building Code.

K. Limited Warranty

4. Please refer to the respective outdoor unit for applicable warranty.

2.3 DUCTED

A. General

1. Unit shall be manufactured by LG.
2. Unit shall be designed to be installed for indoor applications.
3. Ducted Low Static- Unit shall be a low-profile design with a maximum height of eight inches.>
4. Unit shall be designed to mount fully concealed above the finished ceiling.
5. Unit shall have opening to supply air from front horizontal and a dedicated rear horizontal return.
6. Ducted Low Static- Unit shall be field convertible bottom return.>
7. The supply air shall be flanged for field installed ductwork that shall not exceed the external static pressure limitation of the unit.

B. Casing/Panel

1. Unit case shall be manufactured using galvanized steel plate.
2. The cold surfaces of the unit shall be covered internally with a coated polystyrene insulating material.
3. <Ducted Low Static- The cold surfaces of the unit shall be covered externally with sheet insulation made of Ethylene Propylene Diene Monomer (M-Class) (EPDM)>
4. <Ducted Low Static- The external insulation shall be plenum rated and conform to ASTM Standard D-1418.>
5. Unit shall be provided with hanger brackets designed to support the unit weight on four corners.
6. Hanger brackets shall have pre-punched holes designed to accept field supplied, all thread rod hangers.

### C. Cabinet Assembly

1. Unit shall have horizontal supply air discharge outlets and a return air inlet
2. Unit shall be equipped with factory installed temperature thermistors for:
  - a. Return air
  - b. Refrigerant entering coil
  - c. Refrigerant leaving coil
3. Unit shall have a factory assembled, piped and wired electronic expansion valve (EEV) for refrigerant control.
4. Unit shall have a built-in control panel to communicate with other indoor units and to the outdoor unit.
5. Unit shall have the following functions as standard:
  - a. Self-diagnostic function
  - b. Auto addressing
  - c. Auto restart function
  - d. Auto changeover function (Heat Recovery system only)
  - e. Auto operation function
  - f. Child lock function
  - g. Forced operation
  - h. Dual thermistor control
  - i. Sleep mode
  - j. External static pressure (ESP) control
  - k. Dual set point control
  - l. Multiple aux heater applications
  - m. Filter life timer
  - n. External on/off input
  - o. Wi-Fi compatible
  - p. Auto fan operation
  - q. Leak detection logic

### D. Fan Assembly

1. The unit shall have two direct drive Sirocco fans made of high strength Ducted High Static- ABS GP-2200> Ducted Low Static- ABS HT-700> polymeric resin.
2. The fan impeller shall be statically and dynamically balanced.
3. The fans shall be mounted on a common shaft.
4. The fan motor is Brushless Digitally commutated (BLDC) with permanently lubricated and sealed ball bearings.
5. The fan motor shall include thermal, overcurrent and low RPM protection.
6. The fan/motor assembly shall be mounted on vibration attenuating rubber grommets.
7. The fan speed shall be controlled using microprocessor based direct digitally controlled algorithm that provides a minimum of three pre-programed fan speeds,

each setting is also adjustable by field setting to compensate for a limited amount of additional resistance to airflow by adjusting the RPM of the fan motor.

8. In cooling mode, the indoor fan shall have the following settings; Low, Med, High, and Auto.
9. In heating mode, the indoor fan shall have the following settings: Low, Med, High, and Auto.
10. Each of the settings can be field adjusted from the factory setting (RPM/ESP).
11. Unit shall be designed for high speed air volume against an external static pressure of up to Ducted High Static- 0.98" Ducted Low Static- 0.19"> water gauge, model dependent.

#### E. Filter Assembly

1. The return air inlet shall have a factory supplied removable, washable filter. MERV 13 filter rack is available as an option, model dependent.
2. The filter access shall be from the rear of the unit.

#### F. Coil Assembly

1. Unit shall have a factory built coil comprised of aluminum fins mechanically bonded on copper tubing.
2. The copper tubing shall have inner grooves to expand the refrigerant contact surface for high efficiency heat exchanger operation.
3. Unit shall have a minimum two to three row coil, 18-21 fins per inch.
4. Unit shall have a factory supplied condensate drain pan below the coil constructed of HIPS (high impact polystyrene resin).
5. Unit shall include an installed and wired condensate drain lift pump capable of providing minimum 27.5 inch lift from bottom surface of the unit. Ducted High Static- The unit drain pan is supplied with a secondary drain port/plug allowing the pan to be gravity drained and serviced.>
6. The drain pump shall have a safety switch to shut off the unit if condensate rises too high in the drain pan, model dependent.
7. Unit shall have provision of 45° flare refrigerant pipe connections.
8. The coil shall be factory pressure tested at a minimum of 550 psig.
9. All refrigerant piping from outdoor unit to indoor unit shall be field insulated. Each pipe should be insulated separately. Thickness and heat transfer characteristics shall be determined by the design engineer and shall meet all code requirements.

#### G. Microprocessor Control

1. The unit shall have a factory installed microprocessor controller capable of performing functions necessary to operate the system with or without the use of a wall mounted controller. The unit shall have a factory mounted return air thermistor for use as a space temperature control device. All operating parameters except scheduling shall be stored in non-volatile memory resident on the microprocessor. The microprocessor shall provide the following functions, self-diagnostics, auto re-start after a power failure and a test run mode.

2. The unit shall be able to communicate with other indoor units and the outdoor unit using a field supplied minimum of 18 AWG, two core, stranded, twisted, and shielded communication cable (RS-485).
3. The unit controls shall operate the indoor unit using one of the five operating modes:
  - a. Auto changeover (Heat Recovery System only)
  - b. Heating
  - c. Cooling
  - d. Dry
  - e. Fan only
4. The unit shall be able to operate in either cooling or heating mode for testing and/or commissioning.
5. The unit shall be able to operate with the fan turned off during system cooling thermal off.
6. The unit shall be able to operate with a continuous fan setting.
7. The unit shall have adjustable, multi-step cooling and heating mode thermal on/off temperature range settings.
8. The system shall include a product check function to access and display indoor unit type and capacity from a wired programmable thermostat controller.

#### H. Electrical

1. The unit electrical power shall be 208-230/1/60 (V/Ph/Hz).  
The unit shall be capable of operating within voltage limits of +/- 10% of the rated voltage.

#### I. Controls

1. Unit shall use controls provided by the manufacturer to perform all functions necessary to operate the system effectively and efficiently and communicate with the outdoor unit over an RS-485 daisy chain.

#### J. Seismic Installations

1. Provide OSHPD Special Seismic Certification Preapproval (OSP) documents for certified product list of VRF equipment to be installed in high seismic risk areas. Provide LG supplemental installation documents in conformance with CBC 2013, 2016 and 2019 California Building Code and IBC 2012, 2015 and 2018 International Building Code.

#### K. Warranty

1. Please refer to the respective outdoor unit for applicable warranty.

END OF SECTION 230265





## **SECTION 230280**

### **VARIABLE FREQUENCY DRIVES**

#### **PART 1 - GENERAL**

Applicable provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

##### **1.1 DESCRIPTION**

- A. This specification is to cover a complete Variable Frequency motor Drive (VFD) consisting of a pulse width modulated (PWM) inverter designed for use with a standard NEMA Design B induction motor.
- B. The drive manufacturer shall supply the drive and all necessary options as herein specified. The manufacturer shall have been engaged in the production of this type of equipment for a minimum of twenty years. VFDs that are manufactured by a third party and "brand labeled" shall not be acceptable. All VFDs installed on this project shall be from the same manufacturer.

##### **1.2 QUALITY ASSURANCE**

###### **A. Referenced Standards:**

- 1. Institute of Electrical and Electronic Engineers (IEEE)
  - a. Standard 519-1992, IEEE Guide for Harmonic Content and Control.
- 2. Underwriters laboratories
  - a. UL508C
- 3. National Electrical Manufacturer's Association (NEMA)
  - a. ICS 7.0, AC Adjustable Speed Drives
- 4. IEC 16800 Parts 1 and 2
- 5. National Electric Code (NEC)
  - a. NEC 430.120, Adjustable-Speed Drive Systems
- 6. International Building Code (IBC)
  - a. IBC 2006 Seismic – referencing ASC 7-05 and ICC AC-156

###### **B. Qualifications:**

- 1. VFDs and options shall be UL listed as a complete assembly. VFDs that require the customer to supply external fuses for the VFD to be UL listed are not acceptable. VFDs with red label UL stickers, requiring additional branch circuit protection are not acceptable. The base VFD shall be UL listed for 100 KAIC without the need for input fuses.

2. CE Mark – The VFD shall conform to the European Union ElectroMagnetic Compatibility directive, a requirement for CE marking. The VFD shall meet product standard EN 61800-3 for the First Environment restricted level.
3. The entire VFD enclosure, including the bypass shall be seismically certified and labeled as such in accordance with the 2006 International Building Code (IBC):
  - a. VFD manufacturer shall provide Seismic Certification and Installation requirements at time of submittal.
  - b. Seismic importance factor of 1.5 rating is required, and shall be based upon actual shake test data as defined by ICC AC-156.
  - c. Seismic ratings based upon calculations alone are not acceptable. Certification of Seismic rating must be based on testing done in all three axis of motion.
4. Acceptable Manufactures
  - a. ABB ACH Series.
  - b. Alternate manufacturer's requests must be submitted in writing to the Engineer for approval at least 20 working days prior to bid. Approval does not relieve the supplier of specification requirements.
5. The VFD manufacturer shall have available a comprehensive, HVAC Drive Computer Based Training (CBT) product. The CBT product shall include detailed, interactive sections covering VFD unpacking, proper mechanical and electrical installation, and programming. The CBT product shall allow the user to provide just-in-time training to new personnel or refresher training for maintenance and repair personnel on the user's site. The CBT product shall be repeatable, precise and shall include record keeping capability. The CBT product shall record answers to simulations and tests by student ID number. The CBT product must be professionally produced and have interactive sections, student tests, and include video clips of proper wiring and installation.

### 1.3 SUBMITTALS

#### A. Submittals shall include the following information:

1. Outline dimensions, conduit entry locations and weight.
2. Customer connection and power wiring diagrams.
3. Complete technical product description include a complete list of options provided. **Any portions of this specification not met must be clearly indicated or the supplier and contractor shall be liable to provide all additional components required to meet this specification.**
4. Compliance to IEEE 519 – harmonic analysis for particular jobsite including total harmonic voltage distortion and total harmonic current distortion (TDD).
  - a. The VFD manufacturer shall provide calculations; specific to this installation, showing total harmonic voltage distortion is less than 5%. Input filters shall be sized and provided as required by the VFD manufacturer to ensure compliance with IEEE standard 519. All VFDs shall include a minimum of 5% impedance reactors, **no exceptions**.

## PART 2 – PRODUCTS

### 2.1 VARIABLE FREQUENCY DRIVES

- A. The VFD package as specified herein shall be enclosed in a UL Listed Type enclosure, exceeding NEMA enclosure design criteria (enclosures with only NEMA ratings are not acceptable), completely assembled and tested by the manufacturer in an ISO9001 facility. The VFD tolerated voltage window shall allow the VFD to operate from a line of +30% nominal, and -35% nominal voltage as a minimum.
1. Environmental operating conditions: VFDs shall be capable of continuous operation at 0 to 50° C (32 to 122° F) ambient temperature as per VFD manufacturers documented/submittal data or VFD must be oversized to meet these temperature requirements. Not acceptable are VFDs that can only operate at 40° C intermittently (average during a 24 hour period) and therefore must be oversized. Altitude 0 to 3300 feet above sea level, less than 95% humidity, non-condensing. All circuit boards shall have conformal coating.
  2. Enclosure shall be rated UL Type 1 and shall be UL listed as a plenum rated VFD. VFDs without these ratings are not acceptable. NEMA only type 1 enclosures are not acceptable (must be UL Type 1).
  3. Provide NEMA 3R enclosures where exposed to outside weather or wet conditions.
- B. All VFDs shall have the following standard features:
1. All VFDs shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad shall be removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFDs.
  2. The keypad shall include Hand-Off-Auto selections and manual speed control. The drive shall incorporate “bumpless transfer” of speed reference when switching between “Hand” and “Auto” modes. There shall be fault reset and “Help” buttons on the keypad. The Help button shall include “on-line” assistance for programming and troubleshooting.
  3. There shall be a built-in time clock in the VFD keypad. The clock shall have a battery back-up with 10 years minimum life span. The clock shall be used to date and time stamp faults and record operating parameters at the time of fault. If the battery fails, the VFD shall automatically revert to hours of operation since initial power up. Capacitor back-up is not acceptable. The clock shall also be programmable to control start/stop functions, constant speeds, PID parameter sets and output Form-C relays. The VFD shall have a digital input that allows an override to the time clock (when in the off mode) for a programmable time frame. There shall be four (4) separate, independent timer functions that have both weekday and weekend settings.

4. The VFDs shall utilize pre-programmed application macro's specifically designed to facilitate start-up. The Application Macros shall provide one command to reprogram all parameters and customer interfaces for a particular application to reduce programming time. The VFD shall have two user macros to allow the end-user to create and save custom settings.
5. The VFD shall have cooling fans that are designed for easy replacement. The fans shall be designed for replacement without requiring removing the VFD from the wall or removal of circuit boards. The VFD cooling fans shall operate only when required. To extend the fan and bearing operating life, the VFD shall cycle the cooling fans on and off as required.
6. The VFD shall be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to set point without tripping or component damage (flying start).
7. The VFD shall have the ability to automatically restart after an over-current, over-voltage, under-voltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between attempts shall be programmable.
8. The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes, 130% overload for 2 seconds. The minimum FLA rating shall meet or exceed the values in the NEC/UL table 430.250 for 4-pole motors.
9. The VFD shall have internal 5% impedance reactors to reduce the harmonics to the power line and to add protection from AC line transients. The 5% impedance may be from dual (positive and negative DC bus) reactors, or 5% AC line reactors. VFDs with only one DC reactor shall add an AC line reactor.
10. The input current rating of the VFD shall be no more than 3% greater than the output current rating. VFDs with higher input current ratings require the upstream wiring, protection devices, and source transformers to be oversized per NEC 430.120. Input and output current ratings must be shown on the VFD nameplate.
11. The VFD shall include a coordinated AC transient surge protection system consisting of 4-120 joule rated MOV's (phase to phase and phase to ground), a capacitor clamp, and 5% impedance reactors.
12. The VFD shall provide a programmable loss-of-load (broken belt / broken coupling) Form-C relay output. The drive shall be programmable to signal the loss-of-load condition via a keypad warning, Form-C relay output, and / or over the serial communications bus. The loss-of-load condition sensing algorithm shall include a programmable time delay that will allow for motor acceleration from zero speed without signaling a false loss-of-load condition.
13. The VFD shall have user programmable underload and overload curve functions to allow user defined indications of broken belt or mechanical failure / jam condition causing motor overload.

14. The VFD shall include multiple “two zone” PID algorithms that allow the VFD to maintain PID control from two separate feedback signals (4-20mA, 0-10V, and / or serial communications). The two zone control PID algorithm will control motor speed based on a minimum, maximum, or average of the two feedback signals. All of the VFD PID controllers shall include the ability for “two zone” control.
15. If the input reference (4-20mA or 2-10V) is lost, the VFD shall give the user the option of either (1) stopping and displaying a fault, (2) running at a programmable preset speed, (3) hold the VFD speed based on the last good reference received, or (4) cause a warning to be issued, as selected by the user. The drive shall be programmable to signal this condition via a keypad warning, Form-C relay output and / or over the serial communication bus.
16. The VFD shall have programmable “Sleep” and “Wake up” functions to allow the drive to be started and stopped from the level of a process feedback signal.
17. Provide drive with circuit breaker option and remote panel mounting kit.

C. All VFDs to have the following adjustments:

1. Three (3) programmable critical frequency lockout ranges to prevent the VFD from operating the load continuously at an unstable speed. The lockout range must be fully adjustable, from 0 to full speed.
2. Two (2) PID Set point controllers shall be standard in the drive, allowing pressure or flow signals to be connected to the VFD, using the microprocessor in the VFD for the closed-loop control. The VFD shall have 250 ma of 24 VDC auxiliary power and be capable of loop powering a transmitter supplied by others. The PID set point shall be adjustable from the VFD keypad, analog inputs, or over the communications bus. There shall be two independent parameter sets for the PID controller and the capability to switch between the parameter sets via a digital input, serial communications or from the keypad. The independent parameter sets are typically used for night setback, switching between summer and winter set points, etc.
3. There shall be an independent, second PID loop that can utilize the second analog input and modulate one of the analog outputs to maintain the set point of an independent process (i.e.. valves, dampers, etc.). All set points, process variables, etc. to be accessible from the serial communication network.
4. Two (2) programmable analog inputs shall accept current or voltage signals.
5. Two (2) programmable analog outputs (0-20ma or 4-20 ma). The outputs may be programmed to output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, Active Feedback, and other data..
6. Six (6) programmable digital inputs for maximum flexibility in interfacing with external devices. All digital inputs shall be programmable to initiate upon an application or removal of 24VDC or 24VAC.

7. Three (3) programmable, digital Form-C relay outputs. The relay outputs shall include programmable on and off delay times and adjustable hysteresis. The relays shall be rated for maximum switching current 8 amps at 24 VDC and 0.4 A at 250 VAC; Maximum voltage 300 VDC and 250 VAC; continuous current rating of 2 amps RMS. Outputs shall be true Form-C type contacts; open collector outputs are not acceptable.
8. Run permissive circuit - There shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad, input contact closure, time-clock control, or serial communications), the VFD shall provide a dry contact closure that will signal the damper to open (VFD motor does not operate). When the damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to a VFD digital input and allows VFD motor operation. Two separate safety interlock inputs shall be provided. When either safety is opened, the motor shall be commanded to coast to stop and the damper shall be commanded to close. The keypad shall display "start enable 1 (or 2) missing". The safety input status shall also be transmitted over the serial communications bus.
9. The VFD control shall include a programmable time delay for VFD start and a keypad indication that this time delay is active. A Form C relay output provides a contact closure to signal the VAV boxes open. This will allow VAV boxes to be driven open before the motor operates. The time delay shall be field programmable from 0 – 120 seconds. Start delay shall be active regardless of the start command source (keypad command, input contact closure, time-clock control, or serial communications), and when switching from drive to bypass.
10. Seven (7) programmable preset speeds.
11. Two independently adjustable accel and decel ramps with 1 – 1800 seconds adjustable time ramps.
12. The VFD shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and reduce audible motor noise. The VFD shall have selectable software for optimization of motor noise, energy consumption, and motor speed control.
13. The VFD shall include a carrier frequency control circuit that reduces the carrier frequency based on actual VFD temperature that allows higher carrier frequency settings without derating the VFD.
14. The VFD shall include password protection against parameter changes.

- D. The Keypad shall include a backlit LCD display. The display shall be in complete English words for programming and fault diagnostics (alpha-numeric codes are not acceptable). All VFD faults shall be displayed in English words. The keypad shall include a minimum of 14 assistants including:
1. Start-up assistant
  2. Parameter assistants
    - a. PID assistant
    - b. Reference assistant
    - c. I/O assistant
    - d. Serial communications assistant
    - e. Option module assistant
    - f. Panel display assistant
    - g. Low noise set-up assistant
  3. Maintenance assistant
  4. Troubleshooting assistant
  5. Drive optimizer assistants
- E. All applicable operating values shall be capable of being displayed in engineering (user) units. A minimum of three operating values from the list below shall be capable of being displayed at all times. The display shall be in complete English words (alpha-numeric codes are not acceptable):
1. Output Frequency
  2. Motor Speed (RPM, %, or Engineering units)
  3. Motor Current
  4. Motor Torque
  5. Motor Power (kW)
  6. DC Bus Voltage
  7. Output Voltage
- F. The VFD shall include a fireman's override input. Upon receipt of a contact closure from the fire / smoke control station, the VFD shall operate in one of two modes: 1) Operate at a programmed predetermined fixed speed ranging from -500Hz (reverse) to 500Hz (forward). 2) Operate in a specific fireman's override PID algorithm that automatically adjusts motor speed based on override set point and feedback. The mode shall override all other inputs (analog/digital, serial communication, and all keypad commands), except customer defined safety run interlocks, and force the motor to run in one of the two modes above. "Override Mode" shall be displayed on the keypad. Upon removal of the override signal, the VFD shall resume normal operation, without the need to cycle the normal digital input run command.
- G. Serial Communications
1. The VFD shall have an EIA-485 port as standard. The standard protocols shall be Modbus, Johnson Controls N2, Siemens Building Technologies FLN, and BACnet. Optional protocols for LonWorks, Profibus, EtherNet, BACnet IP, and DeviceNet shall be available. Protocol provided shall match ATC system in Building. Each individual drive shall have the protocol in the base VFD. The use of third party gateways and multiplexers is not acceptable. All protocols shall be "certified" by the governing authority (i.e. BTL Listing for BACnet). Use of non-certified protocols is not allowed.

2. The BACnet connection shall be an EIA-485, MS/TP interface operating at 9.6, 19.2, 38.4, or 76.8 Kbps. The connection shall be tested by the BACnet Testing Labs (BTL) and be BTL Listed. The BACnet interface shall conform to the BACnet standard device type of an Applications Specific Controller (B-ASC). The interface shall support all BIBBs defined by the BACnet standard profile for a B-ASC including, but not limited to:
  - a. Data Sharing – Read Property – B.
  - b. Data Sharing – Write Property – B.
  - c. Device Management – Dynamic Device Binding (Who-Is; I-Am).
  - d. Device Management – Dynamic Object Binding (Who-Has; I-Have).
  - e. Device Management – Communication Control – B.
3. If additional hardware is required to obtain the BACnet interface, the VFD manufacturer shall supply one BACnet gateway per drive. Multiple VFDs sharing one gateway shall not be acceptable.
4. Serial communication capabilities shall include, but not be limited to; run-stop control, speed set adjustment, proportional/integral/derivative PID control adjustments, current limit, accel/decel time adjustments, and lock and unlock the keypad. The drive shall have the capability of allowing the DDC to monitor feedback such as process variable feedback, output speed / frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature. The DDC shall also be capable of monitoring the VFD relay output status, digital input status, and all analog input and analog output values. All diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote VFD fault reset shall be possible.
5. Serial communication in bypass shall include, but not be limited to; bypass run-stop control, the ability to force the unit to bypass, and the ability to lock and unlock the keypad. The bypass shall have the capability of allowing the DDC to monitor feedback such as, current (in amps), kilowatt hours (resettable), operating hours (resettable), and bypass logic board temperature. The DDC shall also be capable of monitoring the bypass relay output status, and all digital input status. All bypass diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote bypass fault reset shall be possible.
6. The VFD / bypass shall allow the DDC to control the drive and bypass digital and analog outputs via the serial interface. This control shall be independent of any VFD function. The analog outputs may be used for modulating chilled water valves or cooling tower bypass valves. The drive and bypass' digital (Form-C relay) outputs may be used to actuate a damper, open a valve or control any other device that requires a maintained contact for operation. In addition, all of the drive and bypass' digital inputs shall be capable of being monitored by the DDC system. This allows for remote monitoring of which (of up to 4) safeties are open.
7. The VFD shall include an independent PID loop for customer use. The independent PID loop may be used for cooling tower bypass value control, chilled water value / hot water valve control, etc. Both the VFD PID control loop and the independent PID control loop shall continue functioning even if the serial communications connection is lost. As default, the VFD shall keep the last good set point command and last good DO & AO commands in memory in the event the serial communications connection is lost and continue controlling the process.



- H. EMI / RFI filters. All VFDs shall include EMI/RFI filters. The onboard filters shall allow the VFD assembly to be CE Marked and the VFD shall meet product standard EN 61800-3 for the First Environment restricted level with up to 100 feet of motor cable. No Exceptions. Certified test reports shall be provided with the submittals confirming compliance to EN 61800-3, First Environment.
- I. All VFDs through 75HP at 480 V shall be protected from input and output power mis-wiring. The VFD shall sense this condition and display an alarm on the keypad. The VFD shall not sustain damage from this power mis-wiring condition.
- J. Optional Features – Optional features shall be furnished and mounted by the drive manufacturer. All optional features shall be UL Listed by the drive manufacturer as a complete assembly and carry a UL508 label.
  - 1. Door interlocked, pad-lockable disconnect switch that will disconnect all input power from the drive and all internally mounted options. Disconnect option shall be available with or without systems requiring bypass.
  - 2. Field-bus adapters - Protocols such as BACnet IP shall be a plug in modules.
- K. Bypass
  - 1. A complete factory wired and tested bypass system consisting of a door interlocked, pad-lockable circuit breaker, output contactor, bypass contactor, and fast acting VFD input fuses. UL Listed motor overload protection shall be provided in both drive and bypass modes.
  - 2. The bypass enclosure door and VFD enclosure must be mechanically interlocked such that the disconnecting device must be in the “Off” position before either enclosure may be accessed.
  - 3. The VFD and bypass package shall have a UL listed short circuit current rating (SCCR) of 100,000 Amps and this rating shall be indicated on the UL data label.
  - 4. The drive and bypass package shall be seismic certified and labeled to the IBC:
    - a. Seismic importance factor of 1.5 rating is required, and shall be based upon actual shake table test data as defined by ICC AC-156.
  - 5. Drive Isolation Fuses - To ensure maximum possible bypass operation, fast acting fuses, exclusive to the VFD, shall be provided to allow the VFD to disconnect from the line prior to clearing upstream branch circuit protection. This maintains bypass operation capability in the event of a VFD failure. Bypass designs which have no such fuses, or that incorporate fuses common to both the VFD and the bypass, will not be accepted. Third contactor “isolation contactors” are not an acceptable alternative to fuses, as contactors could weld closed and are not an NEC recognized disconnecting device.
  - 6. The bypass shall maintain positive contactor control through the voltage tolerance window of nominal voltage +30%, -35%. This feature is designed to avoid contactor coil failure during brown out / low line conditions and allow for input single phase operation when in the VFD mode. Designs that will not allow input single phase operation in the VFD mode are not acceptable.

7. Motor protection from single phase power conditions - the bypass system must be able to detect a single phase input power condition while running in bypass, disengage the motor in a controlled fashion, and give a single phase input power indication. Bypass systems not incorporating single phase protection in bypass mode are not acceptable.
8. The bypass system shall be designed for stand-alone operation and shall be completely functional in both Hand and Automatic modes even if the VFD has been removed from the system for repair / replacement. Serial communications shall remain functional even with the VFD removed. Bypass systems that do not maintain full functionality with the drive removed are not acceptable.
9. Serial communications – the bypass shall be capable of being monitored and / or controlled via serial communications. On-board communications protocols shall include ModBus RTU; Johnson Controls N2; Siemens Building Technologies FLN (P1); and BACnet MS/TP.
  - a. Serial communication capabilities shall include, but not be limited to: bypass run-stop control, the ability to force the unit to bypass, and the ability to lock and unlock the keypad. The bypass shall have the capability of allowing the BAS to monitor feedback such as, current (in amps), kilowatt hours (resettable), operating hours (resettable), and bypass logic board temperature. The BAS shall also be capable of monitoring the bypass relay output status, and all digital input status. All bypass diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote bypass fault reset shall be possible. The following additional status indications and settings shall be transmitted over the serial communications bus and / or via a Form-C relay output – keypad “Hand” or “Auto” selected, bypass selected, and broken belt indication. The BAS system shall also be able to monitor if the motor is running in the VFD mode or bypass mode over serial communications. A minimum of 50 field serial communications points shall be capable of being monitored in the bypass mode.
  - b. The bypass serial communications shall allow control of the drive/bypass (system) digital outputs via the serial interface. This control shall be independent of any bypass function or operating state. The system digital (relay) outputs may be used to actuate a damper, open a valve or control any other device that requires a maintained contact for operation. All system analog and digital I/O shall be capable of being monitored by the BAS system.
10. There shall be an adjustable motor current sensing circuit for the bypass and VFD modes to provide proof of flow (broken belt) indication. The condition shall be indicated on the keypad display, transmitted over the BAS and / or via a Form-C relay output contact closure. The broken belt indication shall be programmable to be a system (drive and bypass) indication. The broken belt condition sensing algorithm shall be programmable to cause a warning or system shutdown.
11. The digital inputs for the system shall accept 24VAC or 24VDC. The bypass shall incorporate an internally sourced power supply and not require an external control power source. The bypass power board shall supply 250 mA of 24 VDC for use by others to power external devices.

12. There shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad command, time-clock control, digital input, or serial communications) the bypass shall provide a dry contact closure that will signal the damper to open before the motor can run. When the damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to a bypass system input and allows motor operation. Up to four separate safety interlock inputs shall be provided. When any safety is opened, the motor shall be commanded to coast to stop, and the damper shall be commanded to close. This feature will also operate in Fireman's override / smoke control mode.
13. The bypass control shall monitor the status of the VFD and bypass contactors and indicate when there is a welded contactor contact or open contactor coil. This failed contactor condition shall be indicated on the bypass LCD display, programmed to activate a Form-C relay output, and / or over the serial communications protocol.
14. The bypass control shall include a programmable time delay bypass start including keypad indication of the time delay. A Form C relay output commands the VAV boxes open. This will allow VAV boxes to be driven open before the motor operates at full speed in the bypass mode. The time delay shall be field programmable from 0 – 120 seconds.
15. There shall be a keypad adjustment to select manual or automatic transfer to bypass. The user shall be able to select via keypad programming which drive faults will result in an automatic transfer to bypass mode and which faults require a manual transfer to bypass. The user may select whether the system shall automatically transfer from drive to bypass mode on the following drive fault conditions:
  - a. Over current
  - b. Over voltage
  - c. Under voltage
  - d. Loss of analog input
16. The following operators shall be provided:
  - a. Bypass Hand-Off-Auto
  - b. Drive mode selector
  - c. Bypass mode selector
  - d. Bypass fault reset
17. The bypass shall include a two line, 20 character LCD displays. The display shall allow the user to access and view:
  - a. Energy savings – in US dollars
  - b. Bypass motor amps
  - c. Bypass input voltage– average and individual phase voltage
  - d. Bypass power (kW)
  - e. Bypass faults and fault logs
  - f. Bypass warnings
  - g. Bypass operating time (resettable)
  - h. Bypass energy (kilowatt hours – resettable)
  - i. I/O status
  - j. Parameter settings / programming
  - k. Printed circuit board temperature

18. The following indicating lights (LED type) or keypad display indications shall be provided. A test mode or push to test feature shall be provided.
  - a. Power-on (Ready)
  - b. Run enable
  - c. Drive mode selected
  - d. Bypass mode selected
  - e. Drive running
  - f. Bypass running
  - g. Drive fault
  - h. Bypass fault
  - i. Bypass H-O-A mode
  - j. Automatic transfer to bypass selected
  - k. Safety open
  - l. Damper opening
  - m. Damper end-switch made
19. The Bypass controller shall have six programmable digital inputs, and five programmable Form-C relay outputs. This I/O allows for a total System (VFD and Bypass) I/O count of 24 points as standard. The bypass I/O shall be available to the BAS system even with the VFD removed.
20. The on-board Form-C relay outputs in the bypass shall be programmable for any of the following indications.
  - a. System started
  - b. System running
  - c. Bypass override enabled
  - d. Drive fault
  - e. Bypass fault
  - f. Bypass H-O-A position
  - g. Motor proof-of-flow (broken belt)
  - h. Overload
  - i. Bypass selected
  - j. Bypass run
  - k. System started (damper opening)
  - l. Bypass alarm
  - m. Over temperature
21. The bypass shall provide a separate terminal strip for connection of freeze, fire, smoke contacts, and external start command. All external safety interlocks shall remain fully functional whether the system is in VFD or Bypass mode. The remote start/stop contact shall operate in VFD and bypass modes. The terminal strip shall allow for independent connection of up to four (4) unique safety inputs.
22. The bypass shall include a supervisory control mode. In this bypass mode, the bypass shall monitor the value of the VFDs analog input (feedback). This feedback value is used to control the bypass contactor on and off state. The supervisory mode shall allow the user to maintain hysteresis control over applications such as cooling towers and booster pumps even with the VFD out of service.
23. The user shall be able to select the text to be displayed on the keypad when an external safety opens. Example text display indications include "FireStat", "FreezStat", "Over pressure" and "Low suction". The user shall also be able to determine which of the four (4) safety contacts is open over the serial communications connection.

24. Smoke Control Override Mode (Override 1) – The bypass shall include a dedicated digital input that will transfer the motor from VFD mode to Bypass mode upon receipt of a dry contact closure from the Fire / Smoke Control System. The Smoke Control Override Mode action is not programmable and will always function as described in the bypass User's Manual documentation. In this mode, the system will ignore low priority safeties and acknowledge high priority safeties. All keypad control, serial communications control, and normal customer start / stop control inputs will be disregarded. This Smoke Control Mode shall be designed to meet the intent of UL864/UUKL.
25. Fireman's Override Mode (Override 2) – the bypass shall include a second, programmable override input which will allow the user to configure the unit to acknowledge some digital inputs, all digital inputs, ignore digital inputs or any combination of the above. This programmability allows the user to program the bypass unit to react in whatever manner the local Authority Having Jurisdiction (AHJ) requires. The Override 2 action may be programmed for "Run-to-Destruction". The user may also force the unit into Override 2 via the serial communications link.
26. Class 10, 20, or 30 (programmable) electronic motor overload protections shall be included.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Installation shall be the responsibility of the mechanical contractor. The contractor shall install the drive in accordance with the recommendations of the VFD manufacturer as outlined in the VFD installation manual.
- B. Power wiring shall be completed by the electrical contractor, to NEC code 430.122 wiring requirements based on the VFD input current. Caution: VFDs supplied without internal reactors have substantially higher input current ratings, which may require larger input power wiring and branch circuit protection. The contractor shall complete all wiring in accordance with the recommendations of the VFD manufacturer as outlined in the installation manual.

### 3.2 START-UP

- A. Certified factory start-up shall be provided for each drive by a factory authorized service center. A certified start-up form shall be filled out for each drive with a copy provided to the owner, and a copy kept on file at the manufacturer.

### 3.3 PRODUCT SUPPORT

- A. Factory trained application engineering and service personnel that are thoroughly familiar with the VFD products offered shall be locally available at both the specifying and installation locations. A toll free 24/365 technical support line shall be available.
- B. A computer based training CD or 8-hour professionally generated video (VCR format) shall be provided to the owner at the time of project closeout. The training shall include installation, programming and operation of the VFD, bypass and serial communication.

### 3.4 WARRANTY

- A. The VFD Product Warranty shall be 24 months from the date of certified start-up, not to exceed 30 months from the date of shipment. The warranty shall include all parts, labor, travel time and expenses. A toll free 24/365 technical support line shall be available.

END OF SECTION 230280

## **SECTION 230290**

### **DUCT MOUNTED COILS**

#### **PART 1 - GENERAL**

Applicable provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

#### **PART 2 - PRODUCTS**

##### **2.1 DUCT MOUNTED CASED COIL SECTIONS**

- A. Coils as manufactured by Carrier shall be with aluminum plate fins, have collars drawn, belled, and firmly bonded to copper tubes by mechanical expansion of tubes. No soldering or tinning used in the bonding process.
- B. Coils have insulated galvanized steel casing and are mounted pitched in the unit casing with stainless steel drain pan. Coils are to be removable in casing.
- C. General Fabrication:
  - 1. All water and refrigerant coils shall have minimum  $\frac{1}{2}$ -in. OD copper tubes mechanically expanded into fins to ensure high thermal performance with lower total flow and pumping requirements. Minimum tube wall thickness shall be 0.016 inches. Optional tube wall thickness of 0.025 in. shall be supplied, if specified.
  - 2. Optionally, water coils shall have minimum  $\frac{5}{8}$ -in. OD copper tubes mechanically expanded into fins to ensure high thermal performance with lower total flow and pumping requirements. Minimum tube wall thickness shall be 0.020 inches. Optional tube wall thickness of 0.035 in. shall be supplied, if specified.
  - 3. Aluminum plate fin type with belled collars. Optional copper plate fins shall be supplied, if specified.
  - 4. Aluminum-finned coils shall be supplied with die-formed casing and tube sheets of mill galvanized steel or stainless steel as specified. Copper-finned coils shall be supplied with stainless steel casing and tube sheets.
- D. Hydronic Heating and Cooling Coils:
  - 1. Headers shall be constructed of steel with steel MPT connections. Headers shall have drain and vent connections accessible from the exterior of the unit. Optional non-ferrous headers and nipples shall be supplied if specified.
  - 2. Configuration: Coils shall be drainable, with non-trapping circuits. Coils will be suitable for a design working pressure of 300 psig at 200 F.
- E. Steam Distribution (Non-Freeze Type) Heating Coils:
  - 1. Headers shall be steel with MPT connections.
  - 2. Inner steam distributing tubes shall be  $\frac{5}{8}$ -in. OD, 0.020 in. wall thickness, located within 1 in. OD, 0.030 in. wall outer condensing tubes. Working pressure shall be 175 psig at 400 F.

3. Inner steam distributing tubes shall be  $\frac{3}{8}$ -in. OD, 0.020 in. wall thickness, located within  $\frac{5}{8}$ -in. OD, 0.035 in. wall outer condensing tubes. Working pressure shall be 175 psig at 400 F.

F. Refrigerant Coils:

1. Headers shall be constructed of copper with brazed joints.
2. Standard circuiting selections include:
  - a. Single distributor arrangement for sizes 03 through 17.
  - b. Row split intertwined, multiple distributor arrangement for sizes 03 through 61.
  - c. Face split, multiple distributor arrangement for sizes 03 through 61.
3. Replaceable nozzle, brass refrigerant distributors and seamless copper distribution tubes are supplied to ensure uniform flow.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Inspect equipment space locations before beginning installation. Verify that the space is correct for entry and access. Do not proceed with installation of the equipment until unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation of equipment, accessories, and components.
- B. All heating, ventilating and air conditioning equipment shall be carefully designed, constructed, and installed so as to prevent any objectionable noise or vibration reaching any part of the building outside of the mechanical equipment room. Care shall also be taken to prevent transmission of noise or odor through ductwork into other spaces. The Contractor shall be required to rectify or replace at his own expense, any equipment not complying with the foregoing requirements.

### 3.3 CLEANING

Clean interior and exterior surfaces promptly after installation of equipment and components. Take care to avoid damage to protective coatings and finishes. Remove excess sealants, lubrication, dirt, and other foreign substances.

END OF SECTION 230290



## **SECTION 230300**

### **FANS**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

#### **PART 2 - PRODUCTS**

##### **2.1 FANS**

- A. Furnish and install fans of the type, models, size and capacity indicated on the Drawings. Models indicated are as manufactured by Carnes Company. ACME or Greenheck, with equivalent characteristics will be considered.
- B. Refer to Drawing schedule for required accessories and related appurtenances.

##### **2.2 ROOF EXHAUST FANS**

- A. All roof exhaust fans shall be centrifugal roof exhausters of aluminum rustproof construction.
- B. Units shall be direct connected with full ball-bearing motor. Power unit shall be isolated against vibration by means of oil resistant rubber or spring steel mounting.
- C. Provide square insulated curb cap of aluminum with aluminum liner as an integral part of the unit. Each unit shall be equipped with a back draft or automatic damper, disconnect switch for the motor and bird screens.

##### **2.3 IN LINE FANS**

- A. Construction: Unit exterior shall be constructed of heavy gauge galvanized steel. The fan housing shall be square in shape and readily attachable to building ductwork. Unit side panels shall be removable for easy access for maintenance and service. The power assembly shall be removable as a complete module.
- B. Wheel: Wheels shall be of the centrifugal backward inclined type. Wheels shall be constructed of aluminum and contain a matching inlet venturi for optimum performance. Wheels shall be statically and dynamically balanced.
- C. Shaft: Fan shafts shall be precision ground and polished. Shafts shall have a first critical speed of at least 125% of the fan's maximum operating speed.
- D. Bearings: Bearings shall be of the one piece, cast iron, pillow block type with relubricable Zerk fittings. Bearings shall be designed for final system balancing.
- E. Drive: Drives shall be sized for a minimum of 150% of driven horsepower. Machined, cast iron motor sheaves shall be adjustable for final system balancing.

- F. Motor: Motor shall be heavy duty ball bearing type, closely matched to the fan load. All motors shall be listed by UL and/or CSA. A disconnect switch shall be factory installed and wired to the fan motors as standard. Motors shall be mounted on the outside of the unit isolated from the airstream. The belt and pillow block ball bearings shall be protected from the airstream by an enclosure.
- G. Backdraft Damper: When no motorized damper is indicated on Drawings at discharge of fan, provide gravity backdraft damper.
- H. Fans shall bear the AMCA ratings seal for Sound and Air performance. Fans shall carry the UL and/or CSA listing mark. Fans shall bear a permanently attached nameplate displaying model and serial number of the unit for future identification.

## 2.4 CEILING MOUNTED EXHAUST FANS

- A. Ceiling mounted exhaust fans shall be of the centrifugal direct driven type. The wheel shall be of the forward curved design, balanced for extremely low sound levels. The motor shall be a low r.p.m. and permanently lubricated for continuous operation. The motor shall be resilient mount to help reduce vibration.
- B. Duct connectors shall be provided and will include built-in automatic backdraft dampers. Grilles shall be of a durable, low profile design with a white finish. 8-way adjustable mounting brackets will be provided to permit a variety of mounting options. Cabinets shall be constructed of heavy gauge galvanized steel and shall include an acoustic lining.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Inspect equipment space locations before beginning installation. Verify that the space is correct for entry and access. Do not proceed with installation of the equipment until unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation of equipment, accessories and components.
- B. All heating, ventilating and air conditioning equipment shall be carefully designed, constructed and installed so as to prevent any objectionable noise or vibration reaching any part of the building outside of the mechanical equipment room. Care shall also be taken to prevent transmission of noise or odor through ductwork into other spaces. The Contractor shall be required to rectify or replace at his own expense, any equipment not complying with the foregoing requirements.

### 3.3 CLEANING

- A. Clean interior and exterior surfaces promptly after installation of equipment and components. Take care to avoid damage to protective coatings and finishes. Remove excess sealants, lubrication, dirt and other foreign substances.

END OF SECTION 230300

## **SECTION 230310**

### **CABINET HEATERS**

#### **PART 1 - GENERAL**

Applicable provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

#### **PART 2 - PRODUCTS**

##### **2.1 HOT WATER CABINET HEATERS**

- A. Furnish and install where indicated on the Drawings hot water cabinet heaters as manufactured by Sterling Co. of model, capacity and performance noted on the Drawing schedule.
- B. The cabinet shall be 16 gauge steel, four side overlap front panels, with M-shaped stiffener running entire panel length as standard. Integral, stamped, inlet and outlet insulated over entire coil section.
- C. Front panel removed with two tamperproof screws, and shall be of finish as selected by Architect. Unit to be equipped with factory mounted fan cycling thermostat. Fans are forwardly curved double-inlet centrifugal of aluminum construction and are modular in design.
- D. The water coil is constructed of copper tubing mechanically expanded into aluminum fins. All joints are brazed with high temperature silver alloy. Water coils have a plugged drain tube and vent tube extended into the unit end compartment. Automatic air vent fittings shall be provided. Coils are field reversible.
- E. Filters are removable by removing front panel. 1" woven glass filters standard to be used.
- F. Provide factory finished trim flange for all semi-recessed applications.

#### **PART 3 - EXECUTION**

##### **3.1 INSPECTION**

- A. Inspect equipment space locations before beginning installation. Verify that the space is correct for entry and access. Do not proceed with installation of the equipment until unsatisfactory conditions have been corrected.

##### **3.2 INSTALLATION**

- A. Comply with manufacturer's instructions and recommendations for installation of equipment, accessories and components.

### 3.3 CLEANING

- A. Clean interior and exterior surfaces promptly after installation of equipment and components. Take care to avoid damage to protective coatings and finishes. Remove excess sealants, lubrication, dirt and other foreign substances.

END OF SECTION 230310

## **SECTION 230320**

### **UNIT HEATERS**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section. Submit shop drawings for checking and approval.

#### **PART 2 - PRODUCTS**

##### **2.1 HOT WATER UNIT HEATERS**

- A. Furnish and install where shown on the Drawings model as manufactured by Sterling Co. or approved equal and shall be of sizes noted on the Drawing.
- B. Casing shall be 20 gauge die-formed steel. Casing substrates shall be prepared for finishing with a hot wash, iron phosphatizing clear rinse, chromic acid rinse and oven drying. Paint finish shall be of lead-free, chromate-free, alkyd melamine resin base and applied with an electrostatic two-pass system.
- C. Coil elements and headers shall be of heavy wall drawn seamless copper tubing. Element tubes shall be brazed into extruded header junctions. Pipe connection saddles shall be of cast bronze. Aluminum fins shall have drawn collars to assure permanent bond with expanded element tubes and exact spacing.
- D. Motors shall be totally enclosed, resilient mounted with class B windings. All motors shall be designed for horizontal mounting.
- E. Fans shall be of the aluminum blade, steel hub type designed and balanced to assure maximum air delivery, low motor horsepower requirements and quiet operation. Blades are spark proof. Fan guards shall be welded steel, zinc plated or painted.
- F. Units shall be equipped with horizontal, individually adjustable louvers. Vertical louvers for 4-way air control shall be available as an optional extra.

#### **PART 3 - EXECUTION**

##### **3.1 INSPECTION**

- A. Inspect equipment space locations before beginning installation. Verify that the space is correct for entry and access. Do not proceed with installation of the equipment until unsatisfactory conditions have been corrected.

##### **3.2 INSTALLATION**

- A. Comply with manufacturer's instructions and recommendations for installation of equipment, accessories and components.

### 3.3 CLEANING

- A. Clean interior and exterior surfaces promptly after installation of equipment and components. Take care to avoid damage to protective coatings and finishes. Remove excess sealants, lubrication, dirt and other foreign substances.

END OF SECTION 230320

## **SECTION 260330**

### **CONVECTORS**

#### **PART 1 - GENERAL**

Applicable provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

#### **PART 2 - PRODUCTS**

##### **2.1 CONVECTORS**

- A. Furnish and install Convectors as manufactured by Sterling Co., Airtherm Co. and American Air Filer Co. considered equal as indicated on the Drawings. Type and size as noted on Drawing. Unit shall be installed in a neat and workmanlike manner in accordance with the Specifications and manufacturer's recommendations.
- B. Convector element shall be constructed of copper tubes expanded and rolled into cast iron headers with contact further strengthened by brass bushings, aluminum fins, ribbed steel side plates and fin tube supports.
- C. Cabinet shall have a one piece 14 gauge steel front panel. Front panel shall be held in place by camlock fasteners.
- D. Dampers shall be factory mounted on the element to reduce heating capacity up to 70% when closed. Key operated damper-tamperproof. Baked enamel finish shall be provided in standard manufacturer's colors as selected by the Architect. Unit shall have (camlock) access doors to provide access to valves.

#### **PART 3 - EXECUTION**

##### **3.1 INSPECTION**

- A. Inspect equipment space locations before beginning installation. Verify that the space is correct for entry and access. Do not proceed with installation of the equipment until unsatisfactory conditions have been corrected.

##### **3.2 INSTALLATION**

- A. Comply with manufacturer's instructions and recommendations for installation of equipment, accessories and components.
- B. All heating, ventilating and air conditioning equipment shall be carefully designed, constructed and installed so as to prevent any objectionable noise or vibration reaching any part of the building outside of the mechanical equipment room. Care shall also be taken to prevent transmission of noise or odor through ductwork into other spaces. The Contractor shall be required to rectify or replace at his own expense, any equipment not complying with the foregoing requirements.

### 3.3 CLEANING

- A. Clean interior and exterior surfaces promptly after installation of equipment and components. Take care to avoid damage to protective coatings and finishes. Remove excess sealants, lubrication, dirt and other foreign substances.

END OF SECTION 230330



## **SECTION 230340**

### **FIN TUBE RADIATION**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

#### **PART 2 - PRODUCTS**

##### **2.1 FIN TUBE RADIATION**

- A. Furnish and install fin-tube heating elements and enclosures, indicated on Drawings, together with required mounting components and accessories.
- B. Materials shall be as manufactured by Sterling Radiator Co., Vulcan Radiator Co. or Standard Fin-Pipe Radiator Corp.
- C. Heating Elements
  - 1. Various lengths and assemblies are indicated on the plan together with their pipe sizes, fin sizes, and spacing. Elements shall be completely independent of and shall not touch enclosures to assure low surface temperature.
  - 2. Heating elements shall consist of full-hard aluminum plate fins not less than .20" thick, permanently bonded to copper seamless drawn tube and guaranteed for working pressure at 300 degrees F not less than 200 psi for 1-1/4" tube. Fins shall be actually embedded in the copper tube.
- D. Enclosure and Accessories
  - 1. Enclosures and accessories shall be of style and dimensions indicated on our Drawings and shall be fabricated from zinc-coated steel. Enclosures shall be 16 gauge. On wall-to-wall applications, enclosures shall be furnished in one piece up to a maximum of 10'-10" enclosure length for rooms or spaces measuring a maximum of 10'-10" wall length, using a 6" end trim each end. Enclosures shall be furnished in two or more lengths for wall lengths exceeding 10'-10".
  - 2. Left end of all enclosures shall have spot-welded back-up angles. The mating right end shall be fastened securely with screws. End enclosures shall have same method of joining.
  - 3. End trims, furnished with roll-flanged edges, shall be used between ends of enclosures and walls on wall-to-wall applications. End trims to be 6" maximum length and shall be attached without visible fasteners. End enclosures shall be furnished where indicated, shall be same gauge as enclosures, and be factory-welded to enclosures.
  - 4. Enclosures shall be supported at top and bottom by means of heavy gauge mounting channel and allow installation and removal of enclosures without scraping walls or disturbing paint lines. Enclosures are securely fastened to the bottom support.

5. Access doors shall be provided where noted on Drawings. Doors shall be 8" x 8" and shall be located directly in the enclosures. Doors shall be hinged. Where radiation is located behind casework coordinate access door locations with casework vendor.
6. Provide vertical and horizontal enclosure for pipe risers and runouts which are exposed above/below/adjacent to radiation enclosure. Riser enclosure shall be of same gauge and finish as radiation enclosure. Provide wall plate which enclosure shall snap onto without exposed fasteners. Sterling model PCH (V).
7. Enclosure finish shall be as selected by Architect (and shall match unit ventilator finish when unit ventilators are also specified for the project).

E. Enclosure Brackets and Element Hangers

1. Enclosure bracket and element hangers shall be installed not farther than 4" apart. Brackets shall be die-formed from 3/16" thick stock, 1-1/2" wide, and shall be lanced to support and position lower flange of enclosure. Enclosures shall be firmly attached to brackets by set screws, operated from under the enclosure. Devices, which do not provide positive fastening of enclosures, are not acceptable. Brackets shall be inserted in pre-punched slots in mounted channel to insure correct alignment and shall be fastened securely to wall at bottom.
2. Sliding saddles shall support heating elements and provide positive positioning of element in enclosure to insure maximum heating efficiency while preventing any possibility of fin impingement on brackets or enclosure joints during expansion or contraction. Element supports shall be a double saddle design fabrication from 16 gauge zinc-coated steel.
3. Saddle shall slide freely on saddle support arm bolted to support bracket. Support arm shall allow 1-1/2" height adjustment for pinch. The element support saddle shall allow 1-5/8" lateral movement for expansion and contraction of heating element. Rod or wire hangers not acceptable.
4. Submit shop drawings of all heating elements and enclosures. Enclosure measurements and accessories are not to be fabricated until after verified measurements have been taken at the site.

- F. Piping Enclosures: Where concealed piping in ceilings and wall of finished spaces is not possible, provide vertical or horizontal metal piping enclosures equal to "Sterling" model PCH (horizontal) or PCHV (vertical). Provide all required hangers, supports, corners, brackets, etc. color per Architect.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Inspect equipment space locations before beginning installation. Verify that the space is correct for entry and access. Do not proceed with installation of the equipment until unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation of equipment, accessories and components.

- B. All heating, ventilating and air conditioning equipment shall be carefully designed, constructed and installed so as to prevent any objectionable noise or vibration reaching any part of the building outside of the mechanical equipment room. The Contractor shall be required to rectify or replace at his own expense, any equipment not complying with the foregoing requirements.

### 3.3 CLEANING

- A. Clean interior and exterior surfaces promptly after installation of equipment and components. Take care to avoid damage to protective coatings and finishes. Remove excess sealants, lubrication, dirt and other foreign substances.

END OF SECTION 230340



## **SECTION 230400**

### **SHEETMETAL WORK AND RELATED ACCESSORIES**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements shall govern work in this section. Submit shop drawings for checking and approval.

#### **PART 2 - PRODUCTS**

##### **2.1 SHEETMETAL DUCTWORK**

- A. Contractor shall furnish and install all sheetmetal ducts as shown on the Drawings. While the Drawings shall be adhered to as closely as possible, the Engineer reserves the right to vary the run and size to meet the field conditions. Any duct size not shown shall be sized in proportion to the air carried at the same resistance in similar ductwork, or of size as directed.
- B. All ductwork shall be constructed of galvanized steel gauges in accordance with the latest edition of the ASHRAE/SMACNA Guide. Bracing angles for ductwork shall be hot dipped galvanized for steel ductwork and appropriate gauge for aluminum ductwork. All ducts 18" and over in width shall be cross broken to prevent flutter.
- C. Round ductwork shall be galvanized steel, spiral lock seam construction of gauges in accordance with the latest edition of ASHRAE/SMACNA guide. Fittings shall be constructed in standing seam manner. All seams, joints and collars shall be sealed in accordance with SMACNA guidelines for medium pressure ductwork to minimize noise and streaking. Ductwork and fittings shall be connected with sheetmetal couplings and sealed as to allow no leakage.
- D. Ducts shall be braced as follows:
  - 1. All ducts not exceeding 24" on one side shall be assembled with airtight slip joints.
  - 2. 25" to 40" larger dimension 1" x 1" x 1/8" angles.
  - 3. 41" to 60" larger dimension 1-1/2" x 1-1/2" x 1/8" angles.
  - 4. All bracing angles shall be a minimum of 4' apart along the length of the duct.
  - 5. Furnish and install all angles and frames for all registers, diffusers, grilles, and louvers.
  - 6. Support horizontal ducts with hangers spaced not more than 8' apart. Place hangers at all changes in direction. Use strap hangers for cuts up to 30" wide.

- E. Comply with all State and Local regulations regarding fire stopping and fireproofing. Provide fusible link fire dampers as required by State, local and Underwriter authorities and where indicated on the Drawings. Each fire damper shall be installed in such a manner as to permit ready access for inspection and maintenance purposes.
- F. Provide splitter and butterfly dampers, deflecting vanes for control of air volume and direction and for balancing systems, where indicated, specified, directed and as required for the proper operation of the systems. Dampers shall be of the same material as the duct, at least one gauge heavier than the duct, reinforced where indicating quadrant and locking device for adjusting damper and locking in position.
- G. Where ducts fewer than 100 square inches penetrate a rated wall, steel ductwork system of a minimum 0.0127 inch thickness shall be used.
- H. All elbows shall have a minimum center line radius of 150% of duct width. If the radius is smaller, turning vanes shall be used: Turning vanes shall be double thickness, fitted into slide strips and screwed or riveted to duct below.
- I. Contractor shall furnish and install all access doors in ducts as required. Access doors shall be of the pan type 1" thick and shall be provided with two galvanized hinges and suitable latched. Access doors insulated with same thickness material as duct and shall be double casing construction.

## 2.2 REGISTERS AND DIFFUSERS

- A. Registers and diffusers shall be installed where shown on the Drawings and shall be of the sizes specified and the type indicated on the drawing schedule.
- B. All registers and diffusers shall be installed in accordance with manufacturer's recommendations.
- C. Registers and diffusers shall be as manufactured by Carnes, Hart and Cooley or Anemostat Co.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Inspect equipment space locations before beginning installation. Verify that the space is correct for entry and access. Do not proceed with installation of the equipment until unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation of equipment, accessories and components.

- B. All heating, ventilating and air conditioning equipment shall be carefully designed, constructed and installed so as to prevent any objectionable noise or vibration reaching any part of the building outside of the mechanical equipment room. Care shall also be taken to prevent transmission of noise or odor through ductwork into other spaces. The Contractor shall be required to rectify or replace at his own expense, any equipment not complying with the foregoing requirements.

### 3.3 CLEANING

- A. Clean interior and exterior surfaces promptly after installation of equipment and components. Take care to avoid damage to protective coatings and finishes. Remove excess sealants, lubrication, dirt and other foreign substances.

END OF SECTION 230400





## **SECTION 230410**

### **PIPING, FITTINGS, VALVES AND NOTES (HOT WATER)**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements shall govern work in this section. Submit shop drawings for checking and approval.

##### **1.1 PIPING NOTES**

- A. The Contractor shall erect all pipe, fittings, valves, hangers, anchors, expansion joints and all accessories specified, indicated on the Drawings or required to assure proper operation of all piping systems installed under this Contract. All piping shall be maintained at a proper level to assure satisfactory operation, venting and drainage. Piping and valves in any locality where possible shall be grouped neatly and shall be run so as to avoid reducing headroom or passage clearance.
- B. All piping shall be new and of the material and weight specified under various services. Steel and wrought iron pipe 2" and larger shall be seamless or lap welded. All piping shall have the maker's name and brand rolled on each length of pipe.
- C. All piping, fittings, valves and strainers shall be cleaned of grease, dirt and scale before installation. All temporary pipe openings shall be kept closed during the performance of the work. The ends of all piping shall be reamed smooth and all burrs removed before installation.
- D. All piping shall be cut accurately to measurements taken on the job. Offset connections shall be installed alignment of vertical to horizontal piping and where required to make a true connection and to provide for expansion. Bent or sprung pipe shall not be installed where shown on Drawings and where necessary to provide for expansion of piping. Cold spring hot lines one-half estimated distance of maximum expansion. Suitable pipe anchors shall be installed where shown or required.
- E. Piping connections shall have unions where necessary for replacement and repair of equipment. Gate valves and controls valves shall be installed where shown and where necessary for proper operation and service.
- F. Vertical piping shall be plumb and horizontal piping shall be parallel to walls and partitions. Piping shall be supported as required to prevent the transmission of noise and vibration.
- G. Work shall include all pipe, fittings, offsets and requirements for the installation of piping of other work including ducts and conduit. Reducing fittings shall be used where pipe changes size. All piping shall be installed with ample clearance to center accurately in sleeves through floors, and walls and partitions.
- H. Piping shall be downgraded to drain connections at low points and upgraded to vent connections at high points unless otherwise noted. Drain connections shall be valved and piped to a floor drain. Vent connections on mains shall be equipped with air vent valves fitted with a copper tube drip line extended to a drain outlet. Vent connections on branches and equipment shall be fitted with key type manual vent cocks.

- I. Drain piping shall be installed from all equipment as required. The Contractor shall extend drain piping and turn down over floor drains.

## PART 2 - PRODUCTS

### 2.1 PIPING (ABOVEGROUND)

- A. All piping installed under this Section of the Specifications shall be in accordance with the following schedule.
  1. All piping, except where indicated differently, (i.e. underground piping) shall be standard weight black steel pipe Schedule 40, Grade A53, black steel. Pipe 2" and smaller, cast iron screwed fittings. Pipe 2-1/2" and larger, steel welding fittings. Pipe and fittings as manufactured by National, Wheeling, Bethlehem or equal, manufactured in accordance with ASTM current edition. All pipes must be reamed before installation.
  2. Where the Contractor elects to use copper piping, it shall be rigid Type "L" copper, Chase, Anaconda or approved equal. Fittings shall be wrought copper, Nibco, Anaconda, Mueller or approved equal. Where copper piping is used, make all additional provisions for expansion. All condensate piping shall be Type "M" copper, rigid, full size of unit drain tapping, or larger as shown on Drawings.
  3. All drainage pipe lines, 2" larger except where galvanized screw pipe is shown on the Drawings or specified hereafter, shall be extra heavy cast iron soil pipe and fittings.
- B. Piping installation shall be arranged for draining through accessible valves at low points.
- C. Threaded short and close nipples shall be Schedule 80, extra heavy weight of the same material as pipe in system in which they are installed.
- D. All bare copper pipe, tubing and fittings shall be cleaned with steel wool and all excess solder shall be removed.

### 2.2 VALVES

- A. All valves, unless specified or noted otherwise, shall be designed for a working pressure of not less than 200 p.s.i. water or 125 p.s.i. steam with name and pressure rating of valve cast in body. All valves shall be of the same manufacturer, unless specified otherwise. Valves for cut-off shall be gate valves, unless otherwise specified.
- B. All valves of same manufacturer: similar to Jenkins Bros., Walworth, Kennedy or approved equal.
- C. Four inch and larger, flanged; smaller sizes, screwed.
- D. All Gate and Globe valves shall be installed with handle in an upright position.

- E. The Contractor shall furnish and install all valves shown on Drawings and all valves that are necessary for proper operation and maintenance of systems and equipment. All piping connections to each piece of equipment and all branch connections to mains shall have cut-off valves.
- F. The following schedule of valves for steam condensate, hot water, etc. is based on Jenkins Brothers, Inc. catalog numbers (except as noted); equivalent Lukenheimer, Walworth, O-I-C, Crane Fairbanks Company valves will be acceptable.
- G. Ball Valves
  - 1. 1/4" to 2-1/2" rated for 600 p.s.i wog, with brass body, chrome plated brass ball, virgin PTFE seats, and full port with threaded or solder connections.
  - 2. 2-1/2" and larger rated for 200 p.s.i with carbon steel body, stainless steel full port ball, RTFE seats, lever operated to 4" gear operated 6" and above, with flanged end connections.
- H. Gate Valves
  - 1. Up to 2" : Bronze gate solid wedge, inside screw traveling stem union bonnet, - Fig. 47U
  - 2. 2-1/2" and 3" : Iron body, bronze-mounted gate, solid wedge, OS&Y rising stem, -Fig. 650-A
  - 3. 4" and larger: Iron body, bronze-mounted gate, solid wedge, OS&Y rising stem, - Fig. 651-A
- I. Globe Valves
  - 1. Up to 2" : Bronze body, regrinding seat ring and plug, union bonnet, -Fig. 546P
  - 2. 2-1/2" and 3" : Iron body, bronze-mounted globe and angle, regrinding disc and seat ring, OS&Y -Fig. 613
  - 3. All gate valves 6" and larger: Fitted 3/4" by-pass globe valve.
- J. Plug Valves
  - 1. Up to 2" : Lubricated, semi-steel short pattern wrench operated, -Fig. 142
  - 2. 2-1/2" and larger: Lubricated, semi-steel short pattern wrench operated, -Fig. 143
  - 3. Similar to Rockwell Mgd. Co., Jenkins, Kennedy or approved equal.

K. Butterfly Valves used for chilled water, condenser water and hot water shall be the following:

1. 2-1/2" to 12" rated for 175 p.s.i bubble tight close off, 14" and larger for 150 p.s.i close-off.
2. Full lug cast iron body, aluminum bronze disc, stainless steel stem EPDM peroxide cured seat.
3. 2-14" to 6" valves to be equipped with 10 position notch plate and lever lock handle. 8" and larger with handwheel gear operator.
4. On installation, valves to be in full open position when flange bolts are tightened and stem in a horizontal position except when equipped with a chainwheel gear operator.
5. Provide chain wheel gear operator on all valves installed 7 feet or higher.
6. Valves to be designed with replaceable seat and parts kits.
7. Valve to be Bray series 31, Dezurik 637 or Demco.

L. Check Valves

1. 150 p.s.i. WSP class.
2. Up to 2" : Bronze, regrinding bronze disc, screw-in cap, -Fig. 762A
3. 2-1/2" and 3" : Iron body, bronze mounted regrinding bronze seat ring and disc, - Fig. 623
4. 4" and larger: Iron body, bronze mounted regrinding bronze seat ring and disc, - Fig. 624

M. Drain Valves: All low points shall have drain valves, with hose ends. Where 1/2" and 3/4" sizes are indicated, "Standard" hose end drain valves shall be used. Provide brass hose end drain caps at each drain valve. Where larger than 3/4" drains are shown, gate valve shall be used. Provide brass nipples and reducer from drain valve size to 3/4" terminating with 3/4" hose end drain valve and cap.

## 2.3 FITTINGS

A. Nipples

1. All nipples shall have clean cut threads and shall be made from new pipe, standard weight for all lengths, except that close and shoulder nipples shall be extra heavy.
2. Fittings - 2-1/2 and Smaller: All fittings shall be standard weight steam pattern gray cast iron, Grinnell, Stockholm or equal approved.
3. Fitting - 3" and Larger: The Contractor has the option to use screwed, flanged or welded fittings so long as all ASME requirements are met.

B. Joints and Unions

1. Threaded joints shall be full and clean cut. The ends of pipe shall be reamed to the full inside diameter, all burrs shall be removed and no more than three threads shall be exposed beyond fittings when made up. Joints shall be made up tight with graphite base pipe joint compound. Exposed threads of ferrous pipe shall be painted with acid-resisting paint after caulking, lampwick or other material will be allowed for correction of defective joints.
2. Flange joints shall be made up perfectly square and tight. Screwed flanges and loose flanges shall be cast iron and welding flanges shall be steel. Flanges shall be faced true and bolted up tight with 1/16" Carlock ring type gasket.
3. Bolts shall be high quality steel with hexagon nuts and heads. The Contractor shall apply grease to threads of bolt.
4. Welded joints in piping shall be by the electric or oxyacetylene process using welding rods of the characteristics similar to pipe material and as recommended by the pipe manufacturer and shall be done in accordance with the ASME Code for pressure piping. Welding shall be done by qualified welders under the requirements of the ASME Boiler and Pressure Vessel Code.
5. The pipe lengths shall be aligned with welding rings and the abutting pipe ends shall be concentric. Prior to welding, the groove and adjacent surfaces shall be thoroughly cleaned of all grease, scale, or rust. During welding, all slag, or flux remaining on the bead shall be removed before laying down the next bead. The welding metal shall be thoroughly fused with the base metal at all sections of the weld. Short lengths of pipe may be beveled on the job with oxyacetylene torch, provided all scale and oxides are removed.
6. Joints shall be butt-welded, single V-type. All fittings shall be steel welding fittings. Elbows and fittings formed with coupling or welded cut pipe sections shall not be acceptable.
7. Bonney Weldolets or welding saddles may be used for branch connections, which are less than one-half the size of the main to which they connect.
8. Ground Joint Unions, Flange Connections, Reaming & Filling Ground joint unions shall be 200 lb. s.w.p. for brass. Flanges shall be 150 lb. s.w.p. for brass, 125 lb. s.w.p. for cast iron.
9. Ground joint unions of flanges shall be used only on exposed accessible piping. Where concealed, right and left nipples and couplings must be used. Where flanged connections are used, full size gaskets must be inserted.

- C. Threads: Shall be standard, clean cut and tapered. All piping shall be reamed free from burrs. All piping shall be kept free of scale and dirt. Caulking of threads will not be permitted. All piping shall be threaded and made up in accordance with the current edition of the ASA Standard Specifications for pipe threads.

D. Unions

1. Unions for use on ferrous pipe 2" and smaller shall be malleable iron with brass to iron ground joint spherical seat and threaded connections. Unions 2 1/2" and over shall be flanged type with gasket.
2. Unions for copper tubing shall be cast bronze conforming to ASA B16. The Contractor shall furnish adapters where required for copper pipe.
3. Where copper pipe connects to ferrous pipe or metals, the Contractor shall furnish EPCO isolating type dielectric unions. Plastic type isolating bushings are not acceptable.
4. Unions shall be installed wherever necessary for repair or replacement of equipment, valves, strainers, etc. Final connections to equipment shall be made in a manner that will permit removal without cutting of pipelines.

E. Solder

1. All sweat joints shall be made up with lead-free solder.
2. Solder shall be Oatey or approved equal. Flux shall be non-toxic and non-corrosive.
3. All copper tubing ends shall be reamed, filed and cleared of burrs and rough edges. All pipes shall be reamed after cutting and threading.

F. Expansion

1. The entire piping installation shall be installed with adequate provision for expansion. No rigid connections will be permitted.
2. Branches shall be of sufficient length and have 3 elbow swings to allow for pipe expansion.
3. Provide expansion joints, guides and anchors equal to "Metra-Flex MetraLoops" where indicated on Drawings or where necessary for proper expansion compensation. Submit shop drawing.
4. Any breaks in the piping within the guarantee period due to improper provision for expansion must be replaced at the expense of this Contractor, and the conditions corrected to prevent future recurrence.
5. Any damages to surrounding areas and equipment due to this failure shall also be repaired and paid for at the expense of the Contractor.
6. Joints to have 150 psi rating, ANSI-B16.5 with liner and cover.

## 2.4 PIPING SLEEVES

- A. Furnish sleeves built into place for all piping passing through walls, floors or building construction. Sleeves, not less than 1/2" larger in diameter than piping and its covering, if any, and extending full depth of construction pierced. Pack sleeves through walls/floors in accordance with Underwriters' Requirements.
- B. Sleeves piercing exterior walls, integral waterproofed walls shall be standard weight steel piping. Furnish welded center flange buried in construction for sleeves through exterior walls below grade. At exterior walls, make pipes watertight in sleeves with oakum packing and caulked lead joints on both sides of wall. All other sleeves: Galvanized sheet steel with lockseam joints, #22 USSG for 3" or under. Sleeves for piping 4" and larger, #18 USSG.
- C. Pipes passing through interior membrane waterproofed floors, cast iron flashing sleeve, with integral flashing flange and clamping ring, similar to Josam Series #1880. Adjust sleeves to floor construction with steel or wrought iron pipe nipples top and bottom, extending 3" above finished floor. Burn & J.R. Smith are equal.
- D. Pipes passing through membrane waterproofed walls, cast iron flashing sleeve with internal flashing flange and clamping ring similar to Josam Series #1870. Make pipes watertight in sleeves with oakum packing and caulked lead joints. Burn & J.R. Smith are equal.
- E. For flashing sleeves specified in Pars. C and D, lead flashing extended at least 10" around flashing sleeves, securely held in place by clamping device.

## 2.5 PIPING ENCLOSURES

- A. Where concealed piping in ceilings and wall of finished spaces is not possible vertical or horizontal metal piping enclosures equal to "Sterling" model PCH (horizontal) or PCHV (vertical). Provide all required hangers, supports, corners, brackets, etc. color per Architect.

## PART 3 - EXECUTION

### 3.1 GENERAL NOTES - PIPING NOTES, DRAINING, VENTING AND MISCELLANEOUS WATER SPECIALTIES

- A. Piping shall be installed as indicated on Drawings. Elevations and dimensions are indicated as a guide only and are subject to change with actual job conditions.
- B. Except for drainage piping, which shall pitch down with flow, mains shall pitch upward or be installed dead level as indicated. Horizontal runs shall be parallel to walls.
- C. In general, all branch connections shall be top of bottom 45 degree or 90 degree, pitching up or down from mains.
- D. Where indicated, flexible connectors shall be installed. All final connections to equipment, pumps, units, etc. shall have companion flanged, flange unions or ground joint unions (125 lbs.).

- E. All piping shall be adequately supported with approved type hangers so as to prevent absolutely any sagging of lines, or any undue strain on pipes or fittings. All pipe lines shall be capped during construction to prevent entry of dirt or other foreign material. All piping lines after erection shall be blown or flushed out to render the piping system as clean as possible before system water is added for operation.
- F. Clean interior and exterior surfaces promptly after installation of equipment and components. Take care to avoid damage to protective coatings and finishes. Remove excess sealants, lubrication, dirt and other foreign substances.
- G. Comply with manufacturer's instructions and recommendations for installation of equipment, accessories and components.
- H. All heating, ventilating and air conditioning equipment shall be carefully designed, constructed and installed so as to prevent any objectionable noise or vibration reaching any part of the building outside of the mechanical equipment room. The Contractor shall be required to rectify or replace at his own expense, any equipment not complying with the foregoing requirements.

### 3.2 DRAINING

- A. All low points shall have drain valves with hose ends. Where 1/2" and 3/4" sizes are indicated, "Standard" hose end drain valves shall be used. Provide brass hose end drain caps at each drain valve. Where larger than 3/4" drains are shown, gate valve shall be used. Provide brass nipple and reducer from drain valve size to 3/4" terminating with 3/4" hose end drain valve and cap.

### 3.3 VENTING (For Hot Water)

- A. All high points in piping shall be vented automatically with float vents. At all high points of piping, whether specifically indicated or not, provide Maid-o-Mist or B&G No. 7 or 27 Air Eliminators with shut off cock, auxiliary key vent and copper tubing overflow carried to floor along wall as indicated or directed.

### 3.4 WATER SPECIALTIES

- A. Air Vents: Install at all high points automatic air vents to eliminate air binding. All automatic air vents shall be approved heavy duty type equipped with petcocks and tubing for manual venting. All vents installed in coils, etc. shall be of manual key operated type. All vents concealed from view shall be accessible through access doors. Vents shall be by Hoffman, Anderson or Bell & Gossett, 125 psig rated.
- B. Pressure Gauge: Furnish and install pressure gauges on suction and discharge sides of each pump and as required to check operation of equipment; pressure gauges shall have 4-1/2" diameter dials, Ashton, Ashcroft or approved equal.



- C. Install thermometers at all locations in piping system as noted on Drawings and as required to check system performance. Thermometers shall be installed at the supply and return of coils and 3-way diverting valves as manufactured by Trerice, Weksler or Moeller, with 4-1/2 inch face, cast aluminum case, chrome plated steel ring, white background with black embossed markings, glass window, stainless steel pointer, brass movement, 316 stainless steel bulb. Provide separable, universal angle sockets for all thermometers.

END OF SECTION 230410



## **SECTION 230415**

### **PIPING, FITTINGS, VALVES AND NOTES (STEAM)**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements shall govern work in this section. Submit shop drawings for checking and approval.

##### **1.1 PIPING NOTES**

- A. The Contractor shall erect all pipe, fittings, valves, hangers, anchors, expansion joints and all accessories specified, indicated on the Drawings or required to assure proper operation of all piping systems installed under this Contract. All piping shall be maintained at a proper level to assure satisfactory operation, venting and drainage. Piping and valves in any locality where possible shall be grouped neatly and shall be run so as to avoid reducing headroom or passage clearance.
- B. All piping shall be new and of the material and weight specified under various services. Steel and wrought iron pipe 2" and larger shall be seamless or lap welded. All piping shall have the maker's name and brand rolled on each length of pipe.
- C. All piping, fittings, valves and strainers shall be cleaned of grease, dirt and scale before installation. All temporary pipe openings shall be kept closed during the performance of the work. The ends of all piping shall be reamed smooth and all burrs removed before installation.
- D. All piping shall be cut accurately to measurements taken on the job. Offset connections shall be installed alignment of vertical to horizontal piping and where required to make a true connection and to provide for expansion. Bent or sprung pipe shall not be installed where shown on Drawings and where necessary to provide for expansion of piping. Cold spring hot lines one-half estimated distance of maximum expansion. Suitable pipe anchors shall be installed where shown or required.
- E. Piping connections shall have unions where necessary for replacement and repair of equipment. Gate valves and controls valves shall be installed where shown and where necessary for proper operation and service.
- F. Vertical piping shall be plumb and horizontal piping shall be parallel to walls and partitions. Piping shall be supported as required to prevent the transmission of noise and vibration.
- G. Work shall include all pipe, fittings, offsets and requirements for the installation of piping of other work including ducts and conduit. Reducing fittings shall be used where pipe changes size. All piping shall be installed with ample clearance to center accurately in sleeves through floors, and walls and partitions.
- H. Piping shall be downgraded to drain connections at low points.

## PART 2 - PRODUCTS

### 2.1 PIPING

- A. All piping installed under this Section of the Specifications shall be in accordance with the following schedule.
  - 1. Piping for low pressure shall be standard weight black steel pipe Schedule 40, Grade A53, black steel and Schedule 80, Grade A53 for medium and high pressure. All steam condensate piping shall be Schedule 80, Grade A53. Pipe 2" and smaller, cast iron screwed fittings. Pipe 2-1/2" and larger, steel welding fittings. Pipe and fittings as manufactured by National, Wheeling, Bethlehem or equal, manufactured in accordance with ASTM current edition. All pipes must be reamed before installation.
  - 2. All drainage pipe lines, 2" larger except where galvanized screw pipe is shown on the Drawings or specified hereafter, shall be extra heavy cast iron soil pipe and fittings.
- B. Threaded short and close nipples shall be Schedule 80, extra heavy weight of the same material as pipe in system in which they are installed.

### 2.2 VALVES

- A. All valves, unless specified or noted otherwise, shall be designed for a working pressure of not less than 200 psi water or 125 psi steam with name and pressure rating of valve cast in body. All valves shall be of the same manufacturer, unless specified otherwise. Valves for cut-off shall be gate valves, unless otherwise specified.
- B. All valves of same manufacturer: similar to Jenkins Bros., Walworth, Kennedy or approved equal.
- C. Four inch and larger, flanged; smaller sizes, screwed.
- D. All Gate and Globe valves shall be installed with handle in an upright position.
- E. The Contractor shall furnish and install all valves shown on Drawings and all valves that are necessary for proper operation and maintenance of systems and equipment. All piping connections to each piece of equipment and all branch connections to mains shall have cut-off valves.
- F. The following schedule of valves for steam, condensate, etc. is based on Jenkins Brothers, Inc. catalog numbers (except as noted); equivalent Lukenheimer, Walworth, O-I-C, Crane Fairbanks Company valves will be acceptable.
- G. Gate Valves
  - 1. Up to 2" : Bronze gate solid wedge, inside screw traveling stem union bonnet, - Fig. 47U

2. 2-1/2" and 3" : Iron body, bronze-mounted gate, solid wedge, OS&Y rising stem, -Fig. 650-A
3. 4" and larger: Iron body, bronze-mounted gate, solid wedge, OS&Y rising stem, - Fig. 651-A
4. Provide chain wheel gear operator on all valves installed 7 feet or higher.

## 2.3 FITTINGS

### A. Nipples

1. All nipples shall have clean cut threads and shall be made from new pipe, standard weight for all lengths, except that close and shoulder nipples shall be extra heavy.
2. Fittings - 2-1/2 and Smaller: All fittings shall be standard weight steam pattern gray cast iron, Grinnell, Stockholm or equal approved.
3. Fitting - 3" and Larger: The Contractor has the option to use screwed, flanged or welded fittings so long as all ASME requirements are met.

### B. Joints and Unions

1. Threaded joints shall be full and clean cut. The ends of pipe shall be reamed to the full inside diameter, all burrs shall be removed and no more than three threads shall be exposed beyond fittings when made up. Joints shall be made up tight with graphite base pipe joint compound. Exposed threads of ferrous pipe shall be painted with acid-resisting paint after caulking, lampwick or other material will be allowed for correction of defective joints.
2. Flange joints shall be made up perfectly square and tight. Screwed flanges and loose flanges shall be cast iron and welding flanges shall be steel. Flanges shall be faced true and bolted up tight with 1/16" Carlock ring type gasket.
3. Bolts shall be high quality steel with hexagon nuts and heads. The Contractor shall apply grease to threads of bolt.
4. Welded joints in piping shall be by the electric or oxyacetylene process using welding rods if the characteristics similar to pipe material and as recommended by the pipe manufacturer and shall be done in accordance with the ASME Code for pressure piping. Welding shall be done by qualified welders under the requirements of the ASME Boiler and Pressure Vessel Code.
5. The pipe lengths shall be aligned with welding rings and the abutting pipe ends shall be concentric. Prior to welding, the groove and adjacent surfaces shall be thoroughly cleaned of all grease, scale or rust. During welding, all slag, or flux remaining on the bead shall be removed before laying down the next bead. The welding metal shall be thoroughly fused with the base metal at all sections of the weld. Short lengths of pipe may be beveled on the job with oxyacetylene torch, provided all scale and oxides are removed.

6. Joints shall be butt-welded, single V-type. All fittings shall be steel welding fittings. Elbows and fittings formed with coupling or welded cut pipe sections shall not be acceptable.
  7. Bonney Weldolets or welding saddles may be used for branch connections, which are less than one-half the size of the main to which they connect.
  8. Ground Joint Unions, Flange Connections, Reaming & Filling Ground joint unions shall be 200 lb. s.w.p. for brass. Flanges shall be 150 lb. s.w.p. for brass, 125 lb. s.w.p. for cast iron.
  9. Ground joint unions of flanges shall be used only on exposed accessible piping. Where concealed, right and left nipples and couplings must be used. Where flanged connections are used, full size gaskets must be inserted.
- C. Threads: Shall be standard, clean cut and tapered. All piping shall be reamed free from burrs. All piping shall be kept free of scale and dirt. Caulking of threads will not be permitted. All piping shall be threaded and made up in accordance with the current edition of the ASA Standard Specifications for pipe threads.
- D. Unions
1. Unions for use on ferrous pipe 2" and smaller shall be malleable iron with brass to iron ground joint spherical seat and threaded connections. Unions 2 1/2" and over shall be flanged type with gasket.
  2. Unions shall be installed wherever necessary for repair or replacement of equipment, valves, strainers, etc. Final connections to equipment shall be made in a manner that will permit removal without cutting of pipelines.
- E. Expansion
1. The entire piping installation shall be installed with adequate provision for expansion. No rigid connections will be permitted.
  2. Branches shall be of sufficient length and have 3 elbow swings to allow for pipe expansion.
  3. Provide expansion joints, guides and anchors equal to "Flexonics" Type HCF where indicated on Drawings or where necessary for proper expansion compensation. Submit shop drawing.
  4. Any breaks in the piping within the guarantee period due to improper provision for expansion must be replaced at the expense of this Contractor, and the conditions corrected to prevent future recurrence.
  5. Any damages to surrounding areas and equipment due to this failure shall also be repaired and paid for at the expense of the Contractor.
  6. Joints to have 150 psi rating, ANSI-B16.5 with liner and cover.

## 2.4 PIPING SLEEVES

- A. Furnish sleeves built into place for all piping passing through walls, floors or building construction. Sleeves, not less than 1/2" larger in diameter than piping and its covering, if any, and extending full depth of construction pierced. Pack sleeves through walls/floors in accordance with Underwriters' Requirements.
- B. Sleeves piercing exterior walls, integral waterproofed walls shall be standard weight steel piping. Furnish welded center flange buried in construction for sleeves through exterior walls below grade. At exterior walls, make pipes watertight in sleeves with oakum packing and caulked lead joints on both sides of wall. All other sleeves: Galvanized sheet steel with lockseam joints, #22 USSG for 3" or under. Sleeves for piping 4" and larger, #18 USSG.
- C. Pipes passing through interior membrane waterproofed floors, cast iron flashing sleeve, with integral flashing flange and clamping ring, similar to Josam Series #1880. Adjust sleeves to floor construction with steel or wrought iron pipe nipples top and bottom, extending 3" above finished floor. Burn & J.R. Smith are equal.
- D. Pipes passing through membrane waterproofed walls, cast iron flashing sleeve with internal flashing flange and clamping ring similar to Josam Series #1870. Make pipes watertight in sleeves with oakum packing and caulked lead joints. Burn & J.R. Smith are equal.
- E. For flashing sleeves specified in Pars. C and D, lead flashing extended at least 10" around flashing sleeves, securely held in place by clamping device.

## 2.5 PIPING ENCLOSURES

- A. Where concealed piping in ceilings and wall of finished spaces is not possible vertical or horizontal metal piping enclosures equal to "Sterling" model PCH (horizontal) or PCHV (vertical). Provide all required hangers, supports, corners, brackets, etc. color per Architect.

## 2.6 ESCUTCHEONS

- A. Furnish tamperproof pipe escutcheons at all surfaces where exposed piping bare or covered, passes through walls, ceilings, floors or partitions.
- B. Escutcheons: Stamped sheet metals, chromium plated over copper on all surfaces and satin finish on exposed side. Fasten escutcheons securely to pipe sleeves or to extensions of sleeves without any part of sleeve or extension being visible; escutcheons held in place by tamperproof screws and on covered pipe by internal spring tension, tamperproof.
- C. Where sleeves or fittings project slightly from wall, partitions, floor or ceiling, provide special deep type escutcheons.

## PART 3 - EXECUTION

### 3.1 GENERAL NOTES

- A. Piping shall be installed as indicated on Drawings. Elevations and dimensions are indicated as a guide only and are subject to change with actual job conditions.
- B. Mains shall pitch upward or be installed dead level as indicated. Horizontal runs shall be parallel to walls.
- C. In general, all branch connections shall be top of bottom 45 degree or 90 degree, pitching up or down from mains.
- D. All piping shall be adequately supported with approved type hangers so as to prevent absolutely any sagging of lines, or any undue strain on pipes or fittings. All pipe lines shall be capped during construction to prevent entry of dirt or other foreign material. All piping lines after erection shall be blown or flushed out to render the piping system as clean as possible before system water is added for operation.

END OF SECTION 230415



## **SECTION 230420**

### **SUPPORTS, SLEEVES AND PLATES**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section. Submit shop drawings for checking and approval.

##### **1.1 DESCRIPTION OF WORK**

- A. This Contractor shall furnish and install all plates, hangers and supports for his equipment including piping, headers, fans expansion tank, ductwork, etc.
- B. All ductwork, piping and equipment shall be hung or supported from structural members only.

#### **PART 2 - PRODUCTS**

##### **2.1 PIPING, DUCTWORK AND EQUIPMENT**

- A. All piping shall be supported from building structure in a neat and workmanlike manner wherever possible, parallel runs of horizontal piping shall be grouped together on trapeze hangers. Vertical risers shall be supported at each floor line with steel pipe clamps. Use of wire perforated metal to support pipes will not be permitted. Hanging pipes from other pipes will not be permitted.
- B. Necessary structural members, hangers and supports of approved design to keep piping in proper alignment and prevent transmission of injurious thrusts and vibrations shall be furnished and installed. In all cases where hangers, brackets, etc., are supported from concrete construction, care shall be taken not to weaken concrete or penetrate waterproofing.
- C. All hangers and supports shall be capable of screw adjustment after piping is erected. Hangers supporting piping expanding into loops, bends and offsets shall be secured to the building structure in such a manner that horizontal adjustment perpendicular to the run of piping supported may be made to accommodate displacement due to expansion. All such hangers shall be finally adjusted, both in the vertical and horizontal direction, when the supported piping is hot.
- D. Pipe hangers shall be as manufactured by Grinnell, whose catalog numbers are given herein, or equivalent Carpenter and Paterson, or F&S Mfg. Co.
- E. Piping shall be supported as follows unless otherwise indicated on the Drawings:
  - 1. Heating piping shall be 1-1/2 " and smaller Fig. #260 adjustable clevis hanger. 2" and larger Fig. #174 one-rod swivel roll hanger.
  - 2. Two-rod hangers shall be used for piping close to the ceiling slab or where conditions prohibit use of other hanger types.

3. Anchors for hanger rods shall be Phillips "Red Head" self-drilling type. Anchors shall be placed only in vertical surfaces.
4. Spacing of pipe supports shall not exceed 8 feet for pipes up to 1-1/2" and 10 feet on all other piping.
5. Hangers shall pass around insulation and a 16 gauge steel protective cradle; 12" long shall be inserted between hangers and insulation. Insulation under cradle shall be high density calcium silicate or approved equal to prevent crushing.
6. All piping shall be supported to allow free movement where expanding or contracting. Pipe shall be anchored as required or directed.
7. All lateral runs of piping shall be securely supported on hangers, rolls, brackets, etc. and in manner to allow for proper expansion and elimination of vibration.
8. 2" and smaller pipe, where run on walls, shall be supported on wrought iron "J" hook brackets with anchor bolts.
9. All horizontal pipes, where run overhead or on walls, shall be supported as follows unless otherwise indicated:
  - a. On adjustable steel clevis type hangers suspended on hanger rods, pipe sizes up to and including 4".
- F. Space limitations in hung ceilings spaces and conditions in other locations may require use of other type of hangers than those specified above. Suitable and approved pipe hangers shall be provided for such job conditions.
- G. All supports shall be fastened to structural members or additional steel supports furnished by this Contractor.
- H. Hanger rods shall be steel, threaded with nuts and lock nuts sizes in accordance with the following schedule:
 

| <u>Pipe Size</u>        | <u>Rod Size</u> |
|-------------------------|-----------------|
| 3/4" to 2" inclusive    | 3/8"            |
| 2-1/2" and 3" inclusive | 1/2"            |
| 4" and 5" inclusive     | 5/8"            |
| 6"                      | 3/4"            |
| 8" to 12" inclusive     | 7/8"            |
- I. Hangers for copper tubing shall be tacked up with formed lead sheet on which tubing or pipe shall be placed.
- J. Where pipes pass through masonry, concrete walls, foundations, or floors, this Contractor shall set sleeves as are necessary for passage of pipes. These sleeves shall be of sufficient size to permit insulation where required to be provided around pipe passing through. This Contractor shall be responsible for exact location of these sleeves.

- K. Sleeves shall not be used in any portion of building where use of same would impair strength of construction features of the building. Inserts for supporting lateral pipes and equipment shall be placed and secured to form work, and all sleeves inserts locations shall be thoroughly checked with Architect so as not to conflict with other trades.
- L. Where pipes pass through floor or walls, they shall be provided with chromium plated escutcheons.
- M. Anchor horizontal piping where indicated and wherever necessary to localize expansion or prevent undue strain on branches. Anchors: Heavy forged construction entirely separate from supports.
- N. Anchor vertical piping wherever indicated and wherever necessary to prevent undue strain on offsets and branches. Anchors, unless otherwise noted: Heavy steel clamps securely bolted and welded to pipes. Extension ends shall bear on building construction.
- O. Ducts shall be hung with 1" x 1/8" metal straps. When width of duct is less than 48", hangers shall be fastened to side of ducts. Auxiliary steel supports that may be required for all mechanical equipment shall be furnished and installed by this Contractor. All operating equipment including fans, piping, etc. shall be supported so as to produce minimum amount of noise transmission.
- P. Refer to "General Conditions" as well.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Inspect equipment space locations before beginning installation. Verify that the space is correct for entry and access. Do not proceed with installation of the equipment until unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation of equipment, accessories and components.
- B. All heating, ventilating and air conditioning equipment shall be carefully designed, constructed and installed so as to prevent any objectionable noise or vibration reaching any part of the building outside of the mechanical equipment room. Care shall also be taken to prevent transmission of noise or odor through ductwork into other spaces. The Contractor shall be required to rectify or replace at his own expense, any equipment not complying with the foregoing requirements.

### 3.3 CLEANING

- A. Clean interior and exterior surfaces promptly after installation of equipment and components. Take care to avoid damage to protective coatings and finishes. Remove excess sealants, lubrication, dirt and other foreign substances.

END OF SECTION 230420



## **SECTION 230430**

### **INSULATION AND COVERINGS**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section. Submit shop drawings for checking and approval.

##### **1.1 DESCRIPTION OF WORK**

- A. Furnish insulation for all piping, equipment and sheet-metal work as noted.
- B. Insulate no piping, ducts or equipment until tested and approved for tightness. All piping and ducts shall be dry when covered. Where existing insulation has been damaged, altered or removed during the course of the work, it shall be replaced with new insulation in a neat manner to match the adjacent insulation.
- C. All insulation must be done by an approved Sub-Contractor or by mechanics skilled in this line of work.
- D. Fire hazard classification shall be 2550 per ASTM E-84, NFPA 255 and UL 723. Insulation shall be rated non-combustible type classified flame spread - 25, smoke developed - 50.

#### **PART 2 - PRODUCTS**

##### **2.1 DUCTWORK (INDOOR)**

- A. Supply, outside air intake and exhaust (on discharge side of fan) and return ductwork shall be covered with fiberglass insulation (unless otherwise indicated) with aluminum foil vapor barrier. All joints shall be lapped so maximum coverage is achieved.
- B. All insulated ductwork shall be insulated with fiberglass board insulation with canvas finish in areas where ductwork is exposed.
- C. Insulation thickness shall be in accordance with the latest edition of the State Energy Code.
- D. Thermal acoustic lining of ductwork where indicated shall be 1.5" thickness closed cell elastomeric unless otherwise noted. The lining shall have a mat facing and shall meet the Life Safety Standards as established by NFPA 90A and 9B and conform to the requirements of ASTM C 1071.

##### **2.2 DUCTWORK (INDOOR EXPOSED IN ELECTRICAL ROOM)**

- A. All exposed ductwork shall be insulated with 2" thick rigid insulation and vapor barrier.

## 2.3 DUCT WORK (OUTDOOR)

- A. All exposed ductwork shall be insulated with 2" thick closed cell, flexible elastomeric foam thermal and acoustic insulation.
- B. Cover insulation watertight with a weather-proofing cladding composite membrane consisting of a multiply embossed UV-resistant aluminum foil/polymer laminate to which is applied a layer of rubberized asphalt specially formulated for use on insulated duct and piping applications. The rubberized asphalt acts as the substrate adhesive and provides the self-healing characteristics necessary to seal around punctures. Protecting the rubberized asphalt is an easily removed plastic release liner which gives its peel and stick functionality.
- C. Insulation and covering shall be installed per manufactures recommendations and requirements. Make proper provision with ductwork support(s) so that insulation is not crushed.

## 2.4 PIPING/EQUIPMENT (INDOOR)

- A. All new heating water system supply and return and steam piping shall be covered with Manville Micro-Lok or equal approved fiberglass insulation with all service (factory applied) vapor retardant jacket. Seal with type H mastic.
- B. Fittings shall be insulated with same material and thickness as adjoining pipe insulation and shall be pre-molded fittings or miter cut segmental insulation wired on. Over the insulation, apply a wrapper of OCF glass cloth sealed with type H mastic. Apply aluminum bands on pipe covering in addition to self-sealing feature.
- C. Insulation Material: Molded fibrous glass insulation, density not less than 4 lbs. per cubic foot.
- D. Insulation Thickness: Shall be in accordance with the latest edition of the State Energy Code.
- E. Jacket and Finish: White flame retardant type, meeting all requirements of "Fire Hazard Classification" of NFPA, similar to "Fiberglass" Type FRJ, Insul-Coustic, Johns-Manville or approved equal.
- F. Insulation and Finishes for Fittings, Valves and Flanges
  - 1. Valves, fittings and flanges other than vapor seal insulation: Insulated in same manner and same thickness as piping in which installed.
  - 2. Use pre-molded sectional covering where available; otherwise use mitered segments of pipe covering.
  - 3. Obtain written approval prior to using other than molded sectional covering.
- G. Vapor seal Insulation for Valves, Fittings and Flanges: Same as above, except joints sealed with vapor barrier adhesive and wrapped with glass mesh tape. Each fitting shall be finished with two coats of vapor seal mastic adhesive.
- H. Jacket and Finishes: Exposed fittings - 6 oz. canvas jacket adhered with lagging adhesive.

I. Concealed fittings: Standard weight canvas jacket adhered with lagging adhesive and with bands of 18 gauge copper coated steel - 2 bands at elbows, 3 at tee.

J. Insulation at Pipe Hangers

1. Where shields are specified at hangers on piping with fibrous glass covering, provide load bearing calcium silicate between shields and piping as follows:
  - a. For pipe covering without vapor barrier jacket, furnish at each shield 12" - long calcium silicate section with canvas section with canvas jacket continuous between shield and insulation.
  - b. For pipe covering with vapor barrier jacket, furnish at each shield 12" - long vapor barrier jacket section with section of fibrous glass replaced with section of calcium silicate. Vapor barrier jacket, continuous between shield and insulation for continuous vapor barrier.

K. Condensate drain and refrigerant piping shall be insulated with 1/2" Imcosheild un-split polyolefin insulation.

L. Equipment

1. Secure fibrous glass block or board insulation in place with wire or galvanized steel bands.
  - a. Small Areas: Secure insulation with 16 gauge wire on maximum 6" centers.
  - b. Large Areas: Secure insulation with 14 gauge wire or .015" thick by 1/2" wide galvanized steel bands on maximum 10" centers. Stagger insulation joints.
  - c. Irregular Surfaces: Where application of block or board insulation is not practical insulate with insulating cement built-up to same thickness as adjoining insulation.
2. Fill joints, voids and irregular surfaces with insulating cement to a uniform thickness.
3. Stretch wire mesh over entire insulated surface and secure to anchors with wire edges laced together.
4. Apply finishing cement, total of 1/2" thick, in 1/4" thick coats. Trowel second coat to a smooth hard finish. Neatly bevel insulation around hand-holes, cleanouts, ASME stamp, manufacturer's nametag and catalog number.

M. Insulated Covers for Pumps: Do not extend pump insulation beyond or interfere with stuffing boxes or interfere with adjustment and servicing of parts regular maintenance or operating attention.

2.5 PIPING (OUTDOOR)

A. All supply and return piping shall be covered with 2" thickness insulation.

B. Insulation shall be calcium silicate with aluminum jacket.

C. Calcium silicate insulation shall conform with ASTM C 533, Type I, and shall be Manville "Thermo-12" or approved equal.

- D. Insulation jacket shall be 0.016 inch thick aluminum for pipes 2-1/2 inches and larger, and 0.010 inch thick for pipes 2 inches and smaller with a built-in isolation felt. All seams and joints shall be weatherproof.
- E. Refrigerant piping shall be insulated with 1/2" Imcosheild un-split polyolefin insulation.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Inspect equipment space locations before beginning installation. Verify that the space is correct for entry and access. Do not proceed with installation of the equipment until unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation of equipment, accessories and components.
- B. All heating, ventilating and air conditioning equipment shall be carefully designed, constructed and installed so as to prevent any objectionable noise or vibration reaching any part of the building outside of the mechanical equipment room. Care shall also be taken to prevent transmission of noise or odor through ductwork into other spaces. The Contractor shall be required to rectify or replace at his own expense, any equipment not complying with the foregoing requirements.

### 3.3 CLEANING

- A. Clean interior and exterior surfaces promptly after installation of equipment and components. Take care to avoid damage to protective coatings and finishes. Remove excess sealants, lubrication, dirt and other foreign substances.

END OF SECTION 230430



## **SECTION 230440**

### **DAMPERS AND MISCELLANEOUS**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section. Submit shop drawings for checking and approval.

#### **PART 2 - PRODUCTS**

##### **2.1 DAMPERS AND MISCELLANEOUS**

- A. Furnish and install where shown on Drawings ARROW PIN-LOCK Dampers No. OBDPL-507 (Opposed) as manufactured by the Arrow Louver & Damper Corp. of Maspeth, NY 11378, or approved equal. Frames and blades to 1/8" extruded aluminum.
- B. Blades to be single unit PIN-LOCK design 6" wide, with the PIN-LOCK an integral section within the blade center axis. Frames to be a combination of 4" extruded aluminum channel and angle, with reinforcing bosses and groove inserts for vinyl seals.
- C. Pivot rods to be 1/2" diameter extruded aluminum, PIN-LOCK design interlocking into blade section. Bearings to be "Double-Sealed" type with Celcon inner bearing on rod riding in Merlon Polycarbonate outer bearing inserted in frame so that outer bearing cannot rotate.
- D. Blade linkage hardware is to be installed in angle or channel frame section out of air stream. All hardware to be of non-corrosive reinforced material or to be cadmium plated.
- E. Rod bearing to be designed for minimum air leakage by means of overlapping design and by extruded vinyl seals to fit into integral ribbed groove inserts in both frames and blades. All dampers in excess of 10 sq. ft. free area to have reinforced corners by means of gusset plates.
- F. Dampers shall be sized by the Control Manufacturer to properly control the flow of air and ensure minimum air stratification in mixing applications. Sizing shall be submitted for approval with information similar to that submitted on valve when sizing valve.

##### **2.2 FIRE DAMPERS**

- A. Dampers shall be multi blade construction UL labeled and be installed in accordance with UL 555, with breakaway connections. The units shall have stainless steel actuator springs with locking devices for horizontally mounted type.

##### **2.3 COMBINATION FIRE / SMOKE DAMPERS**

- A. Furnish and install at locations shown on Drawings, or as described in schedules, combination fire smoke dampers.

- B. Frame shall be a minimum of 16 gauge galvanized steel formed into a structural hat channel reinforced at corners for added strength. The blades shall be airfoil shaped single-piece hollow construction with 14 gauge equivalent thicknesses. Blade action shall be opposed. Bearings shall be stainless steel sleeve turning in an extruded hole in the frame for long life. Galvanized bearing shall not be acceptable.
- C. Blade edge seals shall be silicone rubber and galvanized steel mechanically locked into blade edge (adhesive or clip fastened seals shall be acceptable) and shall withstand a minimum of 450 degrees F. (232 degrees C.) Jamb seals shall be non-corrosive stainless steel flexible metal compression type to further ensure smoke management.
- D. Each combination fire/smoke damper shall be classified for use for fire resistance ratings of less than 3 hours in accordance with UL Standard 555, and shall further be classified by Underwriters Laboratories as a Leakage Rated Damper for use in smoke control systems in accordance with the latest version of UL555S, and bear a UL label attesting to same. Damper manufacturer shall have tested, and qualified with UL, a complete range of damper sizes covering all dampers, required by this Specification. Testing and UL qualifying a single damper size is not acceptable. The leakage rating under UL555S shall be leakage Class I (4 c.f.m./sq. ft. at 1" w.g. and 8 c.f.m./ft. at 4" w.g.).
- E. As part of UL qualification, dampers shall have demonstrated a capacity to operate (to open and close) under HVAC system operating conditions, with pressures of at least 4" w.g. in the closed position, and 4000 f.p.m. air velocity in the open position.
- F. In addition to the leakage rating already specified herein, the dampers and their actuators shall be qualified under UL555S to an elevated temperature of 350 degrees F. (177 degrees C.). Appropriate electric actuators (equal to Ruskin model MA) shall be installed by the damper manufacturer at time of damper fabrication. Damper and actuator shall be supplied as a single entity, which meets all applicable UL555S qualifications for both dampers and actuators. Damper and actuator assembly shall be factory cycled 10 times to assure operation.
- G. Manufacturer shall provide factory assembled sleeve of 17" minimum length (Contractor to verify requirement). Factory supplied caulked sleeve shall be 20 gauge for dampers through 84" wide and 18 gauge above 84" wide.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Inspect equipment space locations before beginning installation. Verify that the space is correct for entry and access. Do not proceed with installation of the equipment until unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation of equipment, accessories and components.

- B. All heating, ventilating and air conditioning equipment shall be carefully designed, constructed and installed so as to prevent any objectionable noise or vibration reaching any part of the building outside of the mechanical equipment room. Care shall also be taken to prevent transmission of noise or odor through ductwork into other spaces. The Contractor shall be required to rectify or replace at his own expense, any equipment not complying with the foregoing requirements.

### 3.3 CLEANING

- A. Clean interior and exterior surfaces promptly after installation of equipment and components. Take care to avoid damage to protective coatings and finishes. Remove excess sealants, lubrication, dirt and other foreign substances.

END OF SECTION 230440



## **SECTION 230450**

### **LOUVERS**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

##### **1.1 SUMMARY**

- A. Section Includes: Fixed, extruded-aluminum louvers with drainable type blades.

##### **1.2 PERFORMANCE REQUIREMENTS**

- A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors.
  - 1. Wind Loads: Determine loads based on pressures as indicated on Drawings.
  - 2. Wind Loads: Determine loads based on a uniform pressure of 30 lbf/sq. ft., acting inward or outward.
- B. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.
- C. Special Finish Warranty: The louver manufacturer shall supply an industry standard 20-year limited warranty against failure or excessive fading of the Fluoropolymer Powder Coat finish.

##### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.
  - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
- C. Samples: For each type of metal finish required.

##### **1.4 INFORMATIONAL SUBMITTALS**

- A. Product Test Reports: Based on tests performed according to AMCA 500-L.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Fasteners: Use types and sizes to suit unit installation conditions.
  - 1. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
  - 2. For fastening galvanized steel, use hot-dip-galvanized steel or 300 series stainless-steel fasteners.
  - 3. For fastening stainless steel, use 300 series stainless-steel fasteners.
  - 4. For color-finished louvers, use fasteners with heads that match color of louvers.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

### 2.2 FABRICATION - GENERAL

- A. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
- B. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.
- C. Horizontal, Drainable-Blade Louver LV-1:
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:
    - a. Construction Specialties, Inc. model A2907
    - b. Approved equal.
  - 2. Louver Depth: 2 inches.
  - 3. Frame and Blade Nominal Thickness: Not less than 0.060 inch for blades and 0.060 inch for frames.
  - 4. Louver Performance Ratings:
    - a. Free Area: 53%.
    - b. Point of Beginning Water Penetration: Not less than 900 fpm.
    - c. Air Performance: Not more than 0.13-inch wg static pressure drop at 1040 fpm free-area intake velocity.
  - 5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

## 2.3 LOUVER SCREENS

- A. General: Provide screen at each exterior louver.
- B. Louver Screen Frames: Same kind and form of metal as indicated for louver to which screens are attached.
- C. Louver Screening:
  - 1. Bird Screening: Flattened, expanded aluminum, 5/8 by 0.050 inch thick.

## 2.4 ALUMINUM FINISHES

- A. Powder Coating
  - 1. All louvers shall be finished with C/S Powder Coat, a coating to be 1.5 to 3 mil. thick full strength 100% resin Fluoropolymer coating. Finish to allow zero VOCs to be emitted into facility of application. Finish to adhere to a 4H Hardness rating.
  - 2. All finishing procedures shall be one continuous operation in the plant of the manufacturer. The coating shall meet or exceed all requirements of AAMA specification 2605 "Voluntary Specification for High Performance Organic Coatings on Architectural extrusions and Panels."
  - 3. Color and Gloss: As selected by Architect from manufacturer's full range.

## 2.5 INSTALLATION

- A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- D. Repair damaged finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory and refinish entire unit or provide new units.
- E. Protect galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Inspect equipment space locations before beginning installation. Verify that the space is correct for entry and access. Do not proceed with installation of the equipment until unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation of equipment, accessories and components.

### 3.3 CLEANING

- A. Clean interior and exterior surfaces promptly after installation of equipment and components. Take care to avoid damage to protective coatings and finishes. Remove excess sealants, lubrication, dirt and other foreign substances.

END OF SECTION 230450



## **SECTION 230460**

### **AUTOMATIC TEMPERATURE CONTROLS**

#### **PART 1 - GENERAL**

Applicable provisions of the conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

##### **1.1 QUALIFICATIONS OF BIDDER**

- A. All bidders must be building automation contractors in the business of installing direct digital control building automation systems for a minimum of 10 years.
- B. All bidders must have an office in the within 50 miles of jobsite.
- C. All bidders must be authorized distributors or branch offices of the manufacturers specified.
- D. All bidders must have a trained staff of application Engineers, who have been certified by the manufacturer in the configuration, programming and service of the automation system.

##### **1.2 SCOPE OF WORK**

- A. This Contractor shall furnish an electronic system of temperature controls. The District has standardized on Alerton controls. All submitted controls shall be directly compatible with existing hardware and software without patch panels or translators or any kind. The ATC Sub-Contractor shall be subject to the District's approval. Communications between the schools is via their Ethernet LAN and remote access is via the Web or Local Intranet. The intent of this specification is to extend and interoperate with this system and to provide a peer-to-peer, networked, distributed control system for the temperature control work that is part of this project. All components, software and operation shall be interoperable with the existing building automation system via the Niagara Framework in the District. The installed system will interface directly with the existing proprietary as well as open protocol systems, including the existing District network, dynamic color graphics software and programming software. The existing software and database will be modified to accept the new equipment being installed under this project to maintain integrity for centralized scheduling, trending, programming and alarming. PC Desktop icons that "link" to a separate EMS system are not acceptable. Any costs associated with connecting to the existing energy management system, including licensed software, programming, training etc. shall be part of the controls contractor's bid. The contractor must demonstrate their ability to perform the integration to the existing Schneider Electric systems prior to submittal acceptance and invoicing.
- B. Only licensed software toolsets will be acceptable for integration work. All systems as described in the sequence of operation will be shown via dynamic Web based graphics with all pertinent system alarms for proper operation and maintenance. The use of separate PC workstations, gateways, metalinks, replacement of existing controllers and control devices and additional software graphic packages to accomplish this integration will not be accepted.

- C. Prospective bidders shall visit the School District Buildings to verify existing DDC controls equipment and Contractors ability to be compatible with these controls before bid. Contact the Schools Supt. of Buildings and Grounds for details. Contractor shall provide Web based graphics for controlled equipment that matches the functionality and appearance of the graphics already in use on the existing system. Contractor shall configure graphic display to meet Owner and Engineer requirements.
- D. The Temperature Controls Contractor (TCC) shall provide each of the following portions of the complete EMCS as a standalone system that can communicate with any other DDC system which is following the same protocol.
1. Operator Workstations: Reuse existing OWS's, software and Databases in the district and provide guaranteed seamless two way communications via the Internet and District LAN, including full control, with both all existing DDC systems currently under control and the DDC system provided as a part of this project.
    - a. The OWS's shall monitor, display, and control information from the DDC systems through one software package. Rebooting of the OWS to access the existing building's multiple systems is not acceptable. Use of separate "Icons" to access multiple DDC systems is not acceptable. The existing database shall be modified to incorporate the work of this project.
      - The system OWS's shall meet the hardware and performance requirements of this specification.
      - The OWS's shall allow customization of the system as described in this specification.
  2. The OWS's shall:
    - a. Provide new color graphic control screens for all equipment provided or modified as part of this project, as outlined below and on the drawings.
    - b. Allow operators to view and work (read and write) all DDC points associated with all DDC equipment provided or modified as part of this project, including all existing DDC points.
    - c. Allow for custom graphics and/or control programming generation for any existing or new equipment.
    - d. Provide seamless continuity of graphics and existing functionality for all existing Owner's equipment currently under DDC control.
- E. All proposed controls contractors that intend on interoperating with the existing DDC system utilizing DDC controls other than those presently installed in the district, shall submit a Technical Proposal, complete with the diagrams, Specifications Compliance Reports, product information, and supporting documentation outlined below. The technical proposal will be utilized to evaluate the methodology that will be used to implement the interoperation and integration of the new controls of this project into the existing district wide energy management system. It will also be used as a basis for vendor qualification on for the project. Arrange the Technical Proposal in order of the specification article numbers.

1. Provide a list of local jobs (three minimum) of similar type and size the bidder has installed, utilizing the products proposed for this project, with owner's representatives' names and telephone numbers for reference. This list should directly reflect:
    - a. Projects that include direct integration to third party microprocessor controllers of the type specified within the scope where an integration and interoperation of Lon Works controls has been successfully achieved between two different manufacturers' controls systems.
      - EMCS network wiring diagram showing interconnection of all panels, workstations, system printer(s) etc. A diagram describing system architecture for this project with product code numbers for workstation, network controllers, application specific controllers, transducers, sensors, communication network, etc.
  2. Provide information on owner training provided as part of the bid package as well as additional opportunities and factory schools available with associated cost. Include details of operator HVAC Training System as specified herein.
  3. Specification Compliance Report. Provide specification compliance report that addresses every paragraph within this specification section utilizing an outline format, as follows:
    - a. Comply-bid package complies without exception;
    - b. Exception – bid package meets the functional intent, but not the letter of the specification. For each paragraph that an exception is taken, identify all deviations from what is specified in the given paragraph and provide a description of what is excluded, what is included, and how the contractor intends to meet the functional intent;
    - c. Does not comply – bid package cannot meet specified function and will not be provided.
    - d. For all paragraphs in this specification section, indicates as "Comply" or "Exception" or "Does not comply". Provide and reference factory product documentation to substantiate compliance.
  4. Provide a statement that all products used on this project is of current manufactures and are readily available through multiple distribution channels. Products in "field testing" status are not acceptable.
- F. The BAS Contractor shall review and study all HVAC Drawings and the entire Specification to familiarize himself with the equipment and system operation and to verify the quantities and types of dampers, operators, alarms, etc. to be provided.
- G. Prior to commencement of schedule programming meet with Owner to discuss block/individual scheduling of system/equipment and alarm protocols. Review equipment designations and graphics screens to be provided. Take minutes of this meeting and issue them to the Construction Manager/Owner's representative.

- H. All temperature control wiring regardless of voltage shall be done by this Contractor. This shall include power wiring of control panels/components from available spare circuits in electrical panels. The automatic temperature control manufacturer shall provide wiring diagrams, field supervision and one (1) year guarantee on the installed DDC system and three (3) year factory warrantee on all control equipment manufactured by the DDC manufacturer.
  - I. Thermostats, temperature sensors, heating control devices, etc. are indicated on the Drawings in general. Provide any additional devices required to carry out project intent as herein described.
  - J. Thermostats/Temperature sensors in areas subject to vandalism shall have in addition separately mounted extra heavy guards. Submit sample.
  - K. Contractor shall include all new heating control devices, thermostats, etc. indicated on Drawings or that is part of a new system.
  - L. Contractor shall furnish all necessary electrical controls, motor starters, switches, etc. for proper operation of equipment furnished by him under this Contract, and as herein noted.
  - M. Point and component lists are to be used as a guide. If the sequence of operation requires additional points/control devices, this Contractor shall be responsible for providing same.
  - N. All control system components installed shall be manufactured by the DDC system manufacturer.
  - O. Communications cabling shall be run in hallways above hung ceiling with plenum cable and wire mold where exposed.
  - P. Removals shall include switches, relays, electric components not required for the new intent. Do not leave behind items with no function. Provide appropriate blanking plates/patching where removals occur in finished spaces.
  - Q. Provide services and manpower necessary for commissioning of system in coordination with the HVAC Contractor, Balancing Contractor and Owner's representative.
- 1.3 SOFTWARE CODE
- A. Owner shall be furnished with a complete, hard-bound copy of all installed software code. Final payment shall be contingent upon this requirement being met.
- 1.4 CODE COMPLIANCE
- A. Provide components and ancillary equipment, which are UL-916 listed and labeled.
  - B. All equipment or piping used in conditioned air streams, spaces or return air plenums shall comply with NFPA 90A Flame/Smoke/Fuel contribution rating of 25/50/0 and all applicable building codes or requirements.
  - C. All wiring shall conform to the National Electrical Code.

- D. Comply with FCC rules, Part 15 regarding Class A radiation for computing devices and low power communication equipment operating in commercial environments.
- E. Comply with FCC, Part 68 rules for telephone modems and data sets.

#### 1.5 SUBMITTALS

- A. All shop drawings shall be prepared in Visio Professional or AutoCAD software. In addition to the Drawings, the Contractor shall furnish a CD containing the identical information. Drawings shall be B size or larger.
- B. Shop drawings shall include a riser diagram depicting locations of all controllers and workstations, with associated network wiring. Also included shall be individual schematics of each mechanical system showing all connected points with reference to their associated controller. Typical will be allowed where appropriate.
- C. Submittal data shall contain manufacturer's data on all hardware and software products required by the Specification. Valve damper and airflow station schedules shall indicate size, configuration, capacity and location of all equipment.
- D. Software submittals shall contain narrative descriptions of sequences of operation, program listings, point lists, and a complete description of the graphics, reports, alarms and configuration to be furnished with the workstation software. Information shall be bound or in a three ring binder with an index and tabs.
- E. Submit submittal data and shop drawings to the Engineer for review prior to ordering or fabrication of the equipment. The Contractor prior to submitting shall check all Documents for accuracy.
- F. The Engineer will make corrections, if required, and return to the Contractor. The Contractor will then resubmit with the corrected or additional data. This procedure shall be repeated until all corrections are made to the satisfaction of the Engineer and the submittals are fully approved.

#### 1.6 SYSTEM STARTUP AND COMMISSIONING

- A. Each point in the system shall be tested for both hardware and software functionality. In addition, each mechanical and electrical system under control of the BAS will be tested against the appropriate sequence of operation specified herein. Successful completion of the system test shall constitute the beginning of the warranty period. A written report will be submitted to the Owner indicating that the installed system functions in accordance with the Drawings and Specifications.
- B. The ATC Contractor shall commission and set in operating condition all major equipment and systems, such as heating, DX cooling, heat recovery and all air handling systems, in the presence of the equipment manufacturer's representatives, as applicable, and the Owner and Architect's representatives.

- C. The ATC Contractor shall provide all manpower and engineering services required to assist the HVAC Contractor and Balancing Contractor in testing, adjusting, and balancing all systems in the building Scope of Work. The Contractor shall have a trained technician available on request during the balancing of the systems. The Contractor shall coordinate all requirements to provide a complete air balance with the Balancing Contractor and shall include all labor and materials in his Contract.

#### 1.7 OPERATING AND MAINTENANCE MANUALS

- A. The operation and maintenance manuals shall contain all information necessary for the operation, maintenance, replacement, installation and parts procurement for the entire system. This documentation shall include specific part numbers and software versions and dates. A complete list of recommended spare parts shall be included with the lead-time and expected frequency of use of each part clearly identified.
- B. Following project completion and testing, the Contractor will submit As-Built Drawings reflecting the exact installation of the system. The as-built documentation shall also include a copy of all application software both in written form and on CD.

#### 1.8 WARRANTY

- A. The Contractor shall provide system warranty for 12 months after system acceptance or beneficial use by the Owner. During the warranty period, the Contractor shall be responsible for all necessary revisions to the software as required to provide a complete and workable system consistent with the letter and intent of the Sequence of Operation section of the Specification.
- B. Updates to the manufacturer's software shall be provided at no charge during the warranty period.

#### 1.9 SPECIFICATION NOMENCLATURE

- A. Acronyms used in this specification are as follows:
  - 1. EMCS Energy Management and Control System
  - 2. NAC Network Area Controller
  - 3. IDC Interoperable Digital Controller
  - 4. FUI Full User Interface
  - 5. BUI Browser User Interface
  - 6. POT Portable Operator's Terminal
  - 7. PMI Power Measurement Interface
  - 8. DDC Direct Digital Controls
  - 9. LAN Local Area Network
  - 10. WAN Wide Area Network
  - 11. OOT Object Oriented Technology
  - 12. PICS Product Interoperability Compliance Statement

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. The Energy Management Control System (EMCS) shall be comprised of a network of interoperable, stand-alone digital controllers, a computer system, graphical user interface software, portable operator terminals, printers, network devices and other devices as specified herein.
- B. The installed system shall provide secure password access to all features, functions and data contained in the overall EMCS.

### 2.2 OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURES

- A. The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system with the capability to integrate Lon Works and Schneider Electric Network 8000 technology communication protocols in one open, interoperable system.
- B. The programming computer software shall employ object-oriented technology (OOT) for representation of all data and control devices within the system. In addition, adherence to industry standards including ANSI / ASHRAE™ Standard 135-1995, to assure interoperability between all system components is required. For each Lon Works device that does not have Lon Work certification, the device supplier must provide an XIF file for the device. All components and controllers supplied under this contract shall be true “peer-to-peer” communicating devices. Components or controllers requiring “polling” by a host to pass data shall not be acceptable.
- C. The supplied system must incorporate the ability to access all data using Java enabled browsers without requiring proprietary operator interface and configuration programs. An Open Database Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on a supplier-installed server for all database access. Systems requiring proprietary database or proprietary user interface programs shall not be acceptable.
- D. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer’s internal Intranet network. Systems employing a “flat” single tiered architecture shall not be acceptable.
  - 1. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for network connected user interfaces.
  - 2. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.

## 2.3 NETWORKS

- A. The Local Area Network (LAN) shall be either a 10 or 100 Megabits/sec Ethernet network supporting, Java, XML, HTTP, and CORBA IIOP for maximum flexibility for integration of building data with enterprise information systems and providing support for multiple Network Area Controllers (NACs), Browser User Interfaces (BUIs) and/or Full User Interfaces (FUIs).
- B. Local area network minimum physical and media access requirements:
  - 1. Ethernet; IEEE standard 802.3
  - 2. Cable; 10 Base-T, UTP-8 wire, category 5
  - 3. Minimum throughput; 10 Mbps, with ability to increase to 100 Mbps

## 2.4 NETWORK ACCESS

- A. Remote Access
  - 1. For Local Area Network installations, provide access to the LAN from a remote location, via the Internet. The owner shall provide a connection to the Internet to enable this access via high-speed cable modem, asynchronous digital subscriber line (ADSL) modem, and ISDN line, T1 Line or via the customer's Intranet to a corporate server providing access to an Internet Service Provider (ISP). Owner agrees to pay monthly access charges for connection and ISP.
  - 2. Where no Local Area Network exists, EMCS supplier shall provide the following:
    - a. 8 Port Ethernet hub (3Com, or equal)
    - b. Ethernet router (Cisco or equal)
  - 3. The owner shall provide a connection to the Internet to enable this access via high-speed cable modem, asynchronous digital subscriber line (ADSL) modem, ISDN line or T1 Line. Owner agrees to pay monthly access charges for connection and ISP.

## 2.5 NETWORK AREA CONTROLLER (NAC)

- A. The Network Area Controller (NAC) shall provide the interface between the LAN or WAN and the field control devices and provide global supervisory control functions over the control devices connected to the NAC. It shall be capable of executing application control programs to provide:
  - 1. Calendar functions
  - 2. Scheduling
  - 3. Trending
  - 4. Alarm monitoring and routing
  - 5. Time synchronization
  - 6. Integration of Lon Works controller data
  - 7. Network Management functions for all Lon Works based devices



- B. The Network Area Controller must provide the following hardware features as a minimum:
1. One Ethernet Port -10 / 100 Mbps.
  2. One RS-232 port.
  3. One Lon Works Interface Port – 78KB FTT-10A.
  4. Battery Backup.
  5. Flash memory for long term data backup (If battery backup or flash memory is not supplied, the controller must contain a hard disk with at least 1 gigabyte storage capacity)
  6. The NAC must be capable of operation over a temperature range of 0 to 55°C.
  7. The NAC must be capable of withstanding storage temperatures of between 0 and 70°C.
  8. The NAC must be capable of operation over a humidity range of 5 to 95% RH, non-condensing.
- C. The NAC shall provide multiple user access to the system and support for ODBC or SQL. A database resident on the NAC shall be an ODBC-compliant database or must provide an ODBC data access mechanism to read and write data stored within it.
- D. The NAC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 16 simultaneous users.
- E. Event Alarm Notification and Actions
1. The NAC shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.
  2. The NAC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via dial-up, telephone connection, or wide-area network.
  3. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but limited to:
    - a. To alarm
    - b. Return to normal
    - c. To fault
  4. Provide for the creation of an unlimited number of alarm classes for the purpose of routing types and or classes of alarms, i.e.: security, HVAC, Fire, etc.
  5. Provide timed (schedule) routing of alarms by class, object, group, or node.
  6. Provide alarm generation from binary object “runtime” and /or event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.
- F. Control equipment and network failures shall be treated as alarms and annunciated.

- G. Alarms shall be annunciated in any of the following manners as defined by the user:
1. Screen message text
  2. Email of the complete alarm message to multiple recipients. Provide the ability to route and email alarms based on:
    - a. Day of week
    - b. Time of day
    - c. Recipient
  3. Pagers via paging services that initiate a page on receipt of email message
  4. Graphic with flashing alarm object(s)
  5. Printed message, routed directly to a dedicated alarm printer
- H. The following shall be recorded by the NAC for each alarm (at a minimum):
1. Time and date
  2. Location (building, floor, zone, office number, etc.)
  3. Equipment (air handler #, access way, etc.)
  4. Acknowledge time, date, and user who issued acknowledgement.
  5. Number of occurrences since last acknowledgement.
- I. Alarm actions may be initiated by user defined programmable objects created for that purpose.
- J. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.
- K. A log of all alarms shall be maintained by the NAC and/or a server (if configured in the system) and shall be available for review by the user.
- L. Provide a “query” feature to allow review of specific alarms by user-defined parameters.
- M. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.
- N. An Error Log to record invalid property changes or commands shall be provided and available for review by the user.

## 2.6 DATA COLLECTION AND STORAGE

- A. The NAC shall have the ability to collect data for any property of any object and store this data for future use.
- B. The data collection shall be performed by log objects, resident in the NAC that shall have, at a minimum, the following configurable properties:
1. Designating the log as interval or deviation.
  2. For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.

3. For deviation logs, the object shall be configured for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object.
  4. For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis.
  5. Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.
- C. All log data shall be stored in a relational database in the NAC and the data shall be accessed from a server (if the system is so configured) or a standard Web Browser.
- D. All log data, when accessed from a server, shall be capable of being manipulated using standard SQL statements.
- E. All log data shall be available to the user in the following data formats:
1. HTML
  2. XML
  3. Plain Text
  4. Comma or tab separated values
- F. Systems that do not provide log data in HTML and XML formats at a minimum shall not be acceptable.
- G. The NAC shall have the ability to archive its log data either locally (to itself), or remotely to a server or other NAC on the network. Provide the ability to configure the following archiving properties, at a minimum:
1. Archive on time of day.
  2. Archive on user-defined number of data stores in the log (buffer size).
  3. Archive when log has reached its user-defined capacity of data stores.
  4. Provide ability to clear logs once archived.

## 2.7 AUDIT LOG

- A. Provide and maintain an Audit Log that tracks all activities performed on the NAC. Provide the ability to specify a buffer size for the log and the ability to archive log based on time or when the log has reached its user-defined buffer size. Provide the ability to archive the log locally (to the NAC), to another NAC on the network, or to a server. For each log entry, provide the following data:
1. Time and date
  2. User ID
  3. Change or activity: i.e., Change setpoint, add or delete objects, commands, etc.

## 2.8 DATABASE BACKUP AND STORAGE

- A. The NAC shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time interval.
- B. Copies of the current database and, at the most recently saved database shall be stored in the NAC. The age of the most recently saved database is dependent on the user-defined database save interval.
- C. The NAC database shall be stored, at a minimum, in XML format to allow for user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is supported.

## 2.9 INTEROPERABLE DIGITAL CONTROLLER (IDC)

- A. Controls shall be microprocessor based Interoperable Lon Mark™ or Lon Works Controllers (IDC). Where possible, all Interoperable Digital Controllers shall bear the applicable Lon Mark™ interoperability logo on each product delivered.
- B. HVAC control shall be accomplished using Lon Mark™ based devices where the application has a Lon Mark profile defined. Where Lon Mark devices are not available for a particular application, devices based on Lon Works shall be acceptable. For each Lon Works device that does not have Lon Mark certification, the device supplier must provide an XIF file for the device. Publicly available specifications for the Applications Programming Interface (API) must be provided for each Lon Works / Lon Mark controller defining the programming or setup of each device. All programming, documentation and programming tools necessary to set up and configure the supplied devices per the specified sequences of operation shall be provided.
- C. The Lon Works network trunk shall be run to the nearest Network Area Controller (NAC). A maximum of 126 devices may occupy any one Lon Works trunk and must be installed in buss architecture using the appropriate trunk termination device. All Lon Works and Lon Mark devices must be supplied using FTT-10A Lon Works communications transceivers.
- D. The Network Area Controller will provide all scheduling, alarming, trending, and network management for the Lon Mark / Lon Works based devices.
- E. The IDCs shall communicate with the NAC at a baud rate of not less than 78.8K baud. The IDC shall provide LED indication of communication and controller performance to the technician, without cover removal.
- F. All IDCs shall be fully application programmable and shall at all times maintain their LONMARK certification. Controllers offering application selection only (non-programmable), require a 10% spare point capacity to be provided for all applications. All control sequences within or programmed into the IDC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.
- G. The supplier of any programmable IDC shall provide one copy of the manufacturer's programming tool, with documentation, to the owner.

## 2.10 FULL USER INTERFACE SOFTWARE (EXISTING)

- A. Operating System: The FUI shall run on Microsoft Windows NT Workstation 4.0, Service Pack 4 or later.
- B. The FUI shall employ browser-like functionality for ease of navigation. It shall include a tree view (similar to Windows Explorer) for quick viewing of, and access to, the hierarchical structure of the database. In addition, menu-pull downs, and toolbars shall employ buttons, commands and navigation to permit the operator to perform tasks with a minimum knowledge of the HVAC Control System and basic computing skills. These shall include, but are not limited to, forward/backward buttons, home button, and a context sensitive locator line (similar to a URL line), that displays the location and the selected object identification.
- C. Real-Time Displays. The FUI, shall at a minimum, support the following graphical features and functions:
  - 1. Graphic screens shall be developed using any drawing package capable of generating a GIF, BMP, or JPG file format. Use of proprietary graphic file formats shall not be acceptable. In addition to, or in lieu of a graphic background, the FUI shall support the use of scanned pictures.
  - 2. Graphic screens shall have the capability to contain objects for text, real-time values, animation, color spectrum objects, logs, graphs, HTML or XML document links, schedule objects, hyperlinks to other URL's, and links to other graphic screens.
  - 3. Graphics shall support layering and each graphic object shall be configurable for assignment to a layer. A minimum of six layers shall be supported.
  - 4. Modifying common application objects, such as schedules, calendars, and set points shall be accomplished in a graphical manner.
    - a. Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
    - b. Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.
  - 5. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
  - 6. Adjustments to analog objects, such as set points, shall be done by right-clicking the selected object and using a graphical slider to adjust the value. No entry of text shall be required.

- D. System Configuration. At a minimum, the FUI shall permit the operator to perform the following tasks, with proper password access:
1. Create, delete or modify control strategies.
  2. Add/delete objects to the system.
  3. Tune control loops through the adjustment of control loop parameters.
  4. Enable or disable control strategies.
  5. Generate hard copy records or control strategies on a printer.
  6. Select points to be alarmable and define the alarm state.
  7. Select points to be trended over a period of time and initiate the recording of values automatically.
- E. On-line Help. Provide a context sensitive, on-line help system to assist the operator in operation and editing of the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext. All system documentation and help files shall be in HTML format.
- F. On-line Documentation. Provide a context sensitive, on-line documentation system to assist the operator in operation and trouble-shooting of each integrated system. On-line help shall be available for all applications and shall provide the relevant data for that particular monitoring screen. As a minimum, provide a link to the Sequence of Operation, input/output summary, and cut sheets in either Adobe Acrobat™ or HTML format.
- G. Security. Each operator shall be required to log on to that system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system administrator shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the operators' access for viewing and/or changing each system application, full screen editor, and object. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected. This auto log-off time shall be set per operator password. All system security data shall be stored in an encrypted format.
- H. System Diagnostics. The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.
- I. Alarm Console
1. The system will be provided with a dedicated alarm window or console. This window will notify the operator of an alarm condition and allow the operator to view details of the alarm and acknowledge the alarm. The use of the Alarm Console can be enabled or disabled by the system administrator.
  2. When the Alarm Console is enabled, a separate alarm notification window will supersede all other windows on the desktop and shall not be capable of being minimized or closed by the operator. This window will notify the operator of new alarms and un-acknowledged alarms. Alarm notification windows or banners that can be minimized or closed by the operator shall not be acceptable.

## 2.11 BROWSER USER INTERFACE SOFTWARE (EXISTING)

- A. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer™ or Netscape Navigator™. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacture-specific browsers shall not be acceptable.
- B. The Web browser software shall run on any operating system and system configuration that is supported by the Web browser. Systems that require specific machine requirements in terms of processor speed, memory, etc., in order to allow the Web browser to function with the EMCS, shall not be acceptable.
- C. The Web browser shall provide the same view of the system, in terms of graphics, schedules, calendars, logs, etc., and provide the same interface methodology as is provided by the Full User Interface. Systems that require different views or that require different means of interacting with objects such as schedules, or logs, shall not be permitted.
- D. The Web browser client shall support at a minimum, the following functions:
  - 1. User log-on identification and password shall be required. If an unauthorized user attempts access, a blank web page shall be displayed. Security using Java authentication and encryption techniques to prevent unauthorized access shall be implemented.
  - 2. Graphical screens developed for the FUI shall be the same screens used for the Web browser client. Any animated graphical objects supported by the FUI shall be supported by the Web browser interface.
  - 3. HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page shall be allowed if the user desires a specific look or format.
  - 4. Storage of the graphical screens shall be in the Network Area Controller (NAC), without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client are not acceptable.
  - 5. Real-time values displayed on a Web page shall update automatically without requiring a manual “refresh” of the Web page.
  - 6. Users shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:
    - a. Modify common application objects, such as schedules, calendars, and set points in a graphical manner.
      - Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
      - Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.

- b. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
  - c. View logs and charts
  - d. View and acknowledge alarms
- 7. The system shall provide the capability to specify a user's (as determined by the log-on user identification) home page. Provide the ability to limit a specific user to a pre-defined home page. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.
- 8. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

## 2.12 SYSTEM PROGRAMMING

- A. The Full User Interface software (FUI) shall provide the ability to perform system programming and graphic display engineering as part of a complete software package. Access to the programming functions and features of the FUI shall be through password access as assigned by the system administrator.
- B. A library of control, application, and graphic objects shall be provided to enable the creation of all applications and user interface screens. Applications are to be created by selecting the desired control objects from the library, dragging or pasting them on the screen, and linking them together using a built in graphical connection tool. Completed applications may be stored in the library for future use. Graphical User Interface screens shall be created in the same fashion. Data for the user displays is obtained by graphically linking the user display objects to the application objects to provide "real-time" data updates. Any real-time data value or object property may be connected to display its current value on a user display. Systems requiring separate software tools or processes to create applications and user interface display shall not be acceptable.
- C. Programming Methods
  - 1. Provide the capability to copy objects from the supplied libraries, or from a user-defined library to the user's application. Objects shall be linked by a graphical linking scheme by dragging a link from one object to another. Object links will support one-to-one, many-to-one, or one-to-many relationships. Linked objects shall maintain their connections to other objects regardless of where they are positioned on the page and shall show link identification for links to objects on other pages for easy identification. Links will vary in color depending on the type of link; i.e., internal, external, hardware, etc.
  - 2. Configuration of each object will be done through the object's property sheet using fill-in the blank fields, list boxes, and selection buttons. Use of custom programming, scripting language, or a manufacturer-specific procedural language for configuration will not be accepted.



3. The software shall provide the ability to view the logic in a monitor mode. When on-line, the monitor mode shall provide the ability to view the logic in real time for easy diagnosis of the logic execution. When off-line (debug), the monitor mode shall allow the user to set values to inputs and monitor the logic for diagnosing execution before it is applied to the system.
4. All programming shall be done in real-time. Systems requiring the uploading, editing, and downloading of database objects shall not be allowed.
5. The system shall support object duplication within a customer's database. An application, once configured, can be copied and pasted for easy re-use and duplication. All links, other than to the hardware, shall be maintained during duplication.

## 2.13 OBJECT LIBRARIES

- A. A standard library of objects shall be included for development and setup of application logic, user interface displays, system services, and communication networks.
- B. The objects in this library shall be capable of being copied and pasted into the user's database and shall be organized according to their function. In addition, the user shall have the capability to group objects created in their application and store the new instances of these objects in a user-defined library.
- C. In addition to the standard libraries specified here, the supplier of the system shall maintain an on-line accessible (over the Internet) library, available to all registered users to provide new or updated objects and applications as they are developed.
- D. The object library shall include objects to support the integration of devices connected to the Network Area Controller (NAC). At a minimum, provide the following as part of the standard library included with the programming software:
  1. Lon Mark/Lon Works devices. These devices shall include, but not be limited to, devices for control of HVAC, lighting, access, and metering. Provide Lon Mark manufacturer-specific objects to facilitate simple integration of these devices. All network variables defined in the Lon Mark profile shall be supported. Information (type and function) regarding network variables not defined in the Lon Mark profile shall be provided by the device manufacturer.
  2. For devices not conforming to the Lon Mark standard, provide a dynamic object that can be assigned to the device based on network variable information provided by the device manufacturer. Device manufacturer shall provide an XIF file and documentation for the device to facilitate device integration.

## 2.14 LONWORKS NETWORK MANAGEMENT

- A. The Full User Interface software (FUI) shall provide a complete set of integrated Lon Works network management tools for working with Lon Works networks. These tools shall manage a database for all Lon Works devices by type and revision and shall provide a software mechanism for identifying each device on the network. These tools shall also be capable of defining network data connections between Lon Works devices, known as “binding”. Systems requiring the use of third party Lon Works network management tools shall not be accepted.
- B. Network management shall include the following services: device identification, device installation, device configuration, device diagnostics, device maintenance and network variable binding.
- C. The Network configuration tool shall also provide diagnostics to identify devices on the network, to reset devices, and to view health and status counters within devices.
- D. These tools shall provide the ability to “learn” an existing Lon Works network, regardless of what network management tool(s) were used to install the existing network, so that existing Lon Works devices and newly added devices are part of a single network management database.
- E. The network management database shall be resident in the Network Area Controller (NAC), ensuring that anyone with proper authorization has access to the network management database at all times. Systems employing network management databases that are not resident, at all times, and within the control system shall not be accepted.

## 2.15 OTHER CONTROL SYSTEM HARDWARE

- A. Motorized Control Dampers: Coordinate with the other trades for the exact quantity, size and location of all dampers. Dampers shall be black enamel finish or galvanized, with nylon bearings. Blade edge and tip seals shall be included for all dampers. Blades shall be 16-gauge minimum and 6 inches wide maximum and frame shall be of welded channel iron. Dampers with both dimensions less than 18 inches may have strap iron frames. Ruskin CD-46 or Equal.
- B. Control Damper and Valve Actuators: Coordinate with other trades for exact quantity, size and location of all dampers. Provide all dampers unless Two-position or proportional electric actuators shall be direct-mount type. All actuators shall be spring return type. Provide one actuator per damper minimum.
- C. Control Valves: Control valves shall be 2-way or 3-way pattern as shown constructed for tight shutoff and shall operate satisfactorily against system pressures and differentials. Two-position valves shall be ‘line’ size. Proportional control valves shall be sized for a maximum pressure drop of 5.0 psi at rated flow (except as may be noted on the drawings). Valves with sizes up to and including 2 inches shall be “screwed” configuration and 2-1/2 inch and larger valves shall be “flanged” configuration. Electrically controlled valves shall include spring return type actuators sized for tight shut-off against system pressures and furnished with integral switches for indication of valve position (open-closed). Three-way butterfly valves, when utilized, shall include a separate actuator for each butterfly segment.

- D. Wall Mount Room Thermostats: Each room thermostat shall provide temperature indication to the digital controller; provide the capability for a software-limited set point adjustment and operation override capability. An integral LCD shall annunciate current room temperature and set point as well as override status indication. In addition, the thermostat shall include a port for connection of the portable operator's terminal described elsewhere in this specification.
- E. Duct Mount, Pipe Mount and Outside Air Temperature Sensors: 10,000-ohm thermistor temperature sensors with an accuracy of  $\pm 0.2^{\circ}\text{C}$ . Outside air sensors shall include an integral sun shield.
- F. Current Sensitive Switches: Solid state, split core current switch that operates when the current level (sensed by the internal current transformer) exceeds the adjustable trip point. Current switch to include an integral LED for indication of trip condition and a current level below trip set point.
- G. Water Flow Meters (when required): Water flow meters shall be axial turbine style flow meters which translate liquid motion into electronic output signals proportional to the flow sensed. Flow sensing turbine rotors shall be non-metallic and not impaired by magnetic drag. Flow meters shall be 'insertion' type complete with 'hot-tap' isolation valves to enable sensor removal without water supply system shutdown. Accuracy shall be  $\pm 2\%$  of actual reading from 0.4 to 20 feet per second flow velocities.
- H. Temperature Control Panels: Furnish temperature control panels of code gauge steel with locking doors for mounting all devices as shown. Control panels shall meet all requirements of Title 24, California Administrative Code. All electrical devices within a control panel shall be factory wired. All external wiring shall be connected to terminal strips mounted within the panel. Provide engraved phenolic nameplates identifying all devices mounted on the face of control panels. A complete set of 'as-built' control drawings (relating to the controls within that panel) shall be furnished within each control panel.

## 2.16 INPUT DEVICES

- A. System accuracy of sensed conditions shall be as follows:
  - 1.  $\pm .5^{\circ}\text{F}$  for space temperature in the  $0\text{-}130^{\circ}\text{F}$  range
  - 2.  $\pm .5^{\circ}\text{F}$  for duct temperatures in the  $40\text{-}130^{\circ}\text{F}$  range
  - 3.  $\pm 1.0^{\circ}\text{F}$  for outside air temperatures in the  $(-30)\text{-}230^{\circ}\text{F}$  range
  - 4.  $\pm 1.0^{\circ}\text{F}$  for water temperatures in the  $30\text{-}230^{\circ}\text{F}$  range
  - 5.  $\pm .1$  inch for filter status differential over a  $0\text{-}2$  inch range
- B. The system shall maintain the specified analog end-to-end accuracy throughout the warranty period from sensor to controller readout.

- C. Packaging: Sensors (transducers) will be appropriately packaged for the location.
  - 1. Architectural housing for space mounting.
  - 2. Weatherproof/sunshield housing for outdoors.
  - 3. Thermal well housing for water applications.
  - 4. Protective housing for duct mounting.
  
- D. Environmental Ratings - The sensor/transducer shall be selected to withstand ambient conditions where:
  - 1. Moisture or condensation is a factor.
  - 2. Vibration exists from ductwork, equipment, etc.
  - 3. Reasonably expected transient conditions exist for temperatures, pressures, humidity's, etc. outside the normal sensing range.
  
- E. Temperature Sensors
  - 1. Temperature sensors will be by the use of thermistors (10K ohm at 77°F) or RTDs (PT100 curve).
  - 2. Sensors in the return or discharge duct shall be of the single point type. Sensors in the mixed air will be of the average type.
  - 3. Thermowells shall be brass or stainless steel for non-corrosive fluids below 250°F and 300 series stainless steel for all other applications.
  - 4. Room temperature sensors:
    - a. Sensing element only
  
- F. Digital Sensors
  - 1. All digital inputs will be provided by dry contacts. The contacts will be wired normally open or normally closed as required.
  - 2. Motor status (pumps, fans, etc.) shall be determined by current-operated switch.

## 2.17 OUTPUT DEVICES

- A. The use of multiplexers will not be accepted.
  
- B. Relays and Contactors
  - 1. All digital outputs will be electrically isolated from the digital controller by interface relays.
  - 2. Field relays shall have a minimum life of 1 million cycles without failure.
  - 3. Contactors shall have a minimum life of ten thousand cycles without failure.

## 2.18 ACTUATORS

- A. Standard manufacturer damper and valve actuators, proportional or two-position as required, sized to properly operate device. Damper actuators shall be of the direct coupled type, Belimo or equal.

## 2.19 WIRING AND CONDUIT

- A. Where different wiring classes terminate within the same enclosure, maintain clearances and install barriers per the National Electric Code.
- B. Where wiring is required to be installed in conduit, EMT shall be used. Conduit shall be minimum 1/2 inch galvanized EMT. Set screw fittings are acceptable for dry interior locations. Watertight compression fittings shall be used for exterior locations and interior locations subject to moisture. Provide conduit seal-off fitting where exterior conduits enter the building or between areas of high temperature/moisture differential.
- C. Flexible metallic conduit (max. 3 feet) shall be used for connections to motors, actuators, controllers, and sensors mounted on vibration producing equipment. Liquid-tight flexible conduit shall be use in exterior locations and interior locations subject to moisture.
- D. Junction boxes shall be provided at all cable splices, equipment terminations, and transitions from EMT to flexible conduit. Interior dry location J-boxes shall be galvanized pressed steel, nominal four-inch square with blank cover. Exterior and damp location JH-boxes shall be cast alloy FS boxes with threaded hubs and gasketed covers.
- E. Where the space above the ceiling is a supply or return air plenum, the wiring shall be plenum rated. Teflon wiring can be run without conduit above suspended ceilings. EXCEPTION: Any wire run in suspended ceilings that is used to control outside air dampers or to connect the system to the fire alarm system shall be in conduit.

## 2.20 ENCLOSURES

- A. All controllers and field interface panels shall be mounted in new enclosures unless otherwise stated in this specification.
- B. All outside mounted enclosures shall meet the NEMA-4 rating.
- C. Wiring within all enclosures shall be run in plastic track. Wiring within controllers shall be wrapped and secured.

## 2.21 CONTROL VALVES

- A. Control Valves: Factory fabricated, of type, body material, and pressure class indicated. Where type or body material is not indicated, make selection as determined by manufacturer for installation requirements and pressure class, based on maximum pressure and temperature rating of piping system.

B. Globe Pattern: As follows:

1. Up to 2 inches: Bronze body, bronze trim, rising stem, renewable composition disc, screwed ends with backseating capacity re-packable under pressure.
2. Over 2 inches: Iron body, bronze trim, rising stem, plug-type disc, flanged ends, renewable seat and disc.
3. Hydronic Systems: As follows:
  - a. Rating: Service at 125 psi WSP and 250°F.
  - b. Internal Construction: Replaceable plugs and seats of stainless steel or brass.
    - Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom of guided plugs.
    - Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom of guided plugs.
  - c. Sizing: 3-psi maximum pressure drop at design flow rate.
  - d. Flow Characteristics: 2-way valves have equal percentage characteristics; 3-way valves have linear characteristics. Select operators to close valves against pump shutoff head.

C. Terminal Unit Control Valves: Bronze body, bronze trim, 2 or 3 port as indicated, replaceable plugs and seats, union and threaded ends.

1. Rating: Service at 125 psi WSP and 250°F.
2. Sizing: 3-psi maximum pressure drop at design flow rate, to close against pump shutoff head.
3. Flow Characteristics: 2-way valves have equal percentage characteristics; 3-way valves have linear characteristics.
4. Operators (2 Position): Synchronous motor with enclosed gear train, dual-return springs, valve-position indicator. Valves spring return to normal position for temperature protection.
5. Operators (Modulating): Self-contained, linear motor, actuator with 60-second full travel, with transformer and single-throw, double-pole contacts.

## 2.22 DAMPERS

A. Dampers: AMCA-rated, parallel or opposed blade design; form frames from not less than 0.1084-inch galvanized steel with mounting holes for duct mounting; damper blades not less than 0.0635-inch galvanized steel, with maximum blade width of 8 inches.

1. Blades secured to 1/2-inch diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass. Ends sealed against spring-stainless-steel blade bearings. Thrust bearings at each end of every blade.

2. Operating Temperature Range: From -40 to 200°F.
3. For standard applications as indicated, (as selected by manufacturer's sizing techniques) with optional closed-cell neoprene edging.
4. Provide low-leakage parallel or opposed blade design (as selected by manufacturer's sizing techniques) with inflatable seal blade edging, or replaceable rubber seals, rated for leakage at less than 10 cfm/sq.ft. of damper area, at differential pressure of 4 inches wg when damper is being held by torque of 50 inch-pounds; test in accordance with AMCA 500. Ruskin CD-46 or equal.

## 2.23 ACTUATORS

- A. Electronic Actuators: The actuator shall be direct coupled over the shaft, enabling it to be mounted directly to the damper shaft without the need for connecting linkage. The actuator shall have electronic overload circuitry to prevent damage. For power-failure/safety applications, an internal mechanical, spring return mechanism shall be built into the actuator housing. Non-spring return actuators shall have an external manual gear release to allow positioning of the damper when the actuator is not powered.
- B. All valves shall be fully proportioning, unless otherwise specified, quiet in operation, and shall be arranged to fail safe, in either a normally open or normally closed position, in the event of power failure. The open or closed position shall be as specified or as required to suit job conditions. All valves shall be capable of operating at varying rates of speed to correspond to the exact dictates of the controller and variable load requirements.
- C. Where valves operate in sequence with other valves or damper operators, provide on each valve a pilot positioner to provide adjustable operating ranges and starting points and positive close off at the required control signal pressure. Positioners must be directly connected to the valve stem. Ratio relays are not acceptable.
- D. Valves shall be sized by the Temperature Control Manufacturer and guaranteed to meet the heating or requirements as specified and indicated on the Drawings. Unless otherwise specified, all shall conform to the requirements herein specified for the piping system in which they are installed.

## 2.24 CENTRAL CONTROL PANEL

- A. Integrate new controls into existing central control touch screen panel. This central panel will allow for time clock scheduling, setpoints, monitoring of points and alarm. All freezestats will be reset manually at the central panel. All alarms will be displayed and reset manually at central panel.
- B. All exhaust fans shall be controlled by the central control panel.
- C. Central control panel shall be connected to existing District IT Network. District shall provide data drop.

## 2.25 AUXILIARY EQUIPMENT/DEVICES

### A. Analog Sensors

1. Duct sensors (greater than four square feet): Monitoring range to suit application. Platinum or nickel wound RTD Type + 0.1% of range. Factory calibration point – 70 Deg. F at 1000 OHMS.
2. Space Temperature Sensors: Space Temperature Sensors shall be 5,000 or 10,000 ohm thermistor with wall plate adapter and blank cover assembly. The sensor shall include an integral occupancy override button and shall also include a RJ11 communications port. Space Temperature Sensors shall include space temperature adjustment slides where shown on the plans. The Space Temperature Sensors shall be mounted approximately 60" above the floor.
3. Hydronic Well Temperature Sensors: Water Temperature Sensors shall be well mounted 5,000 or 10,000 ohm thermistors.
4. Status Indication- Status indication for fans and pumps shall be provided by a current sensing sensor. The sensor shall be installed at the motor starter or motor to provide load indication. The unit shall consist of a current transformer, a solid state current sensing circuit (with adjustable set point) and a solid state switch. A red light emitting diode (LED) shall indicate the on off status of the unit. The switch shall provide a N.O. contact for wiring back to the Field Installed Controller.
5. Combination CO<sub>2</sub> and Space Temperature Sensors: CO<sub>2</sub> and space sensors are comprised of two sensors housed in one unit designed to measure both CO<sub>2</sub> in the air and the building air temperature. Combination sensor shall have the following features:
  - a. Self-Calibration CO<sub>2</sub> sensor with 5 year calibration interval.
  - b. Push button over ride.
  - c. CO<sub>2</sub> sensitivity +/- 20 ppm.
  - d. CO<sub>2</sub> accuracy +/- 100 ppm.
  - e. Space sensor: 5 or 10K thermistor.

## 2.26 DDC SENSORS AND POINT HARDWARE

### A. Temperature Sensors

1. All temperature devices shall use precision thermistors accurate to +/- 1 degree F over a range of –30 to 230 degrees F. Space temperature sensors shall be accurate to +/- .5 degrees F over a range of 40 to 100 degrees F.
2. Standard space sensors shall be available in an off white enclosure for mounting on a standard electrical box.
3. Where manual overrides are required, the sensor housing shall feature both an optional sliding mechanism for adjusting the space temperature setpoint, as well as a push button for selecting after hours operation.
4. Where a local display is specified, the sensor shall incorporate either an LED or LCD display for viewing the space temperature, setpoint and other operator selectable parameters. Using built in buttons; operators shall be able to adjust setpoints directly from the sensor.



5. Duct temperature sensors shall incorporate a thermistor bead embedded at the tip of a stainless steel tube. Probe style duct sensors are useable in air handling applications where the coil or duct area is less than 14 square feet.
6. Averaging sensors shall be employed in ducts, which are larger than 14 square feet. The averaging sensor tube must contain at least one thermistor for every 3 feet, with a minimum tube length of 12 feet.
7. Immersion sensors shall be employed for measurement of temperature in all chilled and hot water applications as well as refrigerant applications. Thermal wells shall be brass or stainless steel for non-corrosive fluids below 250 degrees F. and 300 series stainless steel for all other applications.
8. A pneumatic signal shall not be allowed for sensing temperature.

B. Humidity Sensors

1. Humidity devices shall be accurate to +/- 5% at full scale for space and +/- 3% for duct and outside air applications. Suppliers shall be able to demonstrate that accuracy is NIST traceable.
2. Provide a hand held field calibration tool that both reads the output of the sensor and contains a reference sensor for ongoing calibration.

C. Pressure Sensors

1. Air pressure measurements in the range of 0 to 10" water column will be accurate to +/- 1% using a solid-state sensing element. Acceptable manufacturers include Modus Instruments and Mamac.
2. Differential pressure measurements of liquids or gases shall be accurate to +/- 0.5% of range. The housing shall be NEMA 4 rated.

D. Current and KW Sensors

1. Current status switches shall be used to monitor fans, pumps, motors and electrical loads. Current switches shall be available in solid and split core models and offer either a digital or an analog signal to the automation system. Acceptable manufacturer is Veris or approved equal.
2. Measurement of three-phase power shall be accomplished with a kW/kWH transducer. This device shall utilize direct current transformer inputs to calculate the instantaneous value (kW) and a pulsed output proportional to the energy usage (kWH). Provide Veris Model 6000 Power Transducer or approved equal.

E. Flow Sensors

1. Provide an insertion vortex flow meter for measurement of liquid or gas flows in pipe sizes above 3 inches.
2. Install the flow meter on an isolation valve to permit removal without process shutdown.
3. Sensors shall be manufactured by EMCO or approved equal.

F. Carbon Dioxide Sensors

1. Non-Dispersive Infrared (NDIR), 0-2000 PPM.
2. Power Requirement, 18-30 VDC.
3. Voltage output, 0-10- VDC Full Scale.
4. Current output, 4-20 Ma.

2.27 AIRFLOW MEASURING STATIONS

- A. Provide a thermal anemometer using instrument grade self-heated thermistor sensors with thermistor temperature sensors. The flow station shall operate over a range of 0 to 5,000 feet/min with an accuracy of +/- 2% over 500 feet/min and +/- 10 ft/min for reading less than 500 feet/min.
- B. The output signal shall be linear with field selectable ranges including 0-5 VDC, 0-10VDC and 4-20 mA.
- C. Furnish Ebtron Series 3000 airflow stations or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

- A. All DDC Controllers shall be networked to Central Communications controller.
- B. Existing Front End Workstation in B & G office shall be configured for High School Addition access. Text/Graphic screens for each system shall match existing.
- C. Communications cabling shall be run in hallways above hung ceiling with plenum cable and wiremold where exposed.

3.2 CONTRACTOR RESPONSIBILITIES

- A. General: The Contractor or a Sub-Contractor shall perform installation of the building automation system. However, all installations shall be under the personal supervision of the Contractor. The Contractor shall certify all work as proper and complete.
- B. Demolition: Remove controls, which do not remain as part of the building automation system, all associated abandoned wiring and conduit and all associated pneumatic tubing. The Owner will inform the Contractor of any equipment, which is to be removed, that will remain the property of the Owner. The Contractor will dispose of all other equipment that is removed.
- C. Access to Site: Unless notified otherwise, entrance to building is restricted. No one will be permitted to enter the building unless their names have been cleared with the Owner or the Owner's representative.

- D. Code Compliance: All wiring shall be installed in accordance with all applicable electrical codes and will comply with equipment manufacturer's recommendations. Should any discrepancy be found between wiring Specifications in Division 26 and Division 22, wiring requirements of Division 26 will prevail for work specified in Division 26.
- E. Cleanup: At the completion of the work, all equipment pertinent to this Contract shall be checked and thoroughly cleaned, and all other areas shall be cleaned around equipment provided under this Contract. Clean the exposed surfaces of tubing, hangers, and other exposed metal of grease, plaster, or other foreign materials.

### 3.3 WIRING, CONDUIT, TUBING AND CABLE

- A. All wire will be copper and meet the minimum wire size and insulation class listed below:

| <b><u>Wire Class</u></b> | <b><u>Wire Size</u></b> | <b><u>Isolation Class</u></b> |
|--------------------------|-------------------------|-------------------------------|
| Power                    | 12 Gauge                | 600 Volt                      |
| Class One                | 14 Gauge Std.           | 600 Volt                      |
| Class Two                | 18 Gauge Std.           | 300 Volt                      |
| Class Three              | 18 Gauge Std.           | 300 volt                      |
| Communications           | Per Mfr.                | Per Mfr.                      |

- B. Power and Class One wiring may be run in the same conduit. Class Two and Three wiring and communications wiring may be run in the same conduit.
- C. Where different wiring classes terminate within the same enclosure, maintain clearances and install barriers per the National Electric Code.
- D. Where wiring is required to be installed in conduit, EMT shall be used. Conduit shall be minimum 1/2 inch galvanized EMT. Setscrew fittings are acceptable for dry interior locations. Watertight compression fittings shall be used for exterior locations and interior locations subject to moisture. Provide conduit seal off fitting where exterior conduits enter the building or between areas of high temperature/moisture differential.
- E. Flexible metallic conduit (max. 3 feet) shall be used for connections to motors, actuators, controllers, and sensors mounted on vibration producing equipment. Liquid-tight flexible conduit shall be use in exterior locations and interior locations subject to moisture.
- F. Junction boxes shall be provided at all cable splices, equipment termination, and transitions from EMT to flexible conduit. Interior dry location J-boxes shall be galvanized pressed steel, nominal four-inch square with blank cover. Exterior and damp location JH-boxes shall be cast alloy FS boxes with threaded hubs and gasket covers.
- G. Where the space above the ceiling is a supply or return air plenum, the wiring shall be plenum rated. Teflon wiring can be run without conduit above suspended ceilings. EXCEPTION: Any wire run in suspended ceilings that is used to control outside air dampers or to connect the system to the fire management system shall be in conduit.
- H. Coaxial cable shall conform to RG62 or RG59 rating. Provide plenum rated coaxial cable when running in return air plenums.

### 3.4 HARDWARE INSTALLATION

#### A. Installation Practices for Wiring and Tubing

1. All controllers are to be mounted vertically and per the manufacturer's installation documentation.
2. The 120 VAC power wiring to each Ethernet or Remote Site controller shall be a dedicated run, with a separate breaker. Each run will include a separate hot, neutral and ground wire. The ground wire will terminate at the breaker panel ground. This circuit will not feed any other circuit or device.
3. A true earth ground must be available in the building. Do not use a corroded or galvanized pipe, or structural steel.
4. Wires are to be attached to the building proper at regular intervals such that wiring does not drop. Wires are not to be affixed to or supported by pipes, conduit, etc.
5. Wiring in finished areas will be concealed in ceiling cavity spaces, plenums, and furred spaces and wall construction. Exception; metallic surface raceway may be used in finished areas on masonry walls. All surface raceway in finished areas must be color matched to the existing finish within the limitations of standard manufactured colors.
6. Wiring, in non-finished areas where possible, will be concealed in ceiling cavity spaces, plenums, furred spaces, and wall construction. Exposed conduit will run parallel to or at right angles to the building structure.
7. Wires are to be kept a minimum of three (3) inches from hot water or condense piping.
8. Where sensor wires leave the conduit system, they are to be protected by a plastic insert.

#### B. Installation Practices for Field Devices

1. Well-mounted sensors will include thermal conducting compound within the well to insure good heat transfer to the sensor.
2. Actuators will be firmly mounted to give positive movement and linkage will be adjusted to give smooth continuous movement throughout 100 percent of the stroke.
3. Relay outputs will include transient suppression across all coils. Suppression devices shall limit transients to 150% of the rated coil voltage.
4. Water line mounted sensors shall be removable without shutting down the system in which they are installed.
5. For duct static pressure sensors, the high-pressure port shall be connected to a metal static pressure probe inserted into the duct pointing upstream. The low-pressure port shall be left open to the plenum area at the point that the high-pressure port is tapped into the ductwork.
6. For building static pressure sensors, the high-pressure port shall be inserted into the space via a metal tube. Pipe the low-pressure port to the outside of the building.

### C. Enclosures

1. For all I/O requiring field interface devices, these devices, where practical, will be mounted in a field interface panel (FIP). The Contractor shall provide an enclosure, which protects the device(s) from dust, moisture, conceals integral wiring and moving parts.
2. FIP's shall contain power supplies for sensors, interface relays and Contractors, safety circuits, and I/P transducers.
3. The FIP enclosure shall be of steel construction with baked enamel finish; NEMA 1 rated with a hinged door and keyed lock. The enclosure will be sized for 20% spare mounting space. All locks will be keyed identically.
4. All wiring to and from the FIP will be to screw type terminals. Analog or communications wiring may use the FIP as a raceway without terminating. The use of wire nuts within the FIP is prohibited.
5. All outside mounted enclosures shall meet the NEMA-4 rating.
6. The wiring within all enclosures shall be run in plastic track. Wiring within controllers shall be wrapped and secured.

### D. Identification

1. Identify all control wires with labeling tape or sleeves using either words, letters, or numbers that can be exactly cross-referenced with As-Built Drawings.
2. All field enclosures, other than controllers, shall be identified with a Bakelite nameplate. The lettering shall be in white against a black or blue background.
3. Junction box covers will be marked to indicate that they are a part of the BAS system.
4. All I/O field devices (except space sensors) that are not mounted within FIP's shall be identified with nameplates.
5. All I/O field devices inside FIP's shall be labeled.

### E. Control System Switch-Over

1. Demolition of the existing control system will occur after the new temperature control system is in place including new sensors and new field interface devices.
2. Switch over from the existing control system to the new system will be fully coordinated with the Owner. A representative of the Owner will be on site during switch over.
3. The Contractor shall minimize control system downtime during switch over. Sufficient installation mechanics will be on site so that the entire switch over can be accomplished in a reasonable time frame.

### F. Location

1. The location of sensors is per Mechanical and Architectural Drawings.
2. Outdoor air sensors will be mounted on the north building face directly in the outside air. Install these sensors such that the effects of heat radiated from the building or sunlight is minimized.
3. Field enclosures shall be located immediately adjacent to the controller panel(s) to which it is being interfaced.

### 3.5 SOFTWARE INSTALLATION

- A. General: The Contractor shall provide all labor necessary to install, initialize, start-up and debug all system software as described in this section. This includes any operating system software or other third party software necessary for successful operation of the system.
- B. Database Configuration: The Contractor will provide all labor to configure those portions of the database that are required by the points list and sequence of operation.
- C. Color Graphic Slides: Unless otherwise directed by the Owner, the Contractor will provide color graphic displays as depicted in the Mechanical Drawings for each system and floor plan. For each system or floor plan, the display shall contain the associated points identified in the point list and allow for set point changes as required by the Owner.
- D. Reports - The Contractor will configure a minimum of 6 reports for the Owner as listed below:
  - 1. Central Plant Status Report
  - 2. Air Handler Status Report
  - 3. Energy Consumption Report
  - 4. Space Temperature Report
  - 5. Specialty Equipment Status Report
- E. Documentation - As-Built software documentation will include the following:
  - 1. Descriptive point lists
  - 2. Application program listing
  - 3. Application programs with comments
  - 4. Printouts of all reports
  - 5. Alarm list
  - 6. Printouts of all graphics

### 3.6 COMMISSIONING AND SYSTEM STARTUP

- A. Point-to-Point Checkout: Each I/O device (both field mounted as well as those located in FIP's) shall be inspected and verified for proper installation and functionality. A checkout sheet itemizing each device shall be filled out, dated and approved by the Project Manager for submission to the Owner or Owner's representative.
- B. Controller and Workstation Checkout: A field checkout of all controllers and miscellaneous equipment shall be conducted to verify proper operation of both hardware and software. A checkout sheet itemizing each device and a description of the associated tests shall be prepared and submitted to the Owner or Owner's representative by the completion of the project.
- C. System Acceptance Testing
  - 1. All application software will be verified and compared against the sequences of operation. Control loops will be exercised by inducing a setpoint shift of at least 10% and observing whether the system successfully returns the process variable to setpoint. Record all test results and attach to the Test Results Sheet.

2. Test each alarm in the system and validate that the system generates the appropriate alarm message, that the message appears at all prescribed destinations (workstations or printers), and that any other related actions occur as defined (i.e. graphic panels are invoked, reports are generated, etc.). Submit a Test Results Sheet to the Owner.
3. Perform an operational test of each unique graphic display and report to verify that the item exists, that the appearance and content are correct, and that any special features work as intended. Submit a Test Results Sheet to the Owner.
4. Perform an operational test of each third party interface that has been included as part of the automation system. Verify that all points are properly polled, that alarms have been configured, and that any associated graphics and reports have been completed. If the interface involves a file transfer over Ethernet, test any logic that controls the transmission of the file, and verify the content of the specified information.

### 3.7 SEQUENCES OF OPERATION

#### A. Rooftop Ventilation/Energy Recovery Units

1. Point List
  - a. Supply Fan VFD (Speed and Status)
  - b. Exhaust Fan VFD (Speed and Status)
  - c. Energy Recovery Wheel VFD (Speed and Status)
  - d. Space Temperature
  - e. Space Temperature Setpoint(s)
  - f. OA, EA Temperatures
  - g. Heating Coil Valve(s) Modulation (Remote)
  - h. OA, EA Damper Modulation
  - i. Freeze-stat
  - j. Discharge Temperature
  - k. DX Cooling Start/Stop/Status
  - l. Any Existing Control Points
  - m. Economizer Status
2. Sequence of Operation
  - a. Unoccupied: In this mode:  
Supply and Exhaust fans off, OA and EA dampers closed. If the respective unoccupied space temperature is not maintained by the convectors, the rooftop ventilation unit shall cycle on. The respective heating coil valve shall modulate to satisfy the space heating setpoint. Upon satisfaction, the rooftop unit shall stop until the next cycle, if required.
  - b. Occupied: The OA and EA dampers will open
    - Supply fan will start and ramp up slowly to its' preset speed via VFD. The return fan will follow and track the supply fan as needed.
    - Direct expansion cooling system shall operate as needed to maintain occupied cooling setpoint (adjustable).
    - steam valve will modulate as needed to maintain occupied heating setpoint (adjustable).

- An adjustable dead band offset will prevent short cycling.
- Note: the energy recovery wheel will be on when the unit is on and rotate as needed to maintain exhaust air temperature. Energy wheel freeze protection is integral to the unit.
- Minimum outdoor air shall be as scheduled on drawings.

c. Alarms: In this mode:

- The freezestat mounted after the steam coil will protect the coils from freezing. Should the freezestat go into alarm the supply and return fans will shut off. The OA and EF, dampers will be closed. The OA and EA bypass dampers will be closed. The RA damper shall be open. The hot water coil valve will be open. An alarm will be generated at the operators workstation. Note: The freezestat will be able to be reset from the operator's workstation.
- Should the command not equal the status within 90 seconds from start-up an alarm will be generated at the operator's workstation.
- Should any temperature fall outside of its preset limits (high/low) an alarm will be generated at the operator's workstation.

d. Demand Control Ventilation:

- Ventilation method shall be by demand controls. There shall be no provision to remove CO2 by any other method other than dilution. Prior to space occupancy, a pre-occupancy purge cycle shall be initiated for a minimum 30 minutes. For this purge, fan shall start and run and the outdoor air intake rate shall ramp up to 100 percent of design outdoor air. During occupancy, the outdoor air supply shall start to increase beyond the minimum ventilation setpoint (500 cfm), starting at an interior CO2 concentration of not greater than 100 PPM over that of the outdoor air concentration. The outdoor air supply shall continue to ramp up for full occupancy as CO2 concentrations rise to the upper limit of 1400 PPM over that of the outdoor air.
- Upon conclusion of occupancy, a post occupancy flush cycle shall occur. The fan shall run and the outdoor air intake rate shall ramp up to 100 percent of design outdoor air until indoor CO2 concentrations in the space are reduced to outdoor air levels. After the post occupancy flush cycle has completed, the rooftop unit shall revert to minimum outdoor air ventilation setpoint (500 cfm). This minimum setpoint shall be satisfied whenever the system is in operation. The relief exhaust fan speed shall follow the outdoor air intake rate under all occupancies and conditions to maintain proper relief air. The economizer system shall override the CO2 control system when conditions permit free cooling of the space.

e. Economizer - In this mode:

- If the outside air temperature is greater than the space air temperature, the system will operate as described in the occupied mode.



- If the outside air temperature is less than the space air temperature and the outside air temperature is greater than 50 Degrees F. (adjustable), the ERU mechanical cooling shall stop and the economizer mode shall be enabled.

#### B. Exhaust Fans

1. Point List
  - a. Fans Start/Stop
  - b. Fans Status
2. Sequence of Operation
  - a. Unoccupied Mode: Fans Off, Dampers Closed.
  - b. Occupied Mode: Fans On, Dampers Open.
  - c. Alarms generated at Operator's Workstation: Exhaust Fan Status.

#### C. VRF System Heat Recovery Units

1. Point List
  - a. Space Temperature
  - b. Occupied/Unoccupied
2. Sequence of Operation
  - a. Ductless heat pumps shall be equipped with remote mounted hard-wired thermostat. Heat Pump unit shall cycle to maintain zone heating and cooling temperature set point (adjustable). Integral or field mounted condensate pump shall be integrally wired to shut down heat-pump unit on condensate overflow.

#### D. Packaged Rooftop HVAC Unit

1. Point List
  - a. Space Temperature.
  - b. Discharge Air Temperature.
  - c. Fans Start/Stop.
  - d. Occupied/Unoccupied.
  - e. Gas Valve Modulation.
  - f. Supply Fan VFD Status.
  - g. Filter Dirty.
  - h. D/X Cooling.
  - i. Outside Air Intake and Exhaust Dampers.

## 2. Sequence of Operation

a. Unoccupied: In this mode - Supply fan off, OA dampers closed.

b. Occupied: The OA dampers will open:

- Supply fan will start and ramp up slowly to its' preset speed via VFD.
- Perimeter radiation will be the first stage of heating and operate as needed to maintain the space temperature setpoint (adj.). Should additional heating be required the HVAC unit will stage the gas heating to maintain the heating setpoint (adjustable).
- Direct expansion cooling system shall operate as needed to maintain occupied cooling setpoint (adjustable).
- Gas heating will modulate as needed to maintain occupied heating setpoint (adjustable).
- An adjustable dead band offset will prevent short cycling.

c. Economizer Mode: In this mode:

- If the outside air temperature is greater than the room air temperature, the system will operate as described in the occupied mode.
- If the outside air temperature is less than the room air temperature and the outside air temperature is greater than 50°F (adjustable), the OA will be the first stage of Cooling.
- Should additional cooling be required the mechanical D/X cooling will modulate as needed.

d. Alarms: In this mode:

- Should the command not equal the status within 90 seconds from start-up, an alarm will be generated.
- Should any temperature fall outside of its preset limits (high/low) an alarm will be generated.

e. Ventilation Control

- Outdoor air ventilation shall be controlled by carbon dioxide sensors. Ventilation rate shall vary from minimum 700 cfm to maximum 5550 cfm at full occupancy of 370 people.
- The rooftop RTU exhaust fan shall follow the outdoor air intake rate from minimum outdoor air, up to 5550 cfm through its self-contained variable speed control, and utilize the energy recovery module, when not in economizer mode. When in economizer mode, the exhaust fan shall ramp up to 100 percent to match outdoor air intake and shall bypass the energy recovery heat exchanger.

f. Demand Control Ventilation:

- Ventilation method shall be by demand controls. There shall be no provision to remove CO<sub>2</sub> by any other method other than dilution. Prior to space occupancy, a pre-occupancy purge cycle shall be initiated for a minimum 30 minutes. Fans shall start and run, and the outdoor air intake rate shall ramp up to 100 percent of full occupant load OA ventilation rate of unit capacity. Upon conclusion of space occupancy, a post occupancy flush cycle shall occur. The fans shall run, and the outdoor air intake rate shall ramp up to 100 percent of the unit capacity until indoor CO<sub>2</sub> concentrations in the space are reduced to outdoor air levels. Upon such occurrence, the fans shall shutdown. During occupancy, the outdoor air damper shall start to modulate open beyond the minimum set point (20% of the full occupant load OA ventilation Rate), starting at an interior CO<sub>2</sub> concentration of not greater than 100 PPM over that of the outdoor air concentration. The outdoor air damper shall be open for full occupancy when CO<sub>2</sub> concentrations reach the upper limit of 1400 PPM over that of the outdoor air. The economizer system shall override the CO<sub>2</sub> control system when conditions permit free cooling of the space.

E. Steam Boiler Conversion with Associated Pumps and Appurtenances

1. Point List

- a. Outdoor Air Temperature
- b. Outdoor Relative Humidity
- c. HW Supply Temperature
- d. HW Return Temperature
- e. HW Pumps HWP-1&2 Start/Stop (Primary)
- f. HW Pump HWP-3,4,5,6,10,11 Start/Stop (Secondary)
- g. HW Flow Status (2)
- h. Boiler Start/Stop (2)
- i. Boiler Auto Signal (2)
- j. Boiler Trouble Signal (2)
- k. Boiler Flame Modulation (2)
- l. Automatic Isolation Valves CV-1,2,3,4,5

2. Sequence of Operation

- a. Converted steam to hot water boiler shall operate when condensing hot water boilers cannot maintain hot water set point temperatures (adjustable). When converted boiler is activated condensing boilers shall be deactivated with associated automatic isolation valves CV-1,2,3,4,5 shall modulate to open/closed positions to isolate associated boilers. Converted boiler will be optimized on for occupied schedule when outside air temperature is below 60 degrees (adjustable), and average room temperature is below 70 degrees (adjustable). Converted boiler will be off during unoccupied schedule unless outside air temperature drops below 38 degrees (adjustable). Whenever outside air is below 38 degrees, boiler will sequence on to maintain desired water temperature (adjustable).

- b. The boiler start/stop and firing rate will be controlled by the stand-alone direct digital controller mounted in the new hot water system programmable local control panel. Boiler monitoring and alarming will be done at the central panel touch screen. The three-way control valves will modulate through DDC system **to schedule the hot water supply temperature based on outside air temperature schedule (adjustable)**. Three-way valves shall be sized for proper flow control without hunting. Three-way valve modulation shall be arranged to limit cold water return temperature of 120 degrees F to the boiler during warm-up mode to prevent thermal shock to the boilers. Valve shall always allow minimum 10 percent flow in main header for proper header temperature sensing.
- c. Hot water circulating pump shall be energized when outside air temperature is below 60 degrees (adjustable). Should a pump fail to start its standby pump shall be energized and an alarm sent to the central control panel. Boiler water blend pump shall be hardwired and interlocked with hot water circulating pump operation.

#### F. Condensing Boiler with Associated Pumps and Appurtenances

##### 1. Point List

- a. Outdoor Air Temperature
- b. Outdoor Relative Humidity
- c. HW Supply Temperature
- d. HW Return Temperature
- e. HW Pumps HWP-1&2 Start/Stop (Primary)
- f. HW Pump HWP-3,4,5,6,10,11 Start/Stop (Secondary)
- g. Boiler Pumps HWP-7,8,9 Start/Stop
- h. HW Flow Status (2)
- i. Boiler Start/Stop (3)
- j. Boiler Auto Signal (3)
- k. Boiler Trouble Signal (3)
- l. Boiler Flame Modulation (3)
- m. Automatic Isolation Valves CV-1,2,3,4,5

##### 2. Sequence of Operation

- a. Condensing Boilers shall be primary source of hot water heat distribution. Converted steam to hot water boiler shall secondary source of hot water heat distribution. When condensing hot water boilers cannot maintain hot water set point temperatures (adjustable) they shall be deactivated and converted boiler shall be activated. Associated automatic isolation valves CV-1,2,3,4,5 shall modulate to open/closed positions to isolate associated boiler systems. Condensing Boilers will be optimized on for occupied schedule when outside air temperature is below 60 degrees (adjustable) and average room temperature is below 70 degrees (adjustable). Boilers will be off during unoccupied schedule unless outside air temperature drops below 38 degrees (adjustable). Whenever outside air is below 38 degrees, boilers will sequence on to maintain desired water temperature (adjustable).

- b. The boiler start/stop and firing rate will be controlled by the stand-alone direct digital controller mounted in the new hot water system programmable local control panel. Boiler monitoring and alarming will be done at the central panel touch screen. The three way control valves will modulate through DDC system to schedule the hot water supply through outside air sensor. Three-way valves shall be sized for proper flow control without hunting. Three-way valve modulation shall be arranged to limit cold water return to the boiler during warm-up mode to prevent thermal shock to the boilers.
- c. Hot water circulating pumps shall be energized when outside air temperature is below 60 degrees (adjustable). Should a pump fail to start its standby pump shall be energized and an alarm sent to the central control panel. Boiler water blend pump shall be hardwired and interlocked with hot water circulating pump operation.

#### G. Hot Water Heating Pumps

- 1. Point List
  - a. Pump Start/Stop
  - b. Pump Status
- 2. Sequence of Operation
  - a. Occupied Mode: Pump shall start when the outdoor air temperature drops below 60 ° F. (adjustable).
  - b. Unoccupied Mode: Pump shall start when the outdoor air temperature drops below 40 ° F. (adjustable).
  - c. Lead / Lag: When the system calls for heat, the lead pump shall start, if the pump current sensor, does not sense proper current within 4 minutes, the lead pump shall shutdown and the lag pump shall become lead.

#### H. Hot Water Unit Ventilators

- 1. Point List
  - a. Space Temperature
  - b. Space Temperature Setpoint
  - c. Discharge Air Temperature
  - d. Freezestat Status
  - e. Fan Start/Stop
  - f. OA/RA Damper Modulation
  - g. Face and Bypass Damper Modulation
  - h. Radiation Valve Modulation
  - i. End of Cycle Valve Open/Close

## 2. Sequence of Operation

- a. Unoccupied Mode: Un-occupied setpoint temperature is 60 degrees F (adjustable). The end of cycle valve shall be open, outside air damper shall be closed, the return damper shall be open and the F&B damper shall be in full face position. The radiation valve shall modulate to maintain night setback setpoint. Should the radiation alone fail to maintain the setpoint, the unit fan shall be energized.
- b. Occupied Mode: Unit fan shall run continuously. Occupied setpoint temperature is 68 degrees F (adjustable). During morning warm-up mode (room temperature more than 2 degrees below daytime setpoint), outside air damper shall be closed. As room temperature rises, outside air damper shall modulate to minimum position. **Note: Morning warm-up shall be scheduled to occur prior to space occupancy.** Should room temperature continue to rise past setpoint, radiation valve shall modulate closed, F&B damper shall modulate to full bypass, end of cycle valve shall close and then outside air damper shall modulate further open to provide free cooling (based on differential enthalpy). As room temperature decreases the reverse shall occur. A freezestat shall stop fan, close outside air damper, place F&B damper in full bypass position and open the end of cycle valve.

## I. Condensing Units

### 1. Point List

- a. System Enabled/Disabled
- b. System Status
- c. Space Temperature

### 2. Sequence of Operation

- a. Unoccupied Mode: System Disabled.
- b. Occupied Mode: System Enabled.
- c. System shall operate in accordance with its own packaged controls.
- d. Alarms generated at Operators Workstation: Space temp out of Bounds +/- 5 F.

## J. Indoor Energy Recovery Unit

### 1. Point List

- a. Supply Fan Status
- b. Exhaust Fan Status
- c. OA, EA, Air Temperatures
- d. OA, EA, Damper
- e. Discharge Temperature
- f. Condensing Unit Status

## 2. Sequence of Operation

- a. Unoccupied - In this mode:  
Supply and Exhaust fans off, OA and EA dampers closed, Perimeter Radiation heat shall be first stage of heat to the space. If additional heat is required, the respective energy recovery unit shall start and run to maintain the night setback temperature (60°F). The hot water coil control valve shall modulate as required.
- b. Occupied - In this mode:
  - The OA and EA dampers will open and thru a hard wired interlock the Supply and Exhaust fans will start.
  - Energy transfer will be both sensible and latent energy between air streams. Latent energy transfer media transfer will be accomplished by direct water vapor transfer from one air stream to the other, without exposing transfer media in succeeding cycles directly to the exhaust air and then to the fresh air.
  - In heating mode, the hot water coil control valve shall modulate as required to maintain occupied heating discharge setpoint (72°F adjustable) as sensed by the remote temperature sensor.
  - An adjustable dead band offset will prevent short cycling.
  - In cooling mode, the respective DX coil and associated condensing unit shall stage its capacity as required to maintain occupied cooling discharge setpoint (72° adjustable) as sensed by the remote temperature sensor.
- c. Economizer - In this mode:
  - If the outside air temperature is greater than the return air temperature, the system will operate as described in the occupied mode.
  - If the outside air temperature is less than the return air temperature and the outside air temperature is greater than 50 Degrees F. (adjustable), the ERU heat transfer wheel shall stop.
- d. Alarms: In this mode:
  - The freezestat mounted after the heating coil will protect the coils from freezing. Should the freezestat go into alarm the outside air and exhaust fans will shut off. The OA and EF dampers will be closed. The hot water coil valve will be open. An alarm will be generated at the operators work station. Note: The freezestat will be able to be reset from the operator's workstation.
  - Should the command not equal the status within 90 seconds from start-up an alarm will be generated at the operator's workstation.
  - Should any temperature fall outside of its preset limits (high/low) an alarm will be generated at the operator's workstation.

K. Fin-Tube Radiation, Convectors

1. Point List
  - a. Space Temperature
  - b. Hot Water Control Valve Modulation
2. Sequence of Operation
  - a. Unoccupied Mode: Modulate control valve to maintain night setback temperature setpoint.
  - b. Occupied Mode: Modulate control valve to maintain daytime temperature setpoint.

L. Cabinet Heaters

1. Point List
  - a. Space Temperature
  - b. Space Temperature Setpoint
  - c. Fan Start/Stop
2. Sequence of Operation: Unit fan and control valve shall cycle based on space temperature setpoint. An aqua-stat shall not allow fan operation if water supply temperature is below 140 degrees F.

M. Unit Heaters

1. Point List
  - a. Space Temperature
  - b. Space Temperature Setpoint
  - c. Fan Start/Stop
2. Sequence of Operation
  - a. Unit fan shall cycle based on space temperature setpoint.

N. Control Valves (Coils)

1. Point List
  - a. Coil entering air Temperature.
  - b. Coil leaving air Temperature.
  - c. Valve Modulation.
  - d. Low Temperature
2. Sequence of Operation:
  - a. The two-way control valve will modulate through the DDC system to modulate the steam supply to satisfy low limit and room temperature setpoints.



- b. The three-way control valve will modulate through the DDC system to modulate the hot water supply to satisfy low limit and room temperature setpoints.

O. Automatic Isolation Control Valves

- 1. Point List
  - a. Valve Modulation.
- 2. Sequence of Operation:
  - a. The two-way control valve will modulate through the DDC system to modulate the associated open/closed positions (adjustable).

P. Space Temperature Setpoints

- 1. Heating mode
  - a. Occupied temperature setpoint shall be maximum 72 degrees F.
  - b. Unoccupied temperature setpoint shall be minimum 55 degrees F.
- 2. Cooling mode
  - a. Occupied temperature setpoint shall be minimum 78 degrees F.
  - b. Unoccupied temperature setpoint shall be maximum 85 degrees F.

### 3.8 CONTROL DIAGRAMS

- A. Complete new control diagrams showing type of apparatus, cycles of operation and details of all equipment must be submitted for checking and be approved before installation is started.
- B. Submit three (3) preliminary copies of the control diagrams, sequence descriptions, and equipment shop drawings for checking and submit six (6) copies, complete for final approval.
- C. At the completion of installation, control manufacturer shall furnish non-fading original; plastic laminated copies of all control diagrams as they apply to the particular instruments thereon. One complete set of non-fading plastic laminated diagrams shall be mounted on wall as directed.

### 3.9 CERTIFICATION

- A. After completion of installation and after equipment has been placed on operation, the temperature control manufacturer shall submit in writing, a complete and detailed report and certification that the entire installation is operating exactly as specified and shall be guaranteed for one year. Report shall state temperature and throttling range readings and settings of all control instruments. Submit to the Engineer preliminary for checking and approval.

### 3.10 INSTALLATION

- A. All work under the automatic temperature control Sub-Contract shall be done by competent skilled mechanics regularly in the employ of the temperature control manufacturer.
- B. Bidder must be a control manufacturer currently involved in the production of commercial pneumatic/electric temperature controls. Franchises and associations are not considered control manufacturers.

### 3.11 TRAINING

- A. The Contractor shall supply personnel to train key customer personnel in the operation and maintenance of the installed system. The training program shall be designed to provide a comprehensive understanding and basic level of competence with the system. It shall be sufficiently detailed to allow customer personnel to operate the system independent of any outside assistance. On-line context sensitive HELP screens shall be incorporated into the system to further facilitate training and operation.
- B. The training plan shall include detailed session outlines and related reference materials. The customer personnel shall be able to utilize these materials in the subsequent training of their co-workers.
  - 1. Training time shall not be less than a total of 40 hours, and shall consist of:
    - a. 16 hours during normal day shift periods for system operators. Specific schedules shall be established at the convenience of the customer.
    - b. 24 hours of system training shall be provided to customer supervisory personnel so that they are familiar with system operation.
    - c. The specified training schedule shall be coordinated with the customer and will follow the training outline submitted by the Contractor as part of the submittal process.
    - d. Provide an as built Video training tape, showing and explaining all animated graphics in detail, all controllers and equipment the FMS operates (Four (4) Copies shall be supplied).
    - e. If further training is needed, the Contractor shall provide another 40 hours at no extra cost.
  - 2. All training sessions shall be scheduled by the Construction Manager. The Contractor shall provide sign-in sheets and distribute minutes of each session prior to the subsequent session. This documentation shall be included in the Operation and Maintenance manuals.

END OF SECTION 230460

## **SECTION 230470**

### **TESTING, START-UP AND ADJUSTMENTS**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section. Submit shop drawings for checking and approval.

##### **1.1 TESTING, START-UP AND ADJUSTMENTS**

- A. Furnish all materials, supplies, labor and power required for testing. Make preliminary tests and prove work satisfactory. Notify Architect and all authorities having jurisdiction in ample time to be present for final testing of all piping. Test before insulating or concealing any piping. Repair defects disclosed by tests, or if required by Architect, replace defective work with new work without additional cost to Owner. Make tests in stages if so ordered by Architect to facilitate work of others. Use of wicking in tightening leaking joints not permitted.
- B. HVAC Contractor is responsible for work of other trades disturbed or damaged by tests and/or repair and replacement of his work, and shall cause work so disturbed or damaged to be restored to its original condition at his own expense.
- C. Unless otherwise specified, all piping systems shall be hydrostatically tested to 150 psig. Tests shall be of four (4) hour duration during which time piping shall show no leaks and during time no sealing of leaks will be permitted.
- D. HVAC Contractor shall balance out system and submit test reports showing operating data to include the following:
  - 1. C.F.M. of all air handling equipment.
  - 2. C.F.M. at each air outlet.
  - 3. G.P.M. for equipment.
  - 4. R.P.M. for each fan and fan motor.
  - 5. Motor power consumption.
  - 6. Air temperature readings before and after coils.
  - 7. Water temperature readings in and out of coils and through equipment.
  - 8. Pressure gauge readings before and out of all pertinent equipment.
- E. If the performance of the systems does not conform to the design parameters the Contractor shall return to the site until the systems perform as designed.
- F. HVAC Contractor shall furnish services of qualified personnel, thoroughly familiar with job, to operate and make all adjustments so that system and control equipment shall operate as intended. This shall include adjustment/replacement of sheaves/impellers to achieve design performance. Adjustments shall be made including balancing of water and air systems in cooperation with qualified representatives of mechanical equipment manufacturers and temperature control manufacturer. This shall include any required adjustment/replacement of sheaves, belts, impellers, etc. to achieve design performance. Architect/Engineer is to be notified when this balancing is to be performed.

- G. When all work is in an acceptable operating condition, furnish operating and maintenance manuals as specified in General Requirements.
- H. All HVAC equipment shall be carefully designed, constructed and installed so as to prevent any objectionable noise or vibration reaching any part of the building outside of the mechanical equipment room. Care shall also be taken to prevent transmission of noise or odor through ductwork into other spaces.
- I. Contractor shall include in his Bid, adjustment of air quantity below scheduled C.F.M. for air systems deemed "noisy" by Owner subsequent to initial balancing.
- J. The Contractor shall be required to rectify or replace at his own expense, any equipment not complying with the foregoing requirements.
- K. Final inspection and approval shall be made only after proper completion of all of above requirements.

END OF SECTION 230470

## **SECTION 230480**

### **GENERAL LABELING, VALVE CHARTS AND PIPING IDENTIFICATION**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section. Submit shop drawings for checking and approval.

##### **1.1 GENERAL LABELING AND VALVE CHARTS**

- A. This Contractor shall have appropriate descriptive labels, identification tags and nameplates of equipment, valves, etc. furnished and installed under this Contract and shall be properly placed and permanently secured to (or adjacent to) the item being installed. All such labels, identifications, tags, nameplates, etc. shall be selected by the Architect/Engineer.
- B. In general, labels shall be the lamacoid type of sufficient size to permit easy identification, black coated, white edged, with letters 3/16" high. Major equipment, apparatus, control panels, etc. shall have 8" x 4" lamacoid plates with lettering of appropriate size.
- C. Provide tags for all valves, automatic and manual dampers. Tags shall be Type #2020 anodized aluminum of #1420 lamacoid engraved. Tags may not necessarily be standard. Fasten tags to valve or damper with brass chain.
- D. All nameplates, labels, identifications and tags shall be as manufactured by the Seton Name Plate Co., of New Haven, CT or approved equal. Submit complete schedules, listings and descriptive data together with samples for checking and approval before purchasing. Labeling shall include the "number" of the equipment, valve, dampers, switch, etc. and service of the valve.
- E. Mount on laminated plastic boards with transparent surface all valves, wiring diagrams, control diagrams, instruction charts, permits, etc. Valve chart shall be non-fading with original copies laminated.

##### **1.2 IDENTIFICATION OF PIPING**

- A. This Contractor shall provide on all piping, semi-rigid, wrap around plastic identification markers equal to Seton Snap-Around and/or Seton Strap-On pipe markers.
- B. Each marker background is to be appropriately color coded with a clearly printed legend to identify the contents of the pipe. Directions of flow arrows are to be included on each marker.
- C. Identification of all piping shall be adjacent to each valve, at each pipe passage through wall, floor and ceiling construction and at each branch and riser take-off.
- D. Identification shall be on all horizontal pipe runs, marked every 15 ft. as well as at each inlet outlet of equipment.

**END OF SECTION 230480**



## **SECTION 230485**

### **HVAC SYSTEMS COMMISSIONING**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section.

##### **1.1 RELATED DOCUMENTS**

- A. Section 019100 – Commissioning Requirements, including drawings and general provisions of the Contract, including General and Supplementary Conditions, and other Division 01 Specification Sections.
- B. In the case of a conflict between this and any other section in the project specifications, the more stringent or detailed requirements shall apply.

##### **1.2 DEFINITIONS**

- A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.
- B. CxA: Commissioning Authority.

##### **1.3 DESCRIPTION**

- A. The systems that shall be commissioned in this project include but are not limited to the following:
  - 1. Central Building Automation System including packaged unitary controllers.
  - 2. Equipment of the heating, ventilating and air conditioning systems.

##### **1.4 OVERVIEW OF CONTRACTOR'S RESPONSIBILITIES**

- A. Perform commissioning inspections and tests at the direction of the CxA.
- B. Attend construction phase controls coordination meeting.
- C. Attend testing, adjusting, and balancing (TAB) review and coordination meetings.
- D. Participate in HVAC systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.
- E. Provide information requested by the CxA for final commissioning documentation.
- F. Provide measuring instruments and logging devices to record test data and provide data acquisition equipment to record data for the complete range of testing for the required test period.

- G. Provide detailed startup procedures.
- H. Provide copies of all submittals, including all changes thereto, with details as required in the appropriate subsection of 3.1 Responsibilities.
- I. Facilitate the coordination of the commissioning process and incorporate commissioning activities into overall project schedule (OPS).
- J. Ensure all subcontractors and vendors execute their commissioning responsibilities according to the contract documents and the OPS.
- K. Provide required demonstration and training of owner's personnel.
- L. Review and accept construction checklists provided by commissioning authority (CxA).
- M. Prepare O&M manuals, according to the contract documents, including clarifying and updating the original sequences of operation to as-built/as-tested conditions.
- N. Cooperate with the CxA for resolution of issues recorded in the "Issues Log".
- O. Prepare and provide all documentation as necessary for the compilation of the Systems Manual.

## PART 2 - PRODUCTS

### 2.1 TEST EQUIPMENT

- A. The HVAC Contractor shall provide all standard testing equipment required to perform startup, initial checkout, and testing requirements of Division 23.
- B. The Controls Contractor shall provide all standard testing equipment required to test the Building Automation and Automatic Temperature Control System (BAS), including calibration of valve and damper actuators and all sensors. Trend logs for functional testing shall be generated through the BAS interface as requested by the CxA.
- C. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the following tolerances. Temperature sensors and digital thermometers shall have a certified calibration, performed within the past year, to an accuracy of 0.5°F and a resolution of  $\pm 0.1$  °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 RESPONSIBILITIES

- A. HVAC, Controls and TAB Contractors. The commissioning responsibilities applicable to each of the HVAC, Controls and TAB Contractors of Division 23 are follows:



1. Attend the initial commissioning meeting conducted at the start of construction, the commissioning meeting held 30 days prior to startup of the primary equipment, and all commissioning team meetings.
2. Provide a copy of approved shop drawings and startup reports for all commissioned equipment to the CxA. Supplement the shop drawing data with the manufacturer's installation and start-up procedures. This material should be identical to the literature which will be included in the Operation and Maintenance Manuals.
3. The Operation and Maintenance Manuals shall be submitted to the CM prior to the start of training (three (3) weeks before startup and training and at least sixty (60) days before substantial completion).
4. Perform and document results of Pre-functional Inspections at the direction of the CxA. Ensure that the inspection checklists are completed before startup or as specified by the CxA.
5. During the startup and initial checkout process, execute all portions of the manufacturer's start-up checklists for all commissioned HVAC equipment.
6. Perform and clearly document all completed startup and system operational checkout procedures and provide a copy to the CxA.
7. Perform and document results of equipment functional testing at the direction of the CxA. Ensure that the testing is completed in the timeline specified by the CxA.
8. Address current A/E punch list items and Commissioning corrective action items on the "Issues Log" before functional testing. Air and water TAB shall be completed, with discrepancies and problems remedied, before functional testing of the respective air-or water-related systems.
9. Provide skilled technicians to execute starting of equipment and to perform tests in accordance with all Division 23 sections. Where specified, startup shall be performed by a factory authorized service representative. Ensure that they are available and present during the agreed-upon schedules for the sufficient duration to complete the necessary tests, adjustments and problem-solving.
10. Correct deficiencies (differences between specified and observed performance as interpreted by the CxA and A/E) and retest the equipment.
11. Provide training of Owner's operating staff as specified in Division 23 Sections. Use expert qualified personnel.
12. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.
13. Correct deficiencies and make necessary adjustments to O&M manuals for applicable issues identified in any seasonal testing.

- B. HVAC Contractor. The responsibilities of the HVAC Contractor, during construction and acceptance phases in addition to those listed in (A) are:
1. Provide startup for all HVAC equipment.
  2. Prepare a preliminary schedule for Division 23 pipe and duct system testing, flushing and cleaning, equipment start-up and TAB start and completion for use by the PM and CxA. Update the schedule as appropriate.
  3. Notify the PM and CxA when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment, and TAB will occur. Be proactive in seeing that commissioning processes are executed and that the CxA has the scheduling information needed to efficiently facilitate the commission process.
  4. Calibrations: The HVAC Contractor is responsible to calibrate all factory-installed sensors and actuators. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated by the HVAC Contractor.
  5. Supervise all commissioning activities executed by subcontractors, including the Controls Contractor.
  6. List and clearly identify on the as-built duct and piping drawings the locations of all flow meters, fire and smoke dampers, duct detectors, temperature sensors, relative humidity sensors, CO2 sensors, static and differential pressure sensors (air, water and building pressure).
- C. Controls Contractor - The commissioning responsibilities of the Controls Contractor, during construction and acceptance phases in addition to those listed in (A) are:
1. Sequences of Operation Submittals. The Controls Contractor's submittals of control drawings shall include complete detailed sequences of operation for each piece of equipment, regardless of the completeness and clarity of the sequences in the specifications. The submitted sequences shall generally include the following, but can vary according to project needs:
    - a. An overview narrative of the system (one or two paragraphs) generally describing its purpose, components and function.
    - b. Logic diagrams detailing the flow of information for each control algorithm. These diagrams should include all inputs, outputs, and computations.
    - c. All interactions and interlocks with other systems.
    - d. Detailed delineation of control between any packaged controls and the building automation system, listing which points the only monitored at the BAS, and which points can be controlled by and adjusted at the BAS.
    - e. Written sequences of control for packaged controlled equipment. (Equipment manufacturers' stock sequences may be included but will generally require additional narrative).
    - f. Start-up sequences.
    - g. Warm-up mode sequences.
    - h. Normal operating mode sequences.
    - i. Unoccupied mode sequences.

- j. Shutdown sequences.
- k. Capacity control sequences and equipment staging.
- l. Temperature and pressure control: setbacks, setups, resets, etc.
- m. Detailed sequences for all control strategies, e.g., economizer control, optimum start/stop, staging, optimization, demand limiting, etc.
- n. Effects of power or equipment failure with all standby component functions.
- o. Sequences for all alarms and emergency shut downs.
- p. Seasonal operational differences and recommendations.
- q. Initial and recommended values for all adjustable settings, setpoints and parameters that are typically set or adjusted by operating staff; and any other control settings or fixed values, delays, etc. that will be useful during testing and operating the equipment.
- r. Daily/weekly/monthly schedules, as appropriate, if known.
- s. To facilitate referencing in testing procedures, all sequences shall be written in small statements, each with a number for reference. Where possible, the numbering sequence shall correspond with Section 23 0460 Automatic Temperature Controls.

2. Control Drawings Submittal:

- a. The control drawings shall have a key to all abbreviations.
- b. The control drawings shall contain graphic schematic depictions of the system and each component.
- c. The schematics shall include the system and component layout of any equipment that the control system monitors, enables, or controls, even if the equipment is primarily controlled by packaged or integral controls.
- d. Provide a full points list with at least the following included for each point:
  - 1. Controlled system.
  - 2. Point abbreviation
  - 3. Point description
  - 4. Display unit.
  - 5. Control point or setpoint (Yes/No)
  - 6. Input point (Yes/No)
  - 7. Output point (Yes/No)
- e. The controls contractor shall keep the A/E, CxA, HVAC and TAB Contractor informed, in a timely manner, of all changes to this list during programming and setup.

3. Submit a written checkout plan indicating in a step-by-step manner, the procedures that will be followed to test, checkout and adjust the control system prior to functional testing. At minimum, the checkout plan shall include for each type of equipment controlled by the building automation system:

- a. System name.
- b. List of devices.

- c. Step-by-step procedures for testing each controller after installation, including:
    - 1. Process of verifying proper hardware and wiring installation.
    - 2. Process of downloading programs to local controllers and verifying that they are addressed correctly.
    - 3. Process for performing and documenting point-to-point checkout for each digital and analog input and output.
    - 4. Process of performing operational checks of each controlled component.
    - 5. Plan and process for calibrating valve and damper actuators and all sensors.
    - 6. A description of the expected field adjustments for transmitter, controllers and control actuators should control responses fall outside of expected values.
  - d. A copy of the log and field checkout sheets that will document the process. This log must include a place for initial and final read values during calibration of each point and clearly indicate when a sensor, controller or command has “passed” and is operating within the contract parameters.
  - e. A description of the instrumentation required for testing.
  - f. Indicate the portion of the controls checkout plan that should be completed prior to TAB using the controls system for TAB work. Coordinate with the CxA and TAB Contractor for this determination.
4. Point-to-Point Checkout: Include in the checkout plan a point-to-point checkout. Each control point tied to a central control system shall be verified to be commanding, reporting and controlling according to its intended purpose. For each output, commands shall be initiated and verified to be functioning by visually observing and documenting the status of the controlled device in the field (e.g. valve or damper actuator response, pump or fan status). For each input, the system or conditions shall be altered to initiate the input response being tested and the response in the control system observed and recorded (e.g. high duct static pressure alarm).
5. Calibrations: The Controls Contractor is responsible to calibrate all field installed sensors and actuators using test and documentation methods approved by the CxA. The HVAC Contractor is responsible to calibrate all factory installed sensors and actuators.
- a. Sensors installed in the unit at the factory, with a calibration certification provided, need not be field calibrated by the HVAC Contractor.
  - b. Valve leak-by tests shall be conducted by the Contractor when shown on a construction checklist.
  - c. All procedures used shall be fully documented by the Controls Contractor on suitable forms, clearly referencing the procedures followed and written documentation of initial, intermediate and final results.

6. Beyond the control points necessary to execute all documented control sequences, provide monitoring, control and virtual points as indicated in the Specifications.
7. Provide an official notice to proceed to the CxA and project team upon completion of the Building Automation System (BAS) and Automatic Temperature Control System (ATC) installation, including checkout and calibration of each controlled device, to confirm that all system programming is complete as to all respects of the Contract Documents. This shall be submitted by the Controls Contractor prior to the start of functional testing by the CxA.

D. TAB Contractor: The scope of work for the TAB Contractor is provided in Section 230460.

### 3.2 SUBMITTALS

- A. The Contractor shall send one copy of product data, shop drawings and similar submittals to the CxA at the same time they are submitted to the A/E. The CxA will review the submittals and provide any comments to the A/E for inclusion in their comments. The Architect will transmit to the CxA, for the CxA's use in preparing functional test procedures; one reviewed and approved copy of product data, shop drawings and similar submittals received from the HVAC, Controls and TAB Contractors, pertinent to equipment and systems to be commissioned.

### 3.3 STARTUP

- A. The HVAC, Controls and TAB Contractors shall follow the start-up and initial checkout procedures listed in the Responsibilities list in this section. Equipment start-up is required to complete systems and sub-systems so they are fully functional, in compliance with the Contract Documents. The commissioning procedures and functional testing do not relieve or lessen this responsibility, or partially shift that responsibility to any extent onto the Commissioning Agent or Owner.
- B. Testing is intended to begin upon completion of a system. Refer to Section 019100 for additional information related to scheduling.

### 3.4 TESTS

- A. The HVAC and Controls Contractors shall provide the necessary support to the CxA to complete functional testing. The Controls Contractor shall fully test and verify all aspects of the BAS Contract Work on a point / system / integrated operational basis for all points, features and functions specified. The following requirements apply to all mechanical and control systems and features that are to be commissioned when referenced below. Tests shall:
  1. Verify functionality and compliance with the basis of design for each individual sequence module in the sequence of operations. Verify proper operation of all control strategies, energy efficiency and self-diagnostics features by stepping through each sequence and documenting equipment and system performance. Tests shall include startup, normal operation, shutdown, scheduled 'on' and 'off', unoccupied and manual modes, safeties, alarms, over-rides, lockouts and power failure.

2. Verify operation of systems and components that may be impacted during low, normal and high load conditions and during combinations of environmental and interacting equipment conditions that could reasonably exist and potentially result in adverse system reaction.
  3. Verify all alarm and high and low limit functions and messages generated on all points with alarm settings.
  4. Verify integrated performance of all components and control system components, including all interlocks and interactions with other equipment and systems.
  5. Verify shutdown and restart capabilities for both scheduled and unscheduled events (e.g. power failure recovery and normal scheduled start/stop).
  6. Verify proper sequencing of heat transfer elements as required to prevent simultaneous heating and cooling, unless specifically required for dehumidification operation.
  7. Verify system response and stability of control loops under different load conditions and determine if additional loop tuning is required for dehumidification operation.
  8. When applicable, demonstrate a full cycle from 'off' to 'on' and 'no load' to 'full load' and then to 'no load' and 'off'.
  9. Verify time of day schedules and setpoints.
  10. Verify all energy saving control strategies.
  11. Verify that all control system graphics are complete, that graphics are representative of the systems, and that all points and control elements are shown in the same location on the graphics as they are located in the field.
  12. Verify operation control of all adjustable system control points, including proper access level as agreed to during the controls system demonstration.
- B. In addition to specific details, and/or standards referenced for acceptance testing indicated in other Division 23 sections, the following common acceptance criteria shall apply to all mechanical equipment, assemblies, and features:
1. For the conditions, sequences and modes tested, the equipment, integral components and related equipment shall respond to varying loads and changing conditions and parameters appropriately as expected, according to the sequence of operation, as specified, according to acceptable operating practice and the manufacturer's performance specifications.
  2. Systems shall accomplish their intended function and performance (e.g. provide supply air and water at designated temperature and flow rate, etc., and maintain space conditions in terms of air temperature, relative humidity, and CO2 concentration) at specified levels at varying conditions.

3. Control loops shall be stable under all operating conditions. Control loops shall exhibit a quarter decay ratio type response to a step change or other upset and return to stable operation in a time frame that is reasonable and realistic for the system that they are associated with.
4. Resetting a manual safety shall result in a stable, safe, and predictable return to normal operation by the system.
5. Safety circuits and permissive control circuits shall function in all possible combinations of selector switch positions (hand, auto, inverter, bypass etc.).
6. Additional acceptance criteria may be defined by the CxA when detailed tested procedures are developed.
7. At the CxA's discretion, if large numbers of deficiencies or repeated deficiencies are encountered, the CxA shall suspend functional testing until the Contractor corrects the deficiencies and troubleshoots all remaining systems at issue on their own. The Contractor shall be responsible for any resulting schedule delays that increase the overall time period to complete functional testing.
8. Retesting: The CxA will direct the retesting of the equipment once at no charge to the Owner for their time. The CxA's time and expenses incurred for a second retest, if required due to no fault of the CxA, will be reviewed by the Owner to determine the appropriate means of compensation to the CxA for extension of services. The functional testing shall include operating the system and components through each of the written sequences of operation, and other significant modes and sequences, including startup, shutdown, unoccupied mode, manual mode, staging, miscellaneous alarms, power failure, security alarm when impacted and interlocks with other systems or equipment. Sensors and actuators shall be calibrated during construction checkout by the installing contractors and spot-checked by the CxA during functional testing.

### 3.5 WRITTEN WORK PRODUCTS

- A. Written work products of Contractors shall consist of the filled out start-up, initial checkout, and test documentation in accordance with all Division 23 sections.

END OF SECTION 230485





## **SECTION 230490**

### **GUARANTEE**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section.

##### **1.1 GUARANTEE**

- A. The Contractor shall remove, replace and/or repair at his own expense and at the convenience of the Owner, any defects in workmanship, materials, ratings, capacities and/or characteristics occurring in the work within three (3) years or within such longer period as may be provided in the Drawings and/or Section of the Specifications, which guarantee period shall commence with the final acceptance of the entire Contract in accordance with the guarantee provisions stated in the General Conditions, and the Contractor shall pay for all damage to the system resulting from defects in the work and all expenses necessary to remove, replace, and/or repair any other work which may be damaged in removing, replacing and/or repairing the work.

**END OF SECTION 230490**



## **SECTION 260100**

### **GENERAL CONDITIONS**

#### **PART 1 - GENERAL**

Applicable provisions of the conditions of the Contract and Division 1 General Requirements govern the work in this section.

##### **1.1 DESCRIPTION OF WORK**

- A. It is the intention of the Specification and Drawings to call for finish work, tested and ready for operation.
- B. Any apparatus, appliance material or work not shown on the Drawings but mentioned in the Specifications, or vice versa, or any incidental accessories or ancillary devices necessary to make ready for operation even if not particularly specified, shall be furnished, delivered and installed under their respective Division without additional expense to the Owner.
- C. Minor details not usually shown or specified, but necessary for proper installation and operation, shall be included in the work as though they were hereinafter specified or shown.
- D. Work under each section shall include giving written notice to the Architect of any materials or apparatus believed inadequate or unsuitable, in violation of laws, ordinances, rules and regulations of authorities having jurisdiction; and any necessary items of work omitted. In the absence of such written notice, it is mutually agreed that work under each section has included the cost of all necessary items for the approved satisfactory functioning of the entire system without extra compensation.
- E. Small scale drilling through walls and floors which may contain asbestos shall be performed by a person with a "restricted asbestos handler allied trades certificate" and shall have a copy of it in his possession at all times while working of the project.

##### **1.2 DRAWINGS**

- A. Drawings are diagrammatic and indicate the general arrangement of the system and work included in the Contract. (Do not scale the drawings). Consult the Architectural Drawings and details for exact location of fixtures and equipment; where same are not definitely located, obtain this information from the general construction supervisor.
- B. Work under each section shall closely follow Drawings in layout of work; check Drawings of other Divisions to verify spaces in which work will be installed. Maintain maximum headroom; do not begin work until unsatisfactory conditions are corrected.
- C. Make reasonable modifications in the layout as needed to prevent conflict with work of other Sections of the Specifications or for proper execution of the work.

- D. It shall be understood that the right is reserved by the Architect/Engineer to change the location of equipment and apparatus to a reasonable extent as building conditions may dictate, prior to their installation without extra cost to the Owner.

### 1.3 SURVEYS AND MEASUREMENTS

- A. Base all measurements, both horizontal and vertical, from established benchmarks. All work shall agree with these established lines and levels. Verify all measurements at site and check the correctness of same as related to the work.
- B. Before proceeding with the work resolve discrepancies between actual measurements and those indicated, which prevent following good practice or intent of the Drawings or Specifications.

### 1.4 CODES AND STANDARDS – Coordinate with Division 1

- A. The Codes and Standards listed below apply to all Electrical work codes or standards that are mentioned in these Specifications; the latest edition or revision shall be followed:
  - 1. NEMA - Standards
  - 2. ANSI C1 - National Electrical Code (NFPA 70)
  - 3. ANSI C50.13 - Rotating Electrical Machinery
  - 4. NEMA MG2 - Construction and guide for selection, installation and use of electric motors.
  - 5. NEMA MG1 - Motors and Generators
- B. The following State and Local Codes shall apply: New York State Uniform Fire Prevention and Building Code, and Local Building Codes.
- C. The following abbreviations are used within this Division of the Specifications:
  - 1. IES - Illuminating Engineering Society.
  - 2. NEC - National Electrical Code
  - 3. ANSI - American National Standards Institute
  - 4. ASTM - American Society for testing and materials
  - 5. EPA - Environmental Protection Agency
  - 6. IEEE - Institute of Electrical and Electronic Engineers
  - 7. NEMA - National Electrical Manufacturers Association
  - 8. NFPA - National Fire Protection Association.
  - 9. OSHA - Occupational Safety and Health Administration
  - 10. UL - Underwriter's Laboratories

### 1.5 PERMITS AND FEES

- A. Give all necessary notices, obtain all permits and pay all Government and State sales taxes and fees where applicable, and other costs, including utility connections or extensions in connection with work of this Division. File all necessary plans, prepare all documents and obtain all necessary approvals of all Governmental and State departments having jurisdiction; obtain all necessary certificates of inspections for his work and deliver a copy to the Architect before request for acceptance and final payment for the work. Pay fees for utility construction/connections.

- B. Include in the work, without extra cost to the Owner, any labor, materials, services, and apparatus, Drawings in order to comply with all applicable laws, ordinances, rules and regulations, whether or not shown on the Drawings and/or specified.
  - C. All materials furnished and all work installed shall comply with the rules and recommendations of the National Fire Protection Association, with the requirements of the local utility companies, with the recommendations of fire insurance rating organization having jurisdiction and with the requirements of all governmental departments having jurisdiction.
  - D. All materials and equipment for the electrical portion of the mechanical systems shall bear the approval label of or shall be listed by the Underwriter's Laboratories, Inc.
- 1.6 TEMPORARY LIGHT AND POWER – See Division 1
- A. The Contractor shall furnish, install, maintain and, upon direction to do so, remove system of temporary lighting and power for the use of all construction trades.
  - B. The Electrical Contractor shall provide adequate electrical service for the needs of all Contracting Trades.
  - C. Wiring shall be provided for temporary use during building construction, including grounding and fused main cut-off switches. Temporary electric lines with branch switches shall be provided for lighting and for taps for electric tools, pumps and other temporary equipment; all connected to a main line looped through floor spaces and up stair wells or shafts. All power outlets shall be grounded to an equipment ground wire in an approved manner. Electric lines shall be extended to power tools, which cannot be located within reach of extension cords.
  - D. Light bulbs shall be provided in sufficient quantity to light the building for safety purposes. Extension cords shall be provided as may be essential to the proper execution of the work. Temporary lighting shall be provided for all stairs and other locations where needed for safety or the proper execution of the work.
  - E. The Electrical Contractor shall maintain temporary lighting and power systems in good working condition, including the relocation and reinstallation when required to avoid interference with the progress of construction.
  - F. Provide ground-fault personnel ampere protection for all single phase, 15 and 20 ampere receptacles. All receptacles and portable cord connectors shall have NEMA standard locking type configurations.
  - G. The Electrical Contractor shall turn lights on and off at the beginning and end of each working day of any trade unless otherwise directed. He shall arrange for all temporary light and power for all trades which do not have holidays (days off) similar to the electrical trade. The Electrical Contractor shall patch and repair all openings left damaged by the installation and removal of the temporary light and power.

## 1.7 MANUFACTURER'S IDENTIFICATION

- A. Manufacturer's nameplate, name or trademark and address shall be attached permanently to all equipment and materials furnished under this Division. The nameplate of a contractor or distributor may not be used.

## 1.8 SHOP DRAWINGS – See Division 1

- A. Submit for approval detailed shop drawings of all equipment and materials in accordance with working procedures.
- B. Furnish all necessary templates and patterns for installation work and for the purpose of making adjoining work conform; furnish setting plans and shop details to other trades as necessary.
- C. Submit shop drawings for the following:
  - 1. Light fixtures.
  - 2. Receptacles, switches, occupancy sensors.
  - 3. Overcurrent protective devices.
  - 4. Panelboards.
  - 5. Clocks and P.A. system components.
  - 6. Fire alarm system.

## 1.9 MATERIALS AND WORKMANSHIP

- A. All materials and apparatus necessary for the work, except as specifically indicated otherwise, shall be new, of first class quality and shall be furnished, delivered, erected, connected and finished in every detail and shall be so selected and arranged as to fit properly into the building spaces. Where no specific kind or quality of material is given, a first class standard article as accepted by the Architect shall be furnished.
- B. Furnish the services of an experienced Superintendent who shall be constantly in charge of the installation of the work, together with all skilled workmen, helpers, and labor to unload, transfer, erect, connect up, adjust, start, operate and test each system.
- C. Unless otherwise specifically indicated on the Drawings or Specifications, all equipment and materials shall be installed in accordance with the recommendations of the manufacturer. This includes the performance of such tests as the manufacturer recommends.

## 1.10 PROTECTION

- A. Work under each Section shall include protecting the work and materials of all other Sections from damage from work or workmen, and shall include making good all damage thus caused. Be responsible for work and equipment until finally inspected, tested, and accepted; protect work against theft, injury or damage; and carefully store material and equipment received on site, which is not immediately installed. Close open ends of work with temporary covers or plugs during construction to prevent entry of obstructing or other foreign material.

- B. Work under each section includes receiving, unloading, uncrating, storing, protecting, setting in place and connecting up completely of any equipment supplied under each section. Work under each section shall also include exercising special care in handling and protecting equipment and fixtures, and shall include the cost of replacing any of the above equipment and fixtures which are missing or damaged by reason of mishandling or failure to protect on the part of the Contractor.

#### 1.11 BASES AND SUPPORTS

- A. Unless specifically noted otherwise, provide all necessary supports, pads, bases, and piers required for all equipment under this Division. Provide all temporary bases and supports as required.
- B. All equipment, unless shown otherwise, shall be securely attached to the building structure. Attachments shall be of a strong and durable nature; any attachments that are, insufficient, shall be replaced as directed by the Architect.

#### 1.12 SLEEVES, INSERTS AND ANCHOR BOLTS

- A. All conduits passing through floors, walls or partitions shall be provided with sleeves having an internal diameter one inch larger than the outside diameter of the conduit, or insulation enclosing the conduit.
- B. Furnish all sleeves, inserts, and anchor bolts necessary to be installed under other sections of the Specifications to accommodate work of this section.
- C. Sleeves through outside walls shall be cast iron sleeves with intermediate integral flange. Sleeves shall be set with ends flush with each face of wall. The remaining space shall be packed with oakum to within 2 inches of each face of the wall. The remaining shall be packed and made watertight with a waterproof compound.
- D. Sleeves through concrete floors or interior masonry walls shall be schedule 40 black steel pipe, set flush with finished walls or ceiling surfaces but extending 2 inches above finished floors.
- E. Sleeves through interior partitions shall be 22 gauge galvanized sheet steel, set flush with finished surfaces or partitions.
- F. Inserts shall be individual or strip type of pressed steel construction with accommodation for removable nuts and threaded rods up to 3/4" inch diameter, permitting lateral adjustment. Individual inserts shall have an opening at the top to allow reinforcing rods up to 1/2" diameter to be passed through the insert body. Strip inserts shall have attached rods having hooked ends to allow fastening to reinforcing rods. Inserts shall be as manufactured by Carpenter and Patterson, Inc. or Grinnell Co., Inc.
- G. Penetrations through fire-rated walls, ceilings and floors in which cables, conduits pass, shall be sealed by a UL approved fire stop fitting classified for an hourly rating equal to the fire rating of the floor, wall or ceiling shall be Gedney Fire Seal Type CFSF of CAPS.

- 1.13 PAINTING – See Division 1; all work required shall be performed by this Contractor.
- A. All finish painting in finished areas shall be performed by others.
  - B. All materials shipped to the job site under the Division, such as panels and plates, shall have a prime coat and standard manufacturer's finish unless otherwise specified.
  - C. Inaccessible conduits, hangers, supports and anchors and ducts shall be coated prior to installing.
  - D. All components of the fire alarm system raceway shall be painted red. This includes but is not limited to conduit, junction boxes, pull boxes.
- 1.14 CUTTING AND PATCHING – See Division 1
- A. All cutting and patching required for the work of this Division shall be done by this Division.
  - B. Work under this Division shall include furnishing, locating and setting inserts and/or sleeves. Do all drilling and cutting necessary for the installation.
  - C. All holes cut through concrete slabs and structural steel shall be punched or drilled from the underside. No structural member shall be cut without the written acceptance of the Architect and all such cutting shall be done in a manner directed by him.
  - D. Refer to Division 1 for additional requirements.
- 1.15 SCAFFOLDING, RIGGING AND HOISTING – Coordinate with Division 1
- A. Furnish all scaffolding, rigging, hoisting, and services necessary for erection and delivery into the premises of any equipment and apparatus furnished under this Division. Remove same from premises when no longer needed.
- 1.16 WATERPROOFING
- A. Where any work penetrates waterproofing, including waterproof concrete and floors in wet areas. Submit proposed method of installation for review by the Architect before beginning work. Furnish all necessary sleeves, caulking and flashing necessary to make opening absolutely watertight.
- 1.17 ACCESSIBILITY AND ACCESS PANELS
- A. Be responsible for the sufficiency of the size of shafts and chases, the adequate thickness of partitions, and the adequate clearance in double partitions and hung ceilings for the proper installation of the work of this Division.
  - B. Locate all equipment, which must be serviced, operated or maintained in fully accessible positions. Minor deviations from Drawings may be allowed for better accessibility with approval of the Architect.



1.18 SHUTDOWNS – See Division 1

- A. When installation of a new system necessitates the temporary shutdown of an existing utility operating system the connection of the new system shall be performed at such time as designated by and in consultation with the Utility Company. Work required after normal business hours shall be done so at no additional cost to the Owner.

1.19 CLEANING - Coordinate with Division 1

- A. Thoroughly clean all equipment of all foreign substances inside and out before being placed in operation.
- B. If any foreign matter should stop any part of a system after being placed in operation, the system shall be disconnected, cleaned and reconnected whenever necessary to locate and remove obstructions. Any work damaged in the course of removing obstructions shall be repaired or replaced when the system is reconnected at no additional cost to the Owner.
- C. Upon completion of work remove from the premises all rubbish, debris, and excess materials. Any oil or grease stains on floor areas caused by work of this Division shall be removed and floor areas left clean.

1.20 RECORD DRAWINGS – Work shall be governed by requirements set forth in Division 1

- A. Maintain at the job site a record set of Electrical Drawings on which any changes in location of equipment, panels, devices, and major conduits shall be recorded. Indicate dimensions of all items installed underground or in concrete.

1.21 OPERATING INSTRUCTIONS – Coordinate with requirements set forth in Division 1

- A. Upon completion of all work and all tests, the Contractor shall furnish the necessary skilled labor and helpers for operating his system and equipment for a period specified under each applicable Section of this Division. During this period, he shall instruct the Owner or his representative fully in the operation, adjustment and maintenance of all equipment furnished. Give at least 7 days notice to the Owner in advance of this period.
- B. The manufacturer shall attest in writing that his equipment has been properly installed prior to start. The following is some of the equipment necessary for this inspection: fire alarm system. These letters will be bound into the operating and maintenance books.

1.22 ADJUSTING AND TESTING

- A. After all equipment and accessories to be furnished are in place, they shall be put in final adjustment and subjected to such operating tests as will assure the Architect that they are in proper adjustment and in satisfactory permanent operating condition.

- B. This particular work shall include the services of a factory engineer to inspect the installation and assist in the initial startup and adjustment to the equipment. The period of these services shall be for such time as necessary to secure proper installation and adjustments. After the equipment is placed in permanent operation, there shall be furnished the service of said engineer for the purpose of supervising the initial operation of the equipment and to instruct the personnel responsible for operation and maintenance of the equipment.
- C. At the completion of the job when all panels, devices, etc. are at full working load the Contractor shall provide infrared scan thermographic inspection test of all connection points, terminals, etc. of wires #8 AWG and larger to detect "hot-spots" in the electrical current flow. Correct all hot-spots.

#### 1.23 UNDERWRITER'S LABEL

- A. All electrical equipment and materials shall be new and shall comply with the standards of and shall bear the label of the Underwriter's Laboratories.

#### 1.24 ELECTRICAL SAFETY INSPECTION

- A. Electrical Contractor shall arrange for an Electrical Safety Inspection to be performed by the Local Inspection Agency (i.e.: New York Electrical Inspection Services, Atlantic Inland, Middle Department Inspection Agency). A Certificate of Compliance "Underwriter's Certificate" shall be issued to the Owner. All costs and coordination required shall be included in this Contractors Base Bid.

#### 1.25 REMOVALS – Coordinate with Division 1 and Division 2

- A. The scope of removals shown on the Drawings are diagrammatic only and indicate the intent of the work to be performed and not the complete scope of demolition and/or removal work. It shall be the responsibility of this Contractor to remove any electrical devices even if not specifically indicated to be removed on these Drawings in order to accommodate new work.
- B. All power conductors, control wiring and conduit associated with mechanical equipment such as fans, pumps, etc. designated for removal on the HVAC Drawings shall be removed clear back to the source of power and disconnected. All motor starters, disconnect switches, control devices, etc. shall be removed. Refer to HVAC Drawings for extent of HVAC removals.
- C. Any device removed shall include (but shall not be limited to) the removal of all associated wiring, conduit, boxes, and auxiliary devices back to the previous device on the circuit, or back to the panelboard or origin of the circuit or any other items that are not incorporated in new layout, until such removal is complete. If the removal of any device interrupts service of any other device that is to remain, the Contractor shall provide all materials and labor to ensure continuity of service to those devices to remain.
- D. Junction boxes, pullboxes, wireways, conduits, or any other devices required to reconnect circuitry shall be installed concealed within the ceilings, partitions and/or walls, floors, no surface or exposed circuiting shall be permitted, unless specifically indicated.

- E. The Electrical Contractor shall patch all openings in walls, ceilings or roof that are left open as a result of removals. Refer to cutting and patching section.
- F. Any electrical device removed including but not limited to disconnect switches, panelboards, etc. shall be cleaned, protected and turned over to the Owner or disposed of as directed by Owner.

END OF SECTION 260100



## **SECTION 260125**

### **SCOPE OF WORK**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section.

##### **1.1 SCOPE OF WORK**

- A. The work under this section includes all labor, materials, equipment, tools, transportation and the performance of all work necessary and required for furnishing and installing all Electrical work shown on the Contract Documents, as specified herein and as otherwise required by job conditions or reasonably implied, including, but not necessarily limited to the following:
1. The addition of new fire alarm devices (i.e., automatic fan shutdown, for new HVAC equipment) and the replacement of the existing ones as shown on Drawings.
  2. The contractor shall dispose of all debris, including but not limited to fixtures, equipment, lamps, ballast, wiring devices and the like in accordance with, as defined by governing law and regulations of the jurisdiction where the work is being performed.
  3. Provisions for temporary fire prevention actions to be taken during the period of construction until the new fire alarm system is operational.
  4. Modifications to existing electrical distribution system as indicated on the Drawings.
  5. Distribution panelboard, circuit breaker panelboards, feeder, conduit, cables and branch circuit wiring with all connections complete.
  6. Conduit, conduit fittings, junction and pull boxes and all appurtenances necessary for the raceway systems including necessary supports and fasteners.
  7. Electrical conductors, connectors, fittings and connection lugs.
  8. Branch circuit devices, outlet boxes, pull boxes, motor disconnect switches, etc.
  9. Power wiring to HVAC and Plumbing equipment including disconnect switches as shown and/or required by NEC.
  10. Empty conduit for computer and telephone.
  11. Lighting fixtures and lamps including site lighting and occupancy sensor.
  12. Public address speakers and clocks.
  13. Temporary electric power while existing electrical service is being removed until the new electrical service is being installed.

14. Core drilled holes for conduit passing through walls, ceilings and floors.
  15. All necessary cutting, patching and core drilling incidental to the electrical work.
  16. Temporary light and power.
  17. Licenses, permits, inspection and approvals.
  18. Grounding as required as per NEC.
  19. Sleeves for conduit and watertight caulking between conduit and sleeve.
  20. Testing.
  21. Cutting, patching and drilling.
- B. Coordination Drawings (if applicable): Attention is directed to Division 1 for coordination drawing requirements for this project. These drawings are critical to the proper execution of the work and failure to honor these requirements may become the basis for denial of any and all claims for either or both "time" and "money".

## 1.2 WORK NOT INCLUDED

- A. The following related items will be done by others:
1. Furnishing motors and controllers.
  2. Concrete work.
  3. Excavation and backfill.

END OF SECTION 260125

## **SECTION 260150**

### **APPROVED MANUFACTURERS**

#### **PART 1 - GENERAL**

Applicable provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section. Submit shop drawings for checking and approval.

##### **1.1 APPROVED MANUFACTURERS**

A. The following list of manufacturers constitutes an approved list:

- |     |                          |   |
|-----|--------------------------|---|
| 1.  | Panelboards              | Siemens, Square D, GE   |
| 2.  | Disconnect Switches      | Siemens, Square D, GE   |
| 3.  | Conduit (steel)          | Wheatland, Allied, Republic Conduit   |
| 4.  | Conduit Fittings (steel) | Appleton, Crouse-Hind, O-Z, T&B, M&W  |
| 5.  | Wire and Cable           | General, South Wire, Rome, Cerro  |
| 6.  | Splicing Connectors      | 3M, O-Z, Thomas & Betts   |
| 7.  | Outlet Boxes             | Appleton, National, Steel City, Raco  |
| 8.  | Wiring Devices           | Arrow-Hart, Hubbell, P & S  |
| 9.  | Fuses                    | Bussman, Ferraz-Shawmut, Littlefuse   |
| 10. | Lamp                     | GE, Sylvania, Philips   |
| 11. | Motion Sensors           | Watt Stopper, Sensorswitch  |
| 12. | Fire Alarm System        | Simplex-Grinnell, Pyrotronics, Edwards<br>System Technologies or approved equal |
| 13. | Public Address system    | Rauland-Borg, Bogen or approved equal   |

B. All materials and appliances shall have listing of Underwriters Laboratories, Inc. and be so labeled, or shall conform to their requirements, in which case certified statements to that effect shall be furnished by the manufacturer with a copy of an examination report by a recognized independent testing laboratory acceptable to the Architect and his Engineer. Use new materials and appliances throughout.

C. Where several types or makes of materials are specified, the Contractor has the option of using any of these, but after a type or make has been selected and has received the approval of the Architect, it shall be used throughout.

- D. The Contractor shall provide all structural supports for the proper attachment of equipment supplied by him and also for all equipment supplied to him under other sections of the Specifications for mounting and connections.
- E. Secure all equipment to the building structure independently. Do not secure to work of other trades such as ceiling lath, piping racks, etc., unless specified or noted otherwise.
- F. Wall mounted equipment shall be directly secured to wall by means of steel bolts. Maintain at least 1/4" air space between equipment and supporting wall. Pre-fabricated steel channels providing a high degree of mounting flexibility, such as those manufactured by Kindorf and Unistrut, shall be used for mounting arrays of equipment.
- G. All fastening, supports, hangers, anchors, etc., shall be of a type made for the specific purpose. On masonry walls, metallic expansion shield and machine screws shall be used. Screws with wooden plugs or anchors will not be acceptable on any part of the work.

END OF SECTION 260150



## **SECTION 260200**

### **CONDUIT**

#### **PART 1 - GENERAL**

Applicable provisions of the conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

##### **1.1 WORK INCLUDED**

- A. The work under this section shall include the furnishing of all material, labor, tools and services necessary to install rigid metal conduit, electrical metallic tubing and liquid tight flexible metal conduit, including all fittings to complete all work shown on the Drawings or specified herein.

##### **1.2 RELATED WORK**

- A. Cutting and patching.
- B. Sheet metal flashing and trim.

##### **1.3 REFERENCE FOR METAL RACEWAY**

- A. UL 5 - Surface Metal Raceways and Fittings.
- B. UL 870 - Wireways, Auxiliary Gutters, and Associated Fittings.

#### **PART 2 - PRODUCTS**

##### **2.1 RIGID STEEL CONDUIT**

- A. Industry standard heavy wall conduit.
- B. Minimum 3/4" trade size.
- C. Threaded.
- D. Hot dipped galvanized finish by means of plating after cutting of threads.

##### **2.2 INTERMEDIATE METAL CONDUIT**

- A. Industry standard steel conduit.
- B. Minimum 3/4" trade size.
- C. Threaded.
- D. Hot dipped galvanized finish by means of plating after cutting of threads.

## 2.3 ELECTRICAL METALLIC TUBING

- A. Industry standard thin wall conduit of galvanized steel only.
- B. Minimum 3/4" trade size.
- C. Maximum 4" trade size.

## 2.4 FLEXIBLE METAL CONDUIT

- A. Galvanized steel tape formed into an industry standard interlocking coil.
- B. Minimum 3/4" trade size except for connection of lighting fixtures.
- C. Grounding type.
- D. Separate ground conductor.
- E. Use for short connections to motor terminal box, other vibrating equipment using a minimum length of 18" with 50% slack and a maximum of 6'
- F. From outlet box to recessed lighting fixtures with a maximum length of 6'

## 2.5 WIREWAYS

- A. Lay-in type, UL listed as wireway or auxiliary gutter.
- B. Wireway shall be of code gauge steel construction (UL standard for Wireway Auxiliary Gutters and Associated Fittings) with removable cover. Tamperproof screws shall be provided for sealing covers to prevent access by unauthorized personnel. Wireway shall be provided with knockouts.
- C. Connector and covers shall be attached so that removal of connectors is not necessary to utilize the lay-in feature.
- D. Finish: All sheet metal parts shall be provided with a rust inhibiting phosphating coating and baked enamel finish. All hardware shall be plated to prevent corrosion. All screws extending into the wireway shall be protected by spring nuts or otherwise guarded to prevent wire insulation damage.

## 2.6 CONDUIT SUPPORTS

- A. Conduit clamps, straps and supports: Steel or malleable iron.

## 2.7 CONDUIT FITTINGS

- A. Use compression fittings for all EMT in exposed areas. Utilize set screw fittings only above hung ceilings and concealed areas.

## 2.8 SURFACE METAL RACEWAY

- A. Metal raceway shall be of a two-piece design with a base and snap-on cover.
- B. Raceway and all components shall be listed by Underwriters Laboratories
- C. Single Channel: Steel, zinc plated, off-white finish suitable for repainting. Two piece design with metal base and snap-on cover. Wire Mold V700, Hubbell Inc. 750 Series, or Panduit PMR5/PMR7
- D. Dual Channel: Steel, galvanized, off-white finish but suitable for repainting. Two-piece design with metal base and snap-on cover, minimum 0.04" thick base and cover. Base shall be divided by a removable barrier section. Provide duplex receptacles mounted in top cell and communication outlets in the bottom cell. Coordinate communications jack requirements with owner's IT personnel. Wiremold V4000, Wiremold DS4000 Series, Hubbell Inc. 4000 Series or Panduit PMR40.

## PART 3 - EXECUTION

### 3.1 CONDUIT SIZING, ARRANGEMENT AND SUPPORT

- A. Minimum size - 3/4". Provide grounding bushings on all conduits 1-1/4" and larger.
- B. Arrange conduit to maintain headroom and present a neat appearance.
- C. Route exposed conduit and conduit above accessible ceilings parallel and perpendicular to walls and adjacent piping.
- D. Draw up couplings and fittings full and tight. Protect threads cut in field from corrosion. Paint newly threaded joints of steel conduit with T & B "Kopershield" compound before installation. Running threads prohibited; use three-piece unions or split couplings instead. Use only compression fittings for all EMT in areas where it will be exposed in finished and unfinished areas. Provide set screw fittings only when installed above hung ceilings.
- E. Maintain minimum 6-inch clearance between conduit and piping. Maintain 12-inch clearance between conduit and heat sources such as flues; steam pipes and heating appliances.
- F. Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized straps, lay-in adjustable hangers, clevis hangers, or bolted split stamped galvanized hangers.
- G. Group conduit in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps. Provide space for 25 percent additional conduit.
- H. Do not fasten conduit with wire or perforated pipe straps. Remove all wire used for temporary conduit support during construction, before conductors are pulled.
- I. Exposed conduit on ceiling shall be parallel or perpendicular to wall and vice versa to ceiling when installed on wall. Secure conduit clamps and supports to masonry materials by toggle bolt, expansion bolt or steel insert. Spacing of conduit supports shall not exceed 7 feet.

### 3.2 CONDUIT INSTALLATION

- A. Cut conduit square using a saw or pipe cutter, Deburr cut ends.
- B. Bring conduit to the shoulder of fittings and couplings and fasten securely.
- C. Use conduit hubs or sealing locknuts for fastening conduit to cast boxes and for fastening conduit to sheet metal boxes in damp or wet locations.
- D. Install no more than the equivalent of three 90-degree bends between boxes.
- E. Use conduit bodies to make sharp changes in direction, as around beams.
- F. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2-inch size.
- G. Avoid moisture traps where possible; where unavoidable, provide junction box with drain fitting at conduit low point.
- H. Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.
- I. Provide No. 12 AWG insulated conductor or suitable pull string in empty conduit, except sleeves and nipples.
- J. Install expansion-deflection joints where conduit crosses building expansion or seismic joints.
- K. Where conduit penetrates fire-rated walls and floors, provide pipe sleeves two sizes larger than conduit; Pack void around conduit with fire-stop fittings with UL listed fire rating equal to wall or floor ratings; Seal opening around conduit with UL listed foamed silicone elastomer compound.
- L. Installation of conduit in slab shall comply with ACI 318.
- M. Route conduit through roof openings for piping and duct work where possible; otherwise, route through roof with pitch pocket.
- N. Maximum size conduit in slabs above grade: 1 inch. Do not route conduits to cross each other in slabs above grade. Conduits crossing each other may not be larger than 3/4 inch.
- O. All conduit used for fire alarm system shall be painted red.
- P. For Surface Metal Raceway
  - 1. When installing surface metal raceway contractor shall provide boxes from the same manufacturer of the surface metal raceway.
  - 2. Install separate grounding conductor. Grounding conductors for surface metal raceways.

3. Surface metallic raceways in close proximity of other trades, shall be arranged to allow for proper clearance for servicing and headroom. Surface metallic raceway shall be installed parallel to walls, floors and ceilings in a neat workmanlike manner.

### 3.3 CONDUIT INSTALLATION OF SCHEDULE

- A. Underground installations: PVC minimum Schedule 40, unless otherwise noted on Drawings.
- B. Installations in or under concrete slab: PVC minimum Schedule 40, unless otherwise noted on Drawings.
- C. Exposed outdoor locations: Rigid galvanized steel conduit.
- D. Wet interior locations: Rigid galvanized steel conduit.
- E. Concealed dry interior locations and above accessible ceiling for receptacle and lighting branch wiring: Electrical metallic tubing up to first junction box and flexible metallic tubing (MC cable only) thereafter.
- F. Concealed dry interior locations other than receptacle and lighting branch wiring: Electrical metallic tubing.
- G. Concealed dry interior locations and above accessible ceiling for fire alarm runs: Fire alarm armored cable type MC with red stripe as manufactured by AFC series 1800.
- H. Concealed and exposed dry interior location for feeder runs: Electric metallic tubing.
- I. Exposed dry interior in unfinished locations other than Boiler Rooms: Electric metallic tubing.
- J. Final connections to motors: Flexible metallic tubing (MC cable). Minimum of 10" to maximum of 6' for connections to motors.
- K. Existing exposed dry interior locations (finished spaces), for branch wiring and fire alarm wiring, one-piece steel raceway (similar to Wiremold V-500, V-700).
- L. Final connections to motors: Flexible metallic tubing (MC cable). Minimum of 18" to maximum of 6' for connections to motors.
- M. All conduit installed in boiler room up to 10'-0" AFF and lower shall be rigid galvanized steel conduit. All conduit above 10'-0" shall be electric metallic tubing.
- N. Final connections to equipment and/or motors in boiler room, outdoors and potentially wet indoor areas: liquid tight, flexible; minimum of 18" to maximum 6'-0" connections.

END OF SECTION 260200



## **SECTION 260320**

### **OVERCURRENT PROTECTIVE DEVICES**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

##### **1.1 WORK INCLUDED**

- A. Work of this section includes all labor, materials, equipment and services necessary to complete the electrical work as shown on the Drawings and specified herein, including, but not limited to, the following:
- B. Fuses
  - 1. Current limiting cartridge fuses.
  - 2. Time delay cartridge fuses.
- C. Circuit Breakers
  - 1. Standard molded case circuit breakers "bolted in" type.
  - 2. Solid state circuit breakers.
  - 3. Current limiting circuit breakers.
  - 4. Enclosed circuit breakers.

##### **1.2 SUBMITTALS**

- A. Shop drawings showing dimensions, location of equipment and method of installation.
- B. Product Data: Manufacturer's printed data, catalog cuts.

##### **1.3 DISCONNECT SWITCHES**

- A. Fusible switch assemblies: Quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover when switch is in ON position. Handle lockable in OFF position. Fuse clips shall be designed to accommodate Class R, J fuses.
- B. Non-fusible switch assemblies: Quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover when switch is in ON position. Handle lockable in OFF position.
- C. Enclosures: NEMA Type 1, 3R or 4 as required.

##### **1.4 FUSES**

- A. Voltage ratings of fuses shall be suitable for the supply characteristics to which they are applied.

- B. Fuse type and size shall be suitable for installation in related disconnect switch or circuit breaker.
- C. Current limiting fuses shall be as follows:
  - 1. Regardless of actual available fault current, they shall, at full recovery voltage, be capable of safely interrupting fault currents of 200,000 amperes RMS symmetrical or 280,000 amperes RMS asymmetrical, deliverable at the line side of the fuse.
  - 2. They shall have average melting time-current characteristics to meet the Underwriters Laboratories requirements for "Class RK-1" 0-600 amp fuses.
- D. Regardless of actual available fault current, they shall be capable of limiting peak let through current to the following values based on 200,000 amperes RMS symmetrical or 280,000 amperes asymmetrical being available:

| <u>Rating In Amperes</u> | <u>Peak Let Through Current In Amps</u> |
|--------------------------|---|
| 15-30                    | 6,000                                   |
| 35-50                    | 8,000                                   |
| 70-100                   | 12,000                                  |
| 125-200                  | 20,000                                  |
| 225-601                  | 38,000                                  |

- E. Fuses shall be rejection type. Fuse clip shall be rejection type.
- F. Fuse Type and Application Table:

| <u>Category of Application</u> | <u>Acceptable Fuse Types</u><br>(Bussman Designations @ 600V) |
|--------------------------------|---|
| Motor feeder                   | LPS below 600A  |
| Power panel feeders            | LPS below 600A  |
| Safety switches                | LPS   |

#### 1.5 CIRCUIT BREAKERS

- A. "Bolted-In" type, manually operated, quick-make, quick-break, mechanically trip-free operating mechanisms for simultaneous operation, of all poles, with contacts, arc interrupters and trip elements for each pole. "Plug-in" breakers are not permitted. New circuit breakers to be installed in existing panelboards shall be U.L. certified for installation in those panelboards and be labeled with make and model.
- B. Tripping units shall be "thermal-magnetic" type having bimetallic elements for time delay overload protection, and magnetic elements for short circuit protection.
- C. Manually operable by mean of toggle type operating handles having tripped positions midway between the "on-off" position. Handle to be clearly labeled as to breaker rating.



- D. Minimum frame size for all circuit breakers, 1, 2, or 3 pole shall be 100 amperes.
- E. Their interrupting rating shall not be less than 25,000 amperes RMS symmetrical at 208 volt for distribution panels and 10,000 amperes for power panels.

#### 1.6 APPLICATIONS

##### A. Category of Application for Fuses:

- 1. Feeders on switchboards.
- 2. Branch fused switch unit in distribution panel.
- 3. Fused safety switch.
- 4. Combination motor starters.

##### B. Category of Application for Circuit Breakers:

- 1. Panelboards.
- 2. Switchboards.
- 3. Individual enclosures.
- 4. Combination motor starters.

#### 1.7 SPARE FUSES

- A. Upon Engineer's acceptance of the electrical distribution system, provide spare fuses as follows: 10% of each type and rating installed 600 amperes and smaller (minimum of 3). Provide spare fuse cabinet with directory to store all spare fuses. Locate as directed by Engineer and/or Owner.

#### 1.8 APPROVED MANUFACTURERS

- A. Fuses: Bussman, Ferraz-Shawmut.
- B. Circuit Breakers: Siemens, General Electric, Square D.

#### 1.9 INSTALLATION

- A. All material installation shall be in accordance with manufacturer recommendations and the provisions of all applicable codes.
- B. All fuses and circuit breakers shall be selectively coordinated.
- C. Install disconnect switches where indicated on Drawings.
- D. Install fuses in fusible disconnect switches.

E. Disconnects shall have NEMA 3R enclosure.

1.10 RECORD DRAWINGS

A. Shop drawings showing dimensions, location of equipment and method of installation.

B. Product Data: Manufacturer's printed data, catalog cuts, performance curves.

END OF SECTION 260320

## **SECTION 260350**

### **BOXES**

#### **PART 1 - GENERAL**

Applicable provisions of the conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

##### **1.1 WORK INCLUDED**

- A. The work under this section shall include the furnishing of all material, labor, tools and services necessary to install wall and ceiling outlet boxes, floor boxes, pull and junction boxes to complete all work shown on the Drawings or specified herein.

##### **1.2 RELATED WORK**

- A. Access doors.
- B. Wiring devices: Service fittings and fire-rated poke-through fittings for floor boxes.
- C. Cabinets and enclosures.

#### **PART 2 - PRODUCTS**

##### **2.1 OUTLET BOXES**

- A. Sheet metal outlet boxes: ANSI/NEMA OS 1; Galvanized steel, with 1/2 inch male fixture studs where required.
- B. Cast boxes: Cast fer alloy, deep type, gasketed cover, threaded hubs.
- C. Typical receptacle box shall be 4" square metal boxes, 30.8 cubic inch capacity with brackets as required. Provide 4" square raised device covers.

##### **2.2 PULL AND JUNCTION BOXES**

- A. Sheet metal boxes: ANSI/NEMA OS 1; Galvanized steel.
- B. Sheet metal boxes larger than 12 inches in any dimension: hinged enclosure in accordance with Section 26 04 50.
- C. Cast metal boxes for outdoor and wet location installations: NEMA 250; Type 4 and type 6, flat-flanged, surface-mounted junction box, UL listed as raintight. Galvanized cast iron box and cover with ground flange, neoprene gasket, and stainless steel cover screws.
- D. Cast metal boxes for underground installation: NEMA 250; Type 4, inside flanged, recessed cover box for flush mounting, UL listed as raintight. Galvanized cast iron box and plain cover with neoprene gasket and stainless cover screws.

## PART 3 - EXECUTION

### 3.1 COORDINATION OF BOX LOCATIONS

- A. Provide electrical boxes as required in excess of that shown on Drawings and as required for splices, taps, wire pulling, equipment connections and code compliance.
- B. Electrical box locations shown on Contract Drawings are approximate unless dimensioned. Verify location of floor boxes and outlets in offices and work areas prior to rough-in.
- C. Locate and install boxes to allow access. Where installations are accessible, coordinate locations and sizes of required access doors with Division 1.
- D. Locate and install to maintain headroom and to present neat appearance.

### 3.2 OUTLET BOX INSTALLATION

- A. Do not install boxes back-to-back in walls. Provide minimum 6 inch separation, except provide minimum 24 inch separation in acoustic-rated walls.
- B. Locate boxes in masonry walls to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat openings for boxes.
- C. Provide knockout closures for unused openings.
- D. Support boxes independently of conduit except for cast iron boxes that are connected of rigid metal conduits, both supported within 12 inches of box.
- E. Use multiple-gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.
- F. Install boxes in wall without damaging wall insulation.
- G. Coordinate mounting heights and locations of outlets mounted above counters, benches and backspaces.
- H. Position outlets to locate luminaries as shown on reflected ceiling plans.
- I. In inaccessible ceiling areas, position outlets and junction boxes within 6 inches of recessed luminaire, to be accessible through luminaire ceiling opening.
- J. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.
- K. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.
- L. Provide cast outlet boxes in exterior locations exposed to the weather and wet locations.

### 3.3 PULL AND JUNCTION BOX INSTALLATION

- A. Locate pull boxes and junction boxes above accessible ceilings or in unfinished areas.
- B. Support pull and junction boxes independent of conduit.

### 3.4 FLOOR BOX INSTALLATION

- A. Set boxes level and flush with finish flooring material.
- B. Use cast iron floor boxes for installation in slab on grade.

END OF SECTION 260350



## **SECTION 260400**

### **WIRING DEVICES**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section. Submit shop drawings for checking and approval.

##### **1.1 WORK INCLUDED**

- A. The work under this section shall include the furnishing of all materials, labor, tools and services necessary to install receptacles, service fittings device plates and box covers to complete all work shown on the Drawings or specified herein.

##### **1.2 REFERENCES**

- A. FS W-C-596 - Electrical power connector, plug, receptacles and cable outlet.
- B. FS W-S-896 - Switch, toggle.
- C. NEMA WD 1 - General purpose wiring devices.
- D. NEMA WD 5 - Specific-purpose wiring devices.

##### **1.3 SUBMITTALS**

- A. Submit product data under Provisions of Contract and Division 1.
- B. Provide product data showing configurations, finishes, dimensions and manufacturer's instructions.

#### **PART 2 - PRODUCTS**

##### **2.1 RECEPTACLES**

- A. Convenience and straight-blade receptacles: 125 V, 2 pole, 3 wire, 20 ampere specification grade, ground fault interrupting or isolated ground type.
- B. Internal ground clip of receptacles shall be in one piece with the receptacle mounts.
- C. Receptacles with riveted ground clips will not be accepted.
- D. Isolated ground type receptacle shall be orange in color.

##### **2.2 WALL SWITCHES**

- A. Wall switches for lighting circuits and motor loads under 1/2 hp: AC general use snap switch with toggle handle, rated 20 amperes and 120-277 volts AC.

- B. Handle: Ivory plastic.
- C. Pilot light type: Lighted handle. Pilot strap in adjacent gang.
- D. Locator type: Lighted handle.

## 2.3 COVER PLATES

- A. Decorative cover plate: Stainless steel 302/304 smooth Hubbell "S" series.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install receptacles on roof along parapet wall.
- B. Install specific use receptacles at heights shown on contract drawings.
- C. Drill opening for poke - through fitting installation in accordance with manufacturer's instructions.
- D. Install plates on switch, receptacle, and blank outlets in finished areas, using jumbo size plates for outlets installed in masonry walls.
- E. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings and on surface mounted outlets.
- F. Install devices and wall plates flush and level.

END OF SECTION 260400



## **SECTION 260425**

### **DIGITAL LIGHTING CONTROL SYSTEM**

#### **PART 1 - GENERAL**

Applicable provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section. Submit shop drawings for checking and approval.

##### **1.1 SUMMARY**

###### **A. Section Includes**

1. Digital Lighting Controls
2. Relay Panels
3. Emergency Lighting Control (if applicable)

###### **B. Related Sections**

1. Section 260400 Wiring Devices: Receptacles
2. Section 260575 Interior Luminaires.
3. Electrical Sections, including wiring devices, apply to the work of this Section.

###### **C. Control Intent – Control Intent includes, but is not limited to:**

1. Defaults and initial calibration settings for such items as time delay, sensitivity, fade rates, etc.
2. Initial sensor and switching zones
3. Initial time switch settings
4. Task lighting and receptacle controls
5. Emergency Lighting control (if applicable)

##### **1.2 REFERENCES**

- A. American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE)
- B. Underwriter Laboratories of Canada (ULC)
- C. International Electrotechnical Commission (IEC)
- D. International Organization for Standardization (ISO)
- E. National Electrical Manufacturers Association (NEMA)
- F. WD1 (R2005) - General Color Requirements for Wiring Devices.
- G. Underwriters Laboratories, Inc. (UL)
  1. 20 – Plug Load Controls
  2. 508– Industrial Controls

3. 916 – Energy Management Equipment.
4. 924 – Emergency Lighting

### 1.3 SYSTEM DESCRIPTION & OPERATION

A. The Lighting Control and Automation system as defined under this section covers the following equipment:

1. Digital Occupancy Sensors – Self-configuring, digitally addressable and calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.
2. Digital Switches – Self-configuring, digitally addressable pushbutton on/off, dimming, and scene switches with two-way active infrared (IR) communications.
3. Handheld remotes for personal control – One-button dimming, two-button on/off, or five-button scene remotes provide control using infrared communications. Remote may be configured in the field to control selected loads or scenes without special tools.
4. Digital Daylighting Sensors – Single-zone closed loop, multi-zone open loop and single-zone dual-loop daylighting sensors with two-way active infrared (IR) communications can provide switching, bi-level, tri-level or dimming control for daylight harvesting.
5. Digital Room Controllers – Self-configuring, digitally addressable one, two or three relay plenum-rated controllers for on/off control. Selected models include 0-10 volt or line voltage forward phase control dimming outputs and integral current monitoring capabilities.
6. Digital Plug-Load Controllers – Self-configuring, digitally addressable, single relay, plenum-rated application-specific controllers. Selected models include integral current monitoring capabilities.
7. Configuration Tools – Handheld remote for room configuration and relay panel programming provides two way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away. Unit to have Organic LED display, simple pushbutton interface, and allow bi-directional communication of room variables and occupancy sensor settings. Computer software also customizes room settings.
8. Digital Lighting Management (DLM) local network – Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.
9. Digital Lighting Management (DLM) segment network – Linear topology, BACnet MS/TP network (1.5 twisted pair, shielded,) to connect multiple DLM local networks for centralized control.
10. Network Bridge – provides BACnet MS/TP-compliant digital networked communication between rooms, panels and the Segment Manager or building automation system (BAS) and automatically creates BACnet objects representative of connected devices.
11. Segment Manager – provides web browser-based user interface for system control, scheduling, power monitoring, room device parameter administration and reporting.
12. Programming and Configuration software – Optional PC-native application capable of accessing DLM control parameters within a room, for the local network, via a USB adapter, or globally, for many segment networks simultaneously, via BACnet/IP communication.

13. LMCP Digital Lighting Management Relay Panel – provides up to 8, 24, or 48 mechanically latching relays. Relays include a manual override and a single push-on connector for easy installation or removal from the panel. Panel accepts program changes from handheld configuration tool for date and time, location, holidays, event scheduling, button binding and group programming. Provides BACnet MS/TP-compliant digital networked communication between other lighting controls and/or building automation system (BAS).
14. LMZC-301 – Digital Zone Controller. Accepts program changes from handheld configuration tool for date and time, location, holidays, event scheduling, button binding and group programming. Provides BACnet MS/TP-compliant digital networked communication between other lighting controls and/or building automation system (BAS).
15. Emergency Lighting Control Unit (ELCU) – allows a standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building.

#### 1.4 LIGHTING CONTROL APPLICATIONS

- A. Unless relevant provisions of the applicable local Energy Codes are more stringent, provide a minimum application of lighting controls as follows:
  1. Space Control Requirements – Provide occupancy/vacancy sensors with Manual- or Partial-ON functionality in all spaces except toilet rooms, storerooms, library stacks, or other applications where hands-free operation is desirable and Automatic-ON occupancy sensors are more appropriate. Provide Manual-ON occupancy/vacancy sensors for any enclosed office, conference room, meeting room, open plan system and training room. For spaces with multiple occupants, or where line-of-sight may be obscured, provide ceiling- or corner-mounted sensors and Manual-ON switches.
  2. Bi-Level Lighting – Provide multi-level controls in all spaces except toilet rooms, storerooms, library stacks, or applications where variable dimming is used.
  3. Task Lighting / Plug Loads – Provide automatic shut off of non essential plug loads and task lighting in all spaces except toilet rooms and storerooms. Provide Automatic-ON of plug loads whenever spaces are occupied. For spaces with multiple occupants a single shut off consistent with the overhead lighting may be used for the area.
  4. Daylit Areas – Provide daylight-responsive automatic control in all spaces (conditioned or unconditioned) where daylight contribution is available as defined by relevant local building energy code:
    - a. All luminaires within code-defined daylight zones shall be controlled separately from luminaires outside of daylit zones.
    - b. Daytime setpoints for total ambient illumination (combined daylight and electric light) levels that initiate dimming shall be programmed in compliance with relevant local building energy codes.
    - c. Multiple-leveled switched daylight harvesting controls may be utilized for areas marked on drawings.
    - d. Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system may be designed to turn off electric lighting when daylight is at or above required lighting levels, only if system functions to turn lamps back on at dimmed level, rather than turning full-on prior to dimming.

5. Conference, meeting, training, auditoriums, and multipurpose rooms shall have controls that allow for independent control of each local control zone. Rooms larger than 300 square feet shall instead have at least four (4) pre-set lighting scenes unless otherwise specified. Occupancy / vacancy sensors shall be provided to extinguish all lighting in the space. Spaces with up to four moveable walls shall include controls that can be reconfigured when the room is partitioned.

## 1.5 SUBMITTALS

- A. Submittals Package: Submit the shop drawings, and the product data specified below at the same time as a package.
- B. Shop Drawings
  1. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed.
  2. Show exact location of all digital devices, including at minimum sensors, room controllers, and switches for each area on reflected ceiling plans. (Contractor must provide AutoCAD format reflected ceiling plans.)
  3. Provide room/area details including products and sequence of operation for each room or area. Illustrate typical acceptable room/area connection topologies.
  4. Network riser diagram including floor and building level details. Include network cable specification and end-of-line termination details, if required. Illustrate points of connection to integrated systems. Coordinate integration with mechanical and/or other trades.
- C. Product Data: Catalog sheets, specifications and installation instructions.
- D. Include data for each device which:
  1. Indicates where sensor is proposed to be installed.
  2. Prove that the sensor is suitable for the proposed application.

## 1.6 QUALITY ASSURANCE

- A. Manufacturer: Minimum [10] years experience in manufacture of lighting controls.

## 1.7 PROJECT CONDITIONS

- A. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
  1. Ambient temperature: 0° to 40° C (32° to 104° F).
  2. Relative humidity: Maximum 90 percent, non-condensing.

## 1.8 WARRANTY

- A. Provide a five year limited manufacturer's warranty on all room control devices and panels.

## 1.9 MAINTENANCE

### A. Spare Parts

1. Provide spares of each product to be used for maintenance as listed below: Refer to design documents. Coordinate with owner for quantity prior to purchase order.

## PART 2 – PRODUCTS

### 2.1 MANUFACTURERS

#### A. Acceptable Manufacturer

1. WattStopper
  - a. System: Digital Lighting Management (DLM)
2. Basis of design product: WattStopper Digital Lighting Management (DLM) or subject to compliance and prior approval with specified requirements of this section, one of the following:
  - a. Refer to design documents.

#### B. Substitutions: [If Permitted]

1. All proposed substitutions (clearly delineated as such) must be submitted in writing for approval by the design professional a minimum of 10 working days prior to the bid date and must be made available to all bidders. Proposed substitutes must be accompanied by a review of the specification noting compliance on a line-by-line basis.
2. By using pre-approved substitutions, the contractor accepts responsibility and associated costs for all required modifications to circuitry, devices, and wiring. The contractor shall provide complete engineered shop drawings (including power and control wiring) with deviations from the original design highlighted for review and approval prior to rough-in.

### 2.2 DIGITAL LIGHTING CONTROLS

- A. Furnish the Company's system which accommodates the square-footage coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors, switches, daylighting sensors and accessories which suit the lighting and electrical system parameters.

### 2.3 DIGITAL WALL SWITCH OCCUPANCY SENSORS

- A. Wallbox mounted passive infrared PIR or dual technology (passive infrared and ultrasonic) digital occupancy sensor with 1 or 2 switch buttons.
- B. Digital Occupancy Sensors shall provide scrolling LCD display for digital calibration and electronic documentation. Features include the following:
  1. Digital calibration and pushbutton configuration for the following variables:
    - a. Sensitivity – 0-100% in 10% increments
    - b. Time delay – 1-30 minutes in 1 minute increments

- c. Test mode – Five second time delay
  - d. Detection technology – PIR, Dual Technology activation and/or re-activation.
  - e. Walk-through mode
  - f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
2. Programmable control functionality including:
    - a. Each sensor may be programmed to control specific loads within a local network.
    - b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
    - c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically during the configurable period of time (default 10 seconds) after turning off.
    - d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
      - i Ultrasonic and Passive Infrared
      - ii Ultrasonic or Passive Infrared
      - iii Ultrasonic only
      - iv Passive Infrared only
  3. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
  4. Two RJ-45 ports for connection to DLM local network.
  5. Two-way infrared (IR) transceiver to allow remote programming through handheld configuration tool and control by remote personal controls.
  6. Device Status LEDs including:
    - a. PIR detection
    - b. Ultrasonic detection
    - c. Configuration mode
    - d. Load binding
  7. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
  8. Assignment of local buttons to specific loads within the room without wiring or special tools.
  9. Manual override of controlled loads.
  10. All digital parameter data programmed into an individual wall switch sensor shall be retained in non-volatile FLASH memory within the wall switch sensor itself. Memory shall have an expected life of no less than 10 years.

- C. BACnet object information shall be available for the following objects:
  - 1. Detection state
  - 2. Occupancy sensor time delay
  - 3. Occupancy sensor sensitivity, PIR and Ultrasonic
  - 4. Button state
  - 5. Switch lock control
  - 6. Switch lock status
- D. Units shall not have any dip switches or potentiometers for field settings.
- E. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.
- F. Two-button wall switch occupancy sensors, when connected to a single relay dimming room controller, shall operate in the following sequence as a factory default:
  - 1. Left button
    - a. Press and release - Turn load on
    - b. Press and hold - Raise dimming load
  - 2. Right button
    - a. Press and release - Turn load off
    - b. Press and hold - Lower dimming load
- G. Low voltage momentary pushbuttons shall include the following features:
  - 1. Load/Scene Status LED on each switch button with the following characteristics:
    - a. Bi-level LED
    - b. Dim locator level indicates power to switch
    - c. Bright status level indicates that load or scene is active
  - 2. The following button attributes may be changed or selected using a wireless configuration tool:
    - a. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
    - b. Individual button function may be configured to Toggle, On only or Off only.
    - c. Individual scenes may be locked to prevent unauthorized change.
    - d. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
    - e. Ramp rate may be adjusted for each dimmer switch.
    - f. Switch buttons may be bound to any load on a room controller and are not load type dependent; each button may be bound to multiple loads.
- H. WattStopper part numbers: LMPW, LMDW. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening.

## 2.4 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR

- A. Wall or ceiling mounted (to suit installation) passive infrared (PIR), ultrasonic or dual technology digital (passive infrared and ultrasonic) occupancy sensor.
- B. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:

1. Digital calibration and pushbutton configuration for the following variables:
  - a. Sensitivity – 0-100% in 10% increments
  - b. Time delay – 1-30 minutes in 1 minute increments
  - c. Test mode – Five second time delay
  - d. Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.
  - e. Walk-through mode
  - f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
2. Programmable control functionality including:
  - a. Each sensor may be programmed to control specific loads within a local network.
  - b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
  - c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically within a configurable period of time (default 10 seconds) after turning off.
  - d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
    - i. Ultrasonic and Passive Infrared
    - ii. Ultrasonic or Passive Infrared
    - iii. Ultrasonic only
    - iv. Passive Infrared only
3. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
4. One or two RJ-45 port(s) for connection to DLM local network.
5. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.
6. Device Status LEDs, which may be disabled for selected applications, including:
  - a. PIR detection
  - b. Ultrasonic detection
  - c. Configuration mode
  - d. Load binding
7. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
8. Manual override of controlled loads.
9. All digital parameter data programmed into an individual occupancy sensor shall be retained in non-volatile FLASH memory within the sensor itself. Memory shall have an expected life of no less than 10 years.



- C. BACnet object information shall be available for the following objects:
  - 1. Detection state
  - 2. Occupancy sensor time delay
  - 3. Occupancy sensor sensitivity, PIR and Ultrasonic
- D. Units shall not have any dip switches or potentiometers for field settings.
- E. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.
- F. WattStopper product numbers: LMPX, LMDX, LMPC, LMUC, LMDC

## 2.5 DIGITAL WALL SWITCHES

- A. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration. Wall switches shall include the following features:
  - 1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
  - 2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
  - 3. Configuration LED on each switch that blinks to indicate data transmission.
  - 4. Load/Scene Status LED on each switch button with the following characteristics:
    - a. Bi-level LED
    - b. Dim locator level indicates power to switch
    - c. Bright status level indicates that load or scene is active
  - 5. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.
  - 6. Programmable control functionality including:
    - a. Button priority may be configured to any BACnet priority level, from 1-16, corresponding to networked operation allowing local actions to utilize life safety priority
    - b. Scene patterns may be saved to any button other than dimming rockers. Once set, buttons may be digitally locked to prevent overwriting of the preset levels.
  - 7. All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.
- B. BACnet object information shall be available for the following objects:
  - 1. Button state
  - 2. Switch lock control
  - 3. Switch lock status

- C. Two RJ-45 ports for connection to DLM local network.
- D. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration shall be required to achieve multi-way switching.
- E. The following switch attributes may be changed or selected using a wireless configuration tool:
  - 1. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
  - 2. Individual button function may be configured to Toggle, On only or Off only.
  - 3. Individual scenes may be locked to prevent unauthorized change.
  - 4. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
  - 5. Ramp rate may be adjusted for each dimmer switch.
  - 6. Switch buttons may be bound to any load on a room controller and are not load type dependant; each button may be bound to multiple loads.
- F. WattStopper product numbers: LMSW-101, LMSW-102, LMSW-103, LMSW-104, LMSW-105, LMSW-108, LMDM-101. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening.

## 2.6 HANDHELD REMOTE CONTROLS

- A. Battery-operated handheld devices in 1, 2 and 5 button configurations for remote switching or dimming control. Remote controls shall include the following features:
  - 1. Two-way infrared (IR) transceiver for line of sight communication with DLM local network within up to 30 feet.
  - 2. LED on each button confirms button press.
  - 3. Load buttons may be bound to any load on a room controller and are not load type dependant; each button may be bound to multiple loads.
  - 4. Inactivity timeout to save battery life.
- B. A wall mount holster and mounting hardware shall be included with each remote control.
- C. WattStopper part numbers: LMRH-101, LMRH-102, LMRH-105.

## 2.7 DIGITAL PARTITION CONTROLS

- A. Partition controls shall enable manual or automatic coordination of lighting controls in flexible spaces with up to four moveable walls by reconfiguring the connected digital switches and occupancy sensors.
- B. Four-button low voltage pushbutton switch for manual control.
  - 1. Two-way infrared (IR) transceiver for use with configuration remote control.

2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
  3. Configuration LED on each switch that blinks to indicate data transmission.
  4. Each button represents one wall; Green button LED indicates status.
  5. Two RJ-45 ports for connection to DLM local network.
  6. WattStopper part number: LMPS-104. Available in white, light almond, ivory, grey and black; compatible with wall plates with decorator opening.
- C. Contact closure interface for automatic control via input from limit switches on movable walls (by others).
1. Operates on Class 2 power supplied by DLM local network.
  2. Includes 24VDC output and four input terminals for maintained third party contract closure inputs.
    - a. Input max. sink/source current: 1-5mA
    - b. Logic input signal voltage High: >18VDC
    - c. Logic input signal voltage Low: <2VDC
  3. Four status LEDs under hinged cover indicate if walls are open or closed; supports LMPS-104 as remote status indicator.
  4. Two RJ-45 ports for connection to DLM local network.
  5. WattStopper part number: LMIO-102

## 2.8 DIGITAL DAYLIGHTING SENSORS

- A. Digital daylighting sensors shall work with room controllers to provide automatic switching, bi-level, or tri-level or dimming daylight harvesting capabilities for any load type connected to a room controller. Daylighting sensors shall be interchangeable without the need for rewiring.
1. Closed loop sensors measure the ambient light in the space and control a single lighting zone.
  2. Open loop sensors measure incoming daylight in the space, and are capable of controlling up to three lighting zones.
  3. Dual loop sensors measure both ambient and incoming daylight in the space to insure that proper light levels are maintained as changes to reflective materials are made in a single zone.
- B. Digital daylighting sensors shall include the following features:
1. The sensor's internal photodiode shall only measure lightwaves within the visible spectrum. The photodiode's spectral response curve shall closely match the entire photopic curve. The photodiode shall not measure energy in either the ultraviolet or infrared spectrums. The photocell shall have a sensitivity of less than 5% for any wavelengths less than 400 nanometers or greater than 700 nanometers.
  2. Sensor light level range shall be from 1-6,553 foot candles (fc).
  3. The capability of ON/OFF, bi-level or tri-level switching, or dimming, for each controlled zone, depending on the selection of room controller(s) and load binding to room controller(s).

4. For switching daylight harvesting, the photosensor shall provide a field-selectable deadband, or a separation, between the "ON Setpoint" and the "OFF Setpoint" that will prevent the lights from cycling excessively after they turn off.
5. For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a field-selectable minimum level.
6. Photosensors shall have a digital, independently configurable fade rate for both increasing and decreasing light level in units of percent per second.
7. Photosensors shall provide adjustable cut-off time. Cut-off time is defined by the number of selected minutes the load is at the minimum output before the load turns off. Selectable range between 0-240 minutes including option to never cut-off.
8. Optional wall switch override shall allow occupants to reduce lighting level to increase energy savings or, if permitted by system administrator, raise lighting levels for a selectable period of time or cycle of occupancy.
9. Integral infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.
10. Configuration LED status light on device that blinks to indicate data transmission.
11. Status LED indicates test mode, override mode and load binding.
12. Recessed switch on device to turn controlled load(s) ON and OFF.
13. BACnet object information shall be available for the following daylighting sensor objects, based on the specific photocell's settings:
  - a. Light level
  - b. Day and night setpoints
  - c. Off time delay
  - d. On and off setpoints
  - e. Up to three zone setpoints
  - f. Operating mode – on/off, bi-level, tri-level or dimming
14. One RJ-45 port for connection to DLM local network.
15. A choice of accessories to accommodate multiple mounting methods and building materials. The photosensors may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox. Standard tube photosensors accommodate mounting materials from 0-0.62" thickness (LMLS-400, LMLS-500). Extended tube photosensors accommodate mounting materials from 0.62"-1.25" thickness (LMLS-400-L, LMLS-500-L). Mounting brackets are compatible with J boxes (LMLS-MB1) and wall mounting (LMLS-MB2). LMLS-600 photosensor to be mounted on included bracket below skylight well.
16. Any load or group of loads in the room can be assigned to a daylighting zone
17. Each load within a daylighting zone can be individually enabled or disabled for discrete control (load independence).
18. All digital parameter data programmed into a photosensor shall be retained in non-volatile FLASH memory within the photosensor itself. Memory shall have an expected life of no less than 10 years.

C. Closed loop digital photosensors shall include the following additional features:

1. An internal photodiode that measures light in a 100-degree angle, cutting off the unwanted light from bright sources outside of this cone.
2. Automatic self-calibration, initiated from the photosensor, a wireless configuration tool or a PC with appropriate software.

3. Automatically establishes application-specific setpoints following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling; for dimming operation a sliding setpoint control algorithm with separate Day and Night setpoints shall prevent abrupt ramping of loads.
  4. WattStopper Product Number: LMLS-400, LMLS-400-L.
- D. Open loop digital photosensors shall include the following additional features:
1. An internal photodiode that measures light in a 60-degree angle cutting off the unwanted light from the interior of the room.
  2. Automatically establishes application-specific setpoints following manual calibration using a wireless configuration tool or a PC with appropriate software. For switching operation, an adequate deadband between the ON and OFF setpoints for each zone shall prevent the lights from cycling; for dimming operation, a proportional control algorithm shall maintain the design lighting level in each zone.
  3. Each of the three discrete daylight zones can include any non overlapping group of loads in the room.
  4. WattStopper Product Number: LMLS-500, LMLS-500-L.
- E. Dual loop digital photosensors shall include the following additional features:
1. Close loop portion of dual loop device must have an internal photodiode that measures light in a 100 degree angle, cutting off the unwanted light from sources outside of this con.
  2. Open loop portion of dual loop device must have an internal photodiode that can measure light in a 60 degree angle, cutting off the unwanted light from the interior of the room.
  3. Automatically establishes application-specific set-points following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling; for dimming operation a sliding setpoint control algorithm with separate Day and Night setpoints shall prevent abrupt ramping of load.
  4. Device must reference closed loop photosensor information as a base line reference. The device must be able to analyze the open loop photosensor information to determine if an adjustment in light levels is required.
  5. Device must be able to automatically commission setpoints each night to provide adjustments to electrical lighting based on changes in overall lighting in the space due to changes in reflectance within the space or changes to daylight contribution based on seasonal changes.
  6. Device must include extendable mounting arm to properly position sensor within a skylight well.
  7. WattStopper product number LMLS-600

## 2.9 DIGITAL ROOM CONTROLLERS AND PLUG-LOAD CONTROLLERS

- A. Digital controllers for lighting and plug loads automatically bind the room loads to the connected devices in the space without commissioning or the use of any tools. Room and plug load controllers shall be provided to match the room lighting and plug load control

requirements. The controllers will be simple to install, and will not have dip switches or potentiometers, or require special configuration for standard Plug n' Go applications. The control units will include the following features:

1. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
2. Simple replacement – Using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf.
3. Multiple room controllers connected together in a local network must automatically prioritize each room controller, without requiring any configuration or setup, so that loads are sequentially assigned using room controller device ID's from highest to lowest.
4. Device Status LEDs to indicate:
  - a. Data transmission
  - b. Device has power
  - c. Status for each load
  - d. Configuration status
5. Quick installation features including:
  - a. Standard junction box mounting
  - b. Quick low voltage connections using standard RJ-45 patch cable
6. Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:
  - a. Turn on to 100%
  - b. Remain off
  - c. Turn on to last level
7. Each load shall be configurable to operate in the following sequences based on occupancy:
  - a. Auto-on/Auto-off (Follow on and off)
  - b. Manual-on/Auto-off (Follow off only)
8. The polarity of each load output shall be reversible, via digital configuration, so that on is off and off is on.
9. BACnet object information shall be available for the following objects:
  - a. Load status
  - b. Electrical current
  - c. Total watts per controller
  - d. Schedule state – normal or after-hours
  - e. Demand response control and cap level
  - f. Room occupancy status
  - g. Total room lighting and plug loads watts
  - h. Total room watts/sq ft
  - i. Force on/off all loads

10. UL 2043 plenum rated.
  11. Manual override and LED indication for each load.
  12. Dual voltage (120/277 VAC, 60 Hz), or 347 VAC, 60 Hz (selected models only). 120/277 volt models rated for 20A total load, derating to 16A required for some dimmed loads (forward phase dimming); 347 volt models rated for 15A total load; plug load controllers carry application-specific UL 20 rating for receptacle control.
  13. Zero cross circuitry for each load.
  14. All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.
- B. On/Off Room Controllers shall include:
1. One or two relay configuration
  2. Efficient 150 mA switching power supply
  3. Three RJ-45 DLM local network ports with integral strain relief and dust cover
  4. WattStopper product numbers: LMRC-101, LMRC-102
- C. On/Off/Dimming enhanced Room Controllers shall include:
1. Real time current monitoring
  2. Multiple relay configurations
    - a. One, two or three relays (LMRC-21x series)
    - b. One or two relays (LMRC-22x series)
  3. Efficient 250 mA switching power supply
  4. Four RJ-45 DLM local network ports with integral strain relief and dust cover
  5. One dimming output per relay
    - a. 0-10V Dimming - Where indicated, one 0-10 volt analog output per relay for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting. (LMRC-21x series)
    - b. Line Voltage, Forward Phase Dimming - Where indicated, one forward phase control line voltage dimming output per relay for control of compatible two-wire or three-wire ballasts, LED drivers, MLV, forward phase compatible ELV, neon/cold cathode and incandescent loads. (LMRC-22x series)
    - c. Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected ballast or driver.
    - d. The LED level indicators on bound dimming switches shall utilize this new maximum and minimum trim.

- e. Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100% dimming range defined by the minimum and maximum calibration trim.
  - f. Calibration and trim levels must be set per output channel.
  - g. Devices that set calibration or trim levels per controller are not acceptable.
  - h. All configuration shall be digital. Devices that set calibration or trim levels per output channel via trim pots or dip-switches are not acceptable.
- 6. Each load shall have an independently configurable preset on level for Normal Hours and After Hours events to allow different dimmed levels to be established at the start of both Normal Hours and After Hours events.
  - 7. Fade rates for dimming loads shall be specific to bound switch buttons, and the load shall maintain a default value for any bound buttons that do not specify a unique value.
  - 8. The following dimming attributes may be changed or selected using a wireless configuration tool:
    - a. Establish preset level for each load from 0-100%
    - b. Set high and low trim for each load
    - c. Set lamp burn in time for each load up to 100 hours
  - 9. Override button for each load provides the following functions:
    - a. Press and release for on/off control
    - b. Press and hold for dimming control
  - 10. WattStopper product numbers: LMRC-211, LRMC-212, LRMC-213, LMRC-221, LMRC-222

D. Plug Load Room Controllers shall include:

- 1. One relay configuration with additional connection for un-switched load
- 2. Configurable additive time delay to extend plug load time delay beyond occupancy sensor time delay (e.g. a 10 minute additive delay in a space with a 20 minute occupancy sensor delay ensures that plug loads turn off 30 minutes after the space is vacated).
- 3. Factory default operation is Auto-on/Auto-off, based on occupancy
- 4. Real time current monitoring of both switched and un-switched load (LMPL-201 only)
- 5. Efficient switching power supply
  - a. 150mA (LMPL-101)
  - b. 250mA (LMPL-201)
- 6. RJ-45 DLM local network ports
  - a. Three RJ-45 ports (LMPL-101)
  - b. Four RJ-45 ports (LMPL-201)
- 7. WattStopper product numbers: LMPL-101, LMPL-201.



## 2.10 DLM LOCAL NETWORK (Room Network)

- A. The DLM local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building.
- B. Features of the DLM local network include:
  - 1. Plug n' Go® automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
  - 2. Simple replacement of any device in the network with a standard off the shelf unit without requiring commissioning, configuration or setup.
  - 3. Push n' Learn® configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.
  - 4. Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.
- C. Digital room devices connect to the local network using pre-terminated Cat 5e cables with RJ-45 connectors, which provide both data and power to room devices. Systems that utilize RJ-45 patch cords but do not provide serial communication data from individual end devices are not acceptable.
- D. If manufacturer's pre-terminated Cat 5e cables are not used for the installation, the contractor is responsible for testing each cable following installation and supplying manufacturer with test results.
- E. WattStopper Product Number: LMRJ-Series

## 2.11 DLM SEGMENT NETWORK (Room to Room Network)

- A. The segment network shall be a linear topology, BACnet-based MS/TP subnet to connect DLM local networks (rooms) and LMCP relay panels for centralized control.
  - 1. Each connected DLM local network shall include a single network bridge (LMBC-300), and the network bridge is the only room-based device that is connected to the segment network.
  - 2. Network bridges, relay panels and segment managers shall include terminal blocks, with provisions for separate "in" and "out" terminations, for segment network connections.
  - 3. The segment network shall utilize 1.5 twisted pair, shielded, cable supplied by the lighting control manufacturer. The maximum cable run for each segment is 4,000 feet. Conductor-to-conductor capacitance of the twisted pair shall be less than 30 pf/ft and have a characteristic impedance of 120 Ohms.

4. Network signal integrity requires that each conductor and ground wire be correctly terminated at every connected device.
5. Substitution of manufacturer-supplied cable must be pre-approved: Manufacturer will not certify network reliability, and reserves the right to void warranty, if non-approved cable is installed, and if terminations are not completed according to manufacturer's specific requirements.
6. Segment networks shall be capable of connecting to BACnet-compliant BAS (provided by others) either directly, via MS/TP, or through NB-ROUTERS, via BACnet/IP or BACnet/Ethernet. Systems whose room-connected network infrastructure require gateway devices to provide BACnet data to a BAS are unacceptable.

B. WattStopper Product Number: LM-MSTP, LM-MSTP-DB

## 2.12 CONFIGURATION TOOLS

- A. A wireless configuration tool facilitates optional customization of DLM local networks using two-way infrared communications, while PC software connects to each local network via a USB interface.
- B. Features and functionality of the wireless configuration tool shall include but not be limited to:
  1. Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30 feet.
  2. High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.
  3. Must be able to read and modify parameters for room controllers, occupancy sensors, wall switches, daylighting sensors, network bridges and relay panels, and identify room devices by type and serial number.
  4. Save up to eight occupancy sensor setting profiles and apply profiles to selected sensors.
  5. Temporarily adjust light level of any load(s) on the local network, and incorporate those levels in scene setting. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
  6. Adjust or fine-tune daylighting settings established during auto-configuration, and input light level data to complete configuration of open loop daylighting controls.
  7. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
  8. Verify status of building level network devices.

C. WattStopper Product Numbers: LMCT-100, LMCI-100/LMCS-100

## 2.13 NETWORK BRIDGE

- A. The network bridge module connects a DLM local network to a BACnet-compliant segment network for communication between rooms, relay panels and a segment manager or BAS. Each local network shall include a network bridge component to provide a connection to the local network room devices. The network bridge shall use industry standard BACnet MS/TP network communication and an optically isolated EIA/TIA RS-485 transceiver.
1. The network bridge shall be provided as a separate module connected on the local network through an available RJ-45 port.
  2. Provide Plug n' Go operation to automatically discover room devices connected to the local network and make all device parameters visible to the segment manager via the segment network. No commissioning shall be required for set up of the network bridge on the local network.
  3. The network bridge shall automatically create standard BACnet objects for selected room device parameters to allow any BACnet-compliant BAS to include lighting control and power monitoring features as provided by the DLM room devices on each local network. BACnet objects will be created for the addition or replacement of any given in-room DLM device for the installed life of the system. Products requiring that an application-specific point database be loaded to create or map BACnet objects are not acceptable. Systems not capable of providing BACnet data for control devices via a dedicated BACnet Device ID and physical MS/TP termination per room are not acceptable. Standard BACnet objects shall be provided as follows:
    - a. Read/write the normal or after hours schedule state for the room
    - b. Read the detection state of each occupancy sensor
    - c. Read the aggregate occupancy state of the room
    - d. Read/write the On/Off state of loads
    - e. Read/write the dimmed light level of loads
    - f. Read the button states of switches
    - g. Read total current in amps, and total power in watts through the room controller
    - h. Read/write occupancy sensor time delay, PIR sensitivity and ultrasonic sensitivity settings
    - i. Activate a preset scene for the room
    - j. Read/write daylight sensor fade time and day and night setpoints
    - k. Read the current light level, in foot candles, from interior and exterior photosensors and photocells
    - l. Set daylight sensor operating mode
    - m. Read/write wall switch lock status
    - n. Read watts per square foot for the entire controlled room
    - o. Write maximum light level per load for demand response mode
    - p. Read/write activation of demand response mode for the room
    - q. Activate/restore demand response mode for the room
- B. WattStopper product numbers: LMBC-300

## 2.14 SEGMENT MANAGER

- A. For networked applications, the Digital Lighting Management system shall include at least one segment manager to manage network communication. It shall be capable of serving up a graphical user interface via a standard web browser utilizing either unencrypted TCP/IP traffic via a configurable port (default is 80) or 256 bit AES encrypted SSL TCP/IP traffic via a configurable port (default is 443).
- B. Each segment manager shall have integral support for at least three segment networks. Segment networks may alternately be connected to the segment manger via external routers and switches, using standard Ethernet structured wiring. Each router shall accommodate one segment network. Provide the quantity of routers and switches as shown on the plans.
- C. Operational features of the Segment Manager shall include the following:
  - 1. Connection to PC or LAN via standard Ethernet TCP/IP via standard Ethernet TCP/IP with the option to use SSL encrypted connections for all traffic.
  - 2. Easy to learn and use graphical user interface, compatible with Internet Explorer 8, or equal browser. Shall not require installation of any lighting control software to an end-user PC.
  - 3. Log in security capable of restricting some users to view-only or other limited operations.
  - 4. Automatic discovery of DLM devices and relay panels on the segment network(s). Commissioning beyond activation of the discovery function shall not be required to provide communication, monitoring or control of all local networks and lighting control panels.
  - 5. After discovery, all rooms and panels shall be presented in a standard navigation tree format. Selecting a device from the tree will allow the device settings and operational parameters to be viewed and changed by the user.
  - 6. Ability to view and modify room device operational parameters. It shall be possible to set device parameters independently for normal hours and after hours operation including sensor time delays and sensitivities, and load response to sensor including Manual-On or Auto-On.
  - 7. Ability to set up schedules for rooms and panels, view and override current status of panel channels and relays, and assign relays to groups. Schedules shall automatically set controlled zones or areas to either a normal hours or after hours mode of operation. Support for a minimum of 100 unique schedules, each with up to four time events per day. Support for annual schedules, holiday schedules and unique date-bound schedules.
  - 8. Ability to group rooms and loads for common control by schedules, switches or network commands.
  - 9. Ability to monitor connected load current and display power consumption for areas equipped with room controllers incorporating the integral current monitoring feature.
  - 10. Provide capabilities for integration with a BAS via BACnet protocol. At a minimum, the following points shall be available to the BAS via BACnet IP connection to the segment manager: room occupancy state; room schedule mode; room switch lock control; individual occupancy sensor state; room lighting power; room plug-load power; load ON/OFF state; load dimming level; panel channel schedule state; panel relay state; and Segment Manager Group schedule state control.

11. The Segment Manager shall allow access and control of the overall system database via Native Niagara AX FOX connectivity. Systems that must utilize a Tridium Niagara controller in addition to the programming, scheduling and configuration server are not acceptable.

- D. Segment Manager shall support multiple DLM rooms as follows:
  1. Support up to 120 network bridges and 900 digital in-room devices (LMSM-3E).
  2. Support up to 300 network bridges and 2,200 digital in room devices, connected via network routers and switches (LMSM-6E).
- E. WattStopper Product Numbers: LMSM-3E, LMSM-6E, NB-ROUTER, NB-SWITCH, NB-SWITCH-8, NB-SWITCH-16.

## 2.15 PROGRAMMING, CONFIGURATION AND DOCUMENTATION SOFTWARE

- A. PC-native application for optional programming of detailed technician-level parameter information for all DLM products, including all parameters not accessible via BACnet and the handled IR configuration tool. Software must be capable of accessing room-level parameter information locally within the room when connected via the optional LMCI-100 USB programming adapter, or globally for many segment networks simultaneously utilizing standard BACnet/IP communication.
  1. Additional parameters exposed through this method include but are not limited to:
    - a. Occupancy sensor detection LED disable for performance and other aesthetic spaces where blinking LEDs present a distraction.
    - b. Six occupancy sensor action behaviors for each controlled load, separately configurable for normal hours and after hours modes. Modes include: No Action, Follow Off Only, Follow On Only, Follow On and Off, Follow On Only with Override Time Delay, Follow Off Only with Blink Warn Grace Time, Follow On and Off with Blink Warn Grace Time.
    - c. Separate fade time adjustments per load for both normal and after hours from 0 - 4 hours.
    - d. Configurable occupancy sensor re-trigger grace period from 0 - 4 minutes separate for both normal hours and after hours.
    - e. Separate normal hours and after hours per-load button mode with modes including: Do nothing, on only, off only, on and off.
    - f. Load control polarity reversal so that on events turn loads off and vice versa.
    - g. Per-load DR (demand response) shed level in units of percent.
    - h. Load output pulse mode in increments of 1second.
    - i. Fade trip point for each load for normal hours and after hours that establishes the dimmer command level at which a switched load closes its relay to allow for staggered On of switched loads in response to a dimmer.
  2. Generation of reports at the whole file, partial file, or room level. Reports include but are not limited to:
    - a. Device list report: All devices in a project listed by type.
    - b. Load binding report: All load controller bindings showing interaction with sensors, switches, and daylighting.
    - c. BACnet points report: Per room Device ID report of the valid BACnet points for a given site's BOM.

- d. Room summary report: Device manifest for each room, aggregated by common BOM, showing basic sequence of operations.
  - e. Device parameter report: Per-room lists of all configured parameters accessible via hand held IR programmer for use with O&M documentation.
  - f. Scene report: All project scene pattern values not left at defaults (i.e. 1 = all loads 100%, 2 = all loads 75%, 3 = all loads 50%, 4 = all loads 25%, 5-16 = same as scene 1).
  - g. Occupancy sensor report: Basic settings including time delay and sensitivity(ies) for all occupancy sensors.
- 3. Network-wide programming of parameter data in a spreadsheet-like programming environment including but not limited to the following operations:
    - a. Set, copy/paste an entire project site of sensor time delays.
    - b. Set, copy/paste an entire project site of sensor sensitivity settings.
    - c. Search based on room name and text labels.
    - d. Filter by product type (i.e. LMRC-212) to allow parameter set by product.
    - e. Filter by parameter value to search for product with specific configurations.
  - 4. Network-wide firmware upgrading remotely via the BACnet/IP network.
    - a. Mass firmware update of entire rooms.
    - b. Mass firmware update of specifically selected rooms or areas.
    - c. Mass firmware upgrade of specific products.

B. WattStopper Product Number: LMCS-100, LMCI-100

## 2.16 LMCP LIGHTING CONTROL PANELS

- A. Provide lighting control panels in the locations and capacities as indicated on the plans and schedules. Each panel shall be of modular construction and consist of the following components:
  - 1. Enclosure/Tub shall be NEMA 1, sized to accept an interior with 1 - 8 relays, 1 - 24 relays and 6 four-pole contactors, or 1 - 48 relays and 6 four-pole contactors.
  - 2. Cover shall be configured for surface or flush wall mounting of the panel as indicated on the plans. The panel cover shall have a hinged and lockable door with restricted access to line voltage section of the panel.
  - 3. Interior assembly shall be supplied as a factory assembled component specifically designed and listed for field installation. The interior construction shall provide total isolation of high voltage (Class 1) wiring from low voltage (Class 2) wiring within the assembled panel. The interior assembly shall include intelligence boards, power supply, DIN rails for mounting optional Class 2 control devices, and individually replaceable latching type relays. The panel interiors shall include the following features:
    - a. Removable, plug-in terminal blocks with connections for all low voltage terminations.
    - b. Individual terminal block, override pushbutton, and LED status light for each relay.
    - c. Direct wired switch inputs associated with each relay shall support 2-wire momentary switches only.

- d. Digital inputs (four RJ-45 jacks) shall support 1-, 2-, 3-, 4-, and 8-button digital switches; digital IO modules capable of receiving 0-5V or 0-10V analog photocell inputs; digital IO modules capable of receiving momentary or maintained contact closure inputs or analog sensor inputs; digital daylighting sensors; and digital occupancy sensors. Inputs are divided into two separate digital networks, each capable of supplying 250mA to connected devices.
  - e. True relay state shall be indicated by the on-board LED and shall be available to external control devices and systems via BACnet.
  - f. Automatically sequenced operation of relays to reduce impact on the electrical distribution system when large loads are controlled simultaneously.
  - g. Group and pattern control of relays shall be provided through a simple keypad interface from a handheld IR programmer. Any set of relays can be associated with a group for direct on/off control or pattern (scene) control via a simple programming sequence using the relay override pushbuttons and LED displays for groups 1-8 or a handheld IR programmer for groups 1-99.
  - h. Relay group status shall be provided through LED indicators for groups 1-8 and via BACnet for groups 1-99. A solid LED indicates that the last group action called for an ON state and relays in the group are on or in a mixed state.
  - i. Single-pole latching relays with modular plug-in design. Relays shall provide the following ratings and features:
    - a) Electrical:
      - i 30 amp ballast at 277V
      - ii 20 amp ballast at 347V
      - iii 20amp tungsten at 120V
      - iv 30 amp resistive at 347V
      - v 1.5 HP motor at 120V
      - vi 14,000 amp short circuit current rating (SCCR) at 347V
      - vii Relays shall be specifically UL 20 listed for control of plug-loads
    - b) Mechanical:
      - i Replaceable, ½" KO mounting with removable Class 2 wire harness.
      - ii Actuator on relay housing provides manual override and visual status indication, accessible from Class 2 section of panel.
      - iii Dual line and load terminals each support two #14 - #12 solid or stranded conductors.
      - iv Tested to 300,000 mechanical on/off cycles.
4. Isolated low voltage contacts provide for true relay status feedback and pilot light indication.
5. Power supply shall be a multi-voltage transformer assembly with rated power to supply all electronics, occupancy sensors, switches, pilot lights, and photocells as necessary to meet the project requirements. Power supply to have internal over-current protection with automatic reset and metal oxide varistor protection.

6. Where indicated, lighting control panels designated for control of emergency lighting shall be provided with factory installed provision for automatic bypass of relays controlling emergency circuits upon loss of normal power. Panels shall be properly listed and labeled for use on emergency lighting circuits and shall meet the requirements of UL924 and NFPA 70 - Article 700.
7. Integral system clock shall provide scheduling capabilities for panel-only projects without DLM segment networks or BAS control.
  - a. Each panel shall include digital clock capability able to issue system wide automation commands to up to (11) eleven other panels for a total of (12) twelve networked lighting control panels. The clock shall provide capability for up to 254 independent schedule events per panel for each of the ninety-nine system wide channel groups.
  - b. The clock capability of each panel shall support the time-based energy saving requirements of applicable local energy codes.
  - c. The clock module shall provide astronomic capabilities, time delays, blink warning, daylight savings, and holiday functions and will include a battery backup for the clock function and program retention in non-volatile FLASH memory. Clocks that require multiple events to meet local code lighting shut off requirements shall not be allowed.
  - d. The clock capability of each panel shall operate on a basis of ON/OFF or Normal Hours/After Hours messages to automation groups that implement pre-configured control scenarios. Scenarios shall include:
    - i Scheduled ON / OFF
    - ii Manual ON / Scheduled OFF
    - iii Astro ON / OFF (or Photo ON / OFF)
    - iv Astro and Schedule ON / OFF (or Photo and Schedule ON / OFF)
  - e. The user interface shall be a portable IR handheld remote control capable of programming any panel in the system (LMCT-100)
  - f. The clock capability of each panel shall employ non-volatile memory and shall retain user programming and time for a minimum of 10 years.
  - g. Schedules programmed into the clock of any one panel shall be capable of executing panel local schedule or Dark/Light (photocell or Astro) events for that panel in the event that global network communication is lost. Lighting control panels that are not capable of executing events independently of the global network shall not be acceptable.
8. The lighting control panel can operate as a stand-alone system, or can support schedule, group, and photocell control functions, as configured in a Segment Manager controller, via a segment network connection.
9. The lighting control panel shall support digital communications to facilitate the extension of control to include interoperation with building automation systems and other intelligent field devices. Digital communications shall be RS485 MS/TP-based using the BACnet® protocol.
  - a. The panel shall have provision for an individual BACnet device ID and shall support the full 2<sup>22</sup> range (0 – 4,193,304). The device ID description property shall be writable via the network to allow unique identification of the lighting control panel on the network.
  - b. The panel shall support MS/TP MAC addresses in the range of 0 – 127 and baud rates of 9600k, 38400k, 76800k, and 115.2k bits per second.



- c. Lighting control relays shall be controllable as binary output objects in the instance range of 1 – 64. The state of each relay shall be readable and writable by the BAS via the object present value property.
- d. Lighting control relays shall report their true on/off state as binary input objects in the instance range of 1 – 64.
- e. The 99 group Normal Hours/After Hours control objects associated with the panel shall be represented by binary value objects in the instance range of 201 – 299. The occupancy state of each channel group shall be readable and writable by the BAS via the object present value property. Commanding 1 to a channel group will put all relays associated with the channel into the normal hours mode. Commanding 0 or NULL shall put the relays into the afterhours mode.
- f. Setup and commissioning of the panel shall not require manufacturer-specific software or a computer. All configuration of the lighting control panel shall be performed using standard BACnet objects or via the handheld IR programming remote. Provide BACnet objects for panel setup and control as follows:
  - i Binary output objects in the instance range of 1 – 64 (one per relay) for on/off control of relays.
  - ii Binary value objects in the instance range of 1 – 99 (one per channel) for normal hours/after hours schedule control.
  - iii Binary input objects in the instance range of 1 – 64 (one per relay) for reading true on/off state of the relays.
  - iv Analog value objects in the instance range of 101 – 199 (one per channel group) shall assign a blink warn time value to each channel. A value of 5 shall activate the blink warn feature for the channel and set a 5-minute grace-time period. A value of 250 shall activate the sweep feature for the channel and enable the use of sweep type automatic wall switches.
- g. The description property for all objects shall be writable via the network and shall be saved in non-volatile memory within the panel.
- h. The BO and BV 1 – 99 objects shall support BACnet priority array with a relinquish default of off and after hours respectively. Prioritized writes to the channel BV objects shall propagate prioritized control to each member relay in a way analogous to the BACnet Channel object described in addendum. (<http://www.bacnet.org/Addenda/Add-135-2010aa.pdf>)
- i. Panel-aggregate control of relay Force Off at priority 2 shall be available via a single BV5 object. Force On at priority 1 shall be available via a single BV4 object.
- j. Lockout of all digital switch buttons connected to a given panel shall be command-able via a single BV2 object. The lock status of any connected switch station shall be represented as BV101-196.

10. WattStopper Product Number: LMCP8, LMCP24 or LMCP48

- B. User Interface: Each lighting control panel system shall be supplied with at least (1) handheld configuration tool (LMCT-100). As a remote programming interface the configuration tool shall allow setup, configuration, and diagnostics of the panel without the need for software or connection of a computer. The user interface shall have the following panel-specific functions as a minimum.

1. Set network parameters including panel device ID, MS/TP MAC address, baud rate and max master range.
2. Relay Group creation of up to 99 groups. Group creation shall result in programming of all seven key relay parameters for member relays. The seven parameters are as follows: After-hours Override Time Delay, Normal Hours Override Time Delay, Action on Transition to Normal Hours, Action on Transition to After Hours, Sensor Action During Normal Hours, Sensor Action During After Hours, Blink-Warn Time for After Hours.
3. Program up to 254 separate scheduled events. Events shall occur on seven day intervals with each day selectable as active or inactive and shall be configurable as to whether the event is active on holidays. Holidays are also defined through the User Interface.
4. Program up to 32 separate Dark/Light events. Events shall have a selectable source as either calculated Astro with delay, or a digital IO module with an integral 0-5V or 0-10V analog photocell. Dark/Light events shall occur on seven day intervals with each day selectable as active or inactive and shall be configurable as to whether the event is active on holidays.
5. Button binding of digital switches to groups shall be accessible via the handheld IR remote and accomplished from the digital switch station.
6. Programming of panel location information shall be accomplished by the handheld IR remote and include at a minimum LAT, LON, DST zone, and an approximate city/state location.
7. An additional handheld IR remote may optionally be specified to be permanently mounted to the panel interior via a retractable anti-theft lanyard to allow for convenient programming of the panel while assuring that the handheld programmer is always present at that panel. An unlimited number of handheld IR remotes may also be purchased for facilities staff as determined by the end user's representative.
8. WattStopper Product Number: LMCT-100

## 2.17 EMERGENCY LIGHTING CONTROL DEVICES

- A. Emergency Lighting Control Unit – A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides normal ON/OFF control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include:
  1. 120/277 volts, 50/60 Hz, 20 amp ballast rating
  2. Push to test button
  3. Auxiliary contact for remote test or fire alarm system interface
- B. WattStopper Product Numbers: ELCU-100, ELCU-200.

## PART 3 – EXECUTION

### 3.1 OPTIONAL PRE-INSTALLATION MEETING

- A. A factory authorized manufacturer's representative shall provide the electrical contractor a functional overview of the lighting control system prior to installation. The contractor shall schedule the pre-installation site visit after receipt of approved submittals to review the following:
  - 1. Confirm the location and mounting of all digital devices, with special attention to placement of occupancy and daylighting sensors.
  - 2. Review the specifications for low voltage control wiring and termination.
  - 3. Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.
  - 4. Discuss requirements for integration with other trades.

### 3.2 CONTRACTOR INSTALLATION AND SERVICES

- A. Contractor to install all devices and wiring in a professional manner. All line voltage connections to be tagged to indicate circuit and switched legs.
- B. Contractor to install all room/area devices using manufacturer's factory-tested Cat 5e cable with pre-terminated RJ-45 connectors. If pre-terminated cable is not used for room/area wiring, the contractor is responsible for testing each field-terminated cable following installation and shall supply the lighting controls manufacturers with test results. Contractor to install any room to room network devices using manufacturer-supplied LM-MSTP network wire. Network wire substitution is not permitted and may result in loss of product warranty per DLM SEGMENT NETWORK section of specification. Low voltage wiring topology must comply with manufacturer's specifications. Contractor shall route network wiring as shown in submittal drawings as closely as possible, and shall document final wiring location, routing and topology on as built drawings.
- C. Install the work of this Section in accordance with manufacturer's printed instructions unless otherwise indicated. Before start up, contractor shall test all devices to ensure proper communication.
- D. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings. Adjust time delay so that controlled area remains lighted while occupied.
- E. Provide written or computer-generated documentation on the configuration of the system including room by room description including:
  - 1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
  - 2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
  - 3. Load Parameters (e.g. blink warning, etc.)
- F. Post start-up tuning – After 30 days from occupancy contractor shall adjust sensor time delays and sensitivities to meet the Owner's requirements. Provide a detailed report to the Architect / Owner of post start-up activity.

### 3.3 FACTORY SERVICES COMMISSIONING

- A. Upon completion of the installation, the manufacturer's factory authorized representative shall start up and verify a complete fully functional system.
- B. The Electrical Contractor shall provide both the manufacturer and the electrical engineer with three weeks written notice of the system start up and adjustment date.
- C. Upon completion of the system start up, the manufacturers factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system.

END OF SECTION 260425

**SECTION 260450**  
**CABINETS AND ENCLOSURES**

**PART 1 - GENERAL**

Applicable Provisions of the conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

**1.1 WORK INCLUDED**

- A. The work under this section shall include the furnishing of all materials, labor, tools and services necessary to install hinged cover enclosures to complete all work shown on the Drawings or specified herein.

**1.2 REFERENCES**

- A. NEMA 250 - Enclosures for electrical equipment (1000 volts maximum).
- B. Submittals - Submit product data under Provisions of Contract and Division 1.

**PART 2 - PRODUCTS**

**2.1 HINGED COVER ENCLOSURES**

- A. Construction: NEMA 250; Type 1 and 3R steel.
- B. Finished: Manufacturer's standard enamel finish.
- C. Covers: Continuous hinge, held closed by operable by key.
- D. Provide barriers between normal and emergency wiring. Barriers shall be of non-current carrying material of adequate thickness for mechanical strength but in no case less than 1/4". Each barrier shall have an angle iron framing support all around.

**2.2 FABRICATION**

- A. Shop assemble enclosures in accordance with ANSI/NEMA ISC 6.
- B. Provide knockouts on enclosures.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Install enclosures plumb; Anchor securely to wall and structural supports at each corner, minimum.
- B. Provide necessary feet for free-standing equipment enclosures.
- C. Install trim plumb.

END OF SECTION 250450



## **SECTION 260500**

### **SUPPORTING DEVICES**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section. Submit shop drawings for checking and approval.

##### **1.1 WORK INCLUDED**

- A. The work under this section shall include the furnishing of all material, labor, tools and services necessary to install rigid metal conduit, electrical metallic tubing and flexible metal conduit, including all fittings to complete all work shown on the Drawings or specified herein.

##### **1.2 RELATED WORK**

- A. Conduit and equipment supports.
- B. Fastening hardware.

##### **1.3 REFERENCES**

- A. Conduit supports.

##### **1.4 QUALITY ASSURANCE**

- A. Support system shall be adequate for weight of equipment and conduit, including wiring, which they carry.

#### **PART 2 - PRODUCTS**

##### **2.1 MATERIALS**

- A. Support channel: Galvanized or painted steel.
- B. Hardware: Corrosion resistant.

#### **PART 3 - EXECUTION**

##### **3.1 INSTALLATION**

- A. Fasteners in Pre-Cast Concrete: Fastener system of type for suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other necessary devices for attaching hangers of type required and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing in accordance to ASTM E1190 conducted by a qualified independent agency. Anchors shall not be installed where reinforcing strands are located in plank. Review pre-cast plank shop drawings to determine location.

- B. Refer to pre-cast concrete plank shop drawings for location of strand reinforcing and cores. Do not anchor where reinforcing is located. Use fasteners in concrete, toggle bolts or thru-core anchors with plates supported on top of plank in cores.
- C. Fasten hanger rods, conduit clamps, outlet, junction boxes to building structure using preset inserts, beam clamps and spring steel clips.
- D. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; Expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchors on concrete surfaces; sheet metal screws in sheet metal studs and wood screws in wood construction.
- E. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit.
- F. Do not use powder-actuated anchors.
- G. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.
- H. In wet locations install free-standing electrical equipment on concrete pads.
- I. Install surface mounted cabinets and panelboards with minimum of four anchors. Provide steel channel supports to stand cabinet one inch off wall.
- J. Bridge studs top and bottom with channels to support flush mounted cabinets and panelboards in stud walls.

END OF SECTION 260500



## **SECTION 260550**

### **GENERAL LABELING AND IDENTIFICATION**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

##### **1.1 WORK INCLUDED**

- A. The work under this section shall include the furnishing of all material, labor, tools and services necessary to install nameplates, tape labels, wire markers, conduit color coding to complete all work shown on the Drawings or specified herein.

##### **1.2 RELATED WORK**

- A. Painting.

##### **1.3 SUBMITTALS**

- A. Submit shop drawings under provisions of Division 1.
- B. Include schedule for nameplates and tape labels.

#### **PART 2 - PRODUCTS**

##### **2.1 MATERIALS**

- A. Nameplates: Engraved three-layer laminated plastic, white letters on a black background.
- B. Tape labels: Embossed adhesive tape with 3/16 inch black letters on a white background.
- C. Wire and cable markers: Cloth markers, split sleeve or tubing type.

#### **PART 3 - EXECUTION**

##### **3.1 INSTALLATION**

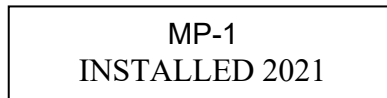
- A. De-grease and clean surfaces to receive nameplates and tape labels.
- B. Install nameplates and tape labels parallel to equipment lines.
- C. Secure nameplates to equipment fronts using screws, rivets, or adhesive. Secure nameplate to inside face of recessed panelboard doors in finished locations.
- D. Embossed tape will not be permitted for any application. Use embossed tape only for identification of individual wall switches and receptacles and control device stations.

### 3.2 WIRE IDENTIFICATION

- A. Provide wire markers on each conductor in panelboard gutters, pull boxes, outlet and junction boxes and at load connection. Identify each branch circuit or feeder number for power and lighting circuits and each control wire number as indicated on equipment manufacturer's shop drawings for control wiring.

### 3.3 NAMEPLATE ENGRAVING SCHEDULE

- A. Provide nameplates to identify all electrical distribution, control equipment and loads served including year of installation. Letter height: 1/2 inch for individual switches, loads served, distributions and control equipment identification. For example:



- B. Panelboards: 3/4 inch, identify equipment designation. 1/2 inch, identify voltage rating and source of power.
- C. Individual circuit breakers, switches and motor starters in panelboards, switchboards and motor control centers: 1/4 inch, identify circuit and load served, including location.
- D. Individual circuit breakers, enclosed switches and motor starters: 1/2 inch, identify load served.

### 3.4 FIRE ALARM

- A. All fire alarm raceway components shall be painted red and identified.

END OF SECTION 260550

## **SECTION 260575**

### **INTERIOR LUMINAIRES**

#### **PART 1 - GENERAL**

Applicable provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section. Submit shop drawings for checking and approval.

##### **1.1 WORK INCLUDED**

- A. Interior luminaires and accessories.
- B. Emergency lighting units.
- C. Exit signs.
- D. LED Driver.
- E. LED dimming and controls.
- F. LED emergency power supply.
- G. Lamps.
- H. Luminaire accessories.

##### **1.2 REFERENCES**

- A. ANSI/IES RP-16-10 – Nomenclature and Definitions for Illuminating Engineering.
- B. ANSI C78.37 7 – Specifications for the Chromaticity of Solid-State Lighting (SSL) Products.
- C. IES LM-79-08 – Electric and Photometric Measurements of Solid-State Lighting Products.
- D. IES LM-80-08 – Measuring Lumen Maintenance of LED Light Sources.
- E. IES 7M-21-11 – Projecting Long Term Lumen Maintenance of LED Light Sources.
- F. IES LM-82-11 – IES Approved Method for the Characterization of LED Light Engines and LED Lamps for Electrical and Photometric Properties as a Function of Temperature.
- G. UL 8750 – LED Equipment for Use in Lighting Products.
- H. NEMA WD 6 - Wiring Devices – Dimensional Requirements.
- I. NFPA 70 - National Electrical Code.
- J. NFPA 101- Life Safety Code.

### 1.3 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.

### 1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70 and to requirements of NFPA 101.
- B. Products: Listed and classified by Underwriters Laboratories, Inc. (UL), American National Standards Institute (ANSI) and Illuminating Engineering Society (IES).

### 1.5 SUBSTITUTIONS

- A. All proposed substitutions must be submitted with each light fixture specification cutsheet, accompanied with footcandle calculation for all spaces, provided for Architect and Engineer's review, prior to approval.
- B. If the substitution is accepted, the contractor accepts responsibility and associated costs for all required modifications to circuitry, devices, and wiring.

## PART 2 - PRODUCTS

### 2.1 LUMINAIRES

- A. Furnish Products as scheduled.

### 2.2 EXIT SIGNS

- A. Manufacturers: As scheduled.
- B. Description: Exit sign fixture suitable for use as emergency lighting unit.
- C. Housing: Extruded aluminum or steel as per schedule.
- D. Face: Aluminum stencil face with red letters, unless otherwise noted.
- E. Directional Arrows: Universal type for field adjustment, direction per drawing.
- F. Mounting: Universal, for field selection or per drawing.
- G. Lamps: L.E.D.
- H. Input Voltage: As scheduled.

### 2.3 LED DRIVERS

- A. Manufacturers: As scheduled.
- B. Voltage: As scheduled.

## 2.4 LAMPS

- A. Lamp Types: As specified for luminaire. LED source.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install suspended luminaires and exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.
- B. Support luminaires 2 x 4 foot (600 x 1200 mm) and larger in size independent of ceiling framing.
- C. All lay-in luminaires shall be supported with chains to building structure.
- D. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.
- E. Exposed Grid Ceilings: Support surface mounted luminaires on grid ceiling directly from building structure. Provide auxiliary members spanning ceiling grid members to support surface mounted luminaires. Fasten surface mounted luminaires to ceiling grid members using bolts, screws, rivets, or suitable clips.
- F. Install wall mounted luminaires, emergency lighting units and exit signs at 80" above finished floor, unless otherwise noted.
- G. Install accessories furnished with each luminaire.
- H. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- I. Bond products and metal accessories to branch circuit equipment grounding conductor.
- J. Install specified lamps in each emergency lighting unit, exit sign, and luminaire.

### 3.2 FIELD QUALITY CONTROL

- A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

### 3.3 ADJUSTING

- A. Aim and adjust luminaires as indicated.
- B. Position exit sign directional arrows as indicated.

### 3.4 CLEANING

- A. Clean electrical parts to remove conductive and deleterious materials.
- B. Remove dirt and debris from enclosures.
- C. Clean photometric control surfaces as recommended by manufacturer.
- D. Clean finished and touch up damage.

### 3.5 PROTECTION OF FINISHED WORK

- A. Relamp luminaires that have failed lamps as substantial completion.

END OF SECTION 260575

## **SECTION 260600**

### **DISCONNECT SWITCHES**

#### **PART 1 - GENERAL**

Applicable provisions of the conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

##### **1.1 WORK INCLUDED**

- A. The work under this section shall include the furnishing of all materials, labor, tools and services necessary to install disconnect switches, fuses and enclosures to complete all work shown on the Drawings or specified herein.

##### **1.2 SUBMITTALS**

- A. Submit product data under Provisions of Contract and Division 1.
- B. Include outline Drawings with dimensions, equipment ratings for voltage, capacity, horsepower and short circuit.

#### **PART 2 - PRODUCTS**

##### **2.1 ACCEPTABLE MANUFACTURERS - DISCONNECT SWITCHES**

- A. Siemens.
- B. Square D.
- C. General Electric.
- D. Or approved equal.

##### **2.2 DISCONNECT SWITCHES**

- A. Fusible switch assemblies: Quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch is in ON position. Handle lockable in OFF position. Fuse clips: Designed to accommodate class R, J fuses.
- B. Non-fusible switch assemblies: Quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.
- C. Enclosures: NEMA Type 1; 3R; 4 as indicated on Drawings.

## 2.3 ACCEPTABLE MANUFACTURERS - FUSES

- A. Bussman.
- B. Ferraz-Shawmut.
- C. Or approved equal.

## 2.4 FUSES

- A. Fuses 600 amperes and less: ANSI/UL 198E, class RK1; RK5; Dual element, current limiting, time delay, 250 volt.
- B. Interrupting rating: 200,000 rms amperes.
- C. An additional fuse of each size required to be supplied.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install disconnect switches where indicated on Drawings.
- B. Install fuses in fusible disconnect switches.
- C. Disconnects installed outdoors shall have NEMA 3R enclosures.
- D. Disconnects installed indoors in dry locations shall have NEMA 1 enclosure.

END OF SECTION 260600



## **SECTION 260650**

### **GROUNDING**

#### **PART 1 - GENERAL**

Applicable provisions of the conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

##### **1.1 WORK INCLUDED**

- A. The work under this section shall include the furnishing of all materials, labor, tools and services necessary to install the power system grounding to complete all work shown on the Drawings or specified herein.

##### **1.2 RELATED WORK**

- A. Panelboards.
- B. Raceways.
- C. Connection Equipment.
- D. Electric Equipment.
- E. Tests and Acceptance.
- F. Transformers.
- G. Electric Service.

##### **1.3 SUBMITTALS**

- A. Manufacturers' data, catalog cuts of ground rods, connectors, bushings, etc., along with recommended installation procedures.

#### **PART 2 - PRODUCTS**

##### **2.1 WIRING**

- A. All wiring used for grounding shall be insulated copper, unless otherwise noted. Size shall be in accordance with code for the application, minimum #12.
- B. Where used in conjunction with computer equipment, grounding conductors shall be equal in size to the phase conductors.
- C. Avoid splices in ground conductors.

## 2.2 RACEWAY

- A. Grounding continuity shall be maintained for all metallic raceways.
- B. Provide bonding jumpers across metal parts separated by non-conducting materials.
- C. Where a grounding conductor is installed as a supplement to metallic raceway serving as the equipment grounding conductor, bonding conductor to the raceway at each end.
- D. All raceway accessories, such as locknuts, bushings, expansion fittings, etc. shall be installed to provide maximum metal-to-metal bonding.

## 2.3 CLAMPS

- A. Provide approved ground clamps for connecting grounding conductors to pipe, conduits, wireways, building steel, grounding rods, etc.
- B. Where bond will be in an inaccessible location or as an alternate to ground clamps, provide exothermic weld, similar to Cadweld.

## 2.4 ACCESSORIES

- A. Provide all necessary accessories of appropriate size and material for connection or termination of grounding conductors including:
  - 1. Straps.
  - 2. Clamps.
  - 3. Lugs.
  - 4. Bars and buses.
  - 5. Isolators (where applicable).
  - 6. Locknuts and bushings.

## 2.5 ACCEPTABLE MANUFACTURERS

- A. Copperweld.
- B. Cadweld (for exothermic welds).
- C. O.Z. Gedney.
- D. Burndy.

## PART 3 - EXECUTION

### 3.1 TRANSFORMERS

- A. Bond each transformer secondary neutral to nearest building structural column or beam via transformer case grounding stud.
- B. Provide jumper between transformer case and all conduit bushings.

- C. Where a separate equipment-grounding conductor is provided the primary and/or secondary feeders; bond to transformer grounding stud.
- D. Where isolation shield is provided, bond to transformer grounding stud.
- E. Where a separate ground riser is provided in addition to or instead of building steel; bond transformer-grounding stud to the ground riser.

### 3.2 STRUCTURAL STEEL BUILDINGS

- A. Select a column common to aligned electric closets as the bonding column for grounding of transformer neutrals, isolated grounds and separate equipment grounding conductors.
- B. All grounding conductors in each closet shall be bonded in close proximity to one another.
- C. Where a grounding conductor to be bonded is not in proximity to the common column, bond to the nearest column or structural beam.
- D. Provide bonding jumper strap across all structural expansion joints where the grounding integrity of the structural system is reduced

### 3.3 RACEWAYS

- A. Grounding continuity is to be maintained for all metallic raceways. Provide necessary clamps, bushings, straps and locknuts to assure continuity.
- B. For non-metallic or flexible raceways, provide a separate equipment-grounding conductor bonded to both ends.
- C. Where indicated, an additional equipment-grounding conductor shall be provided in metallic raceway.
- D. Where indicated, an isolated ground conductor shall be provided in addition to the equipment-grounding conductor. Bond at each end to the isolated ground terminal identified.

### 3.4 EQUIPMENT

- A. All equipment shall be grounded.
- B. Where isolated grounding is indicated, it shall be for the isolation of internal equipment components only. All metallic enclosures of such equipment shall be connected to the equipment ground system.

### 3.5 PANELBOARDS

- A. All panelboards and distribution panels shall be provided with a ground bar bonded to the enclosure. Provide an isolated ground bar connected to the incoming feeder ground where indicated.

### 3.6 TESTING

- A. Upon completion of the installation, confirm the grounding continuity of all raceways, conductors and equipment. Maximum allowable resistance is 25 ohms.

### 3.7 RECORD DRAWINGS

- A. Submit record As-Built Drawings indicating the location of all points where grounding conductors are bonded to steel, rods, plates, etc.
- B. Indicate the location of all grounding buses not installed within distribution equipment.

END OF SECTION 260650

## **SECTION 260675**

### **HIGH PERFORMANCE K-7 DRY-TYPE TRANSFORMERS**

#### **PART 1 - GENERAL**

Applicable provisions of the conditions of the Contract and Division 1 General Requirements govern the work in this section. Submit shop drawings for checking and approval.

##### **1.1 WORK INCLUDED**

- A. Fabricate and test low voltage dry-type distribution transformers as described in this specification and on the Drawings.

##### **1.2 SUMMARY**

- A. Transformers on this project significantly exceed basic DOE 2016 requirements being optimized to provide 33% energy savings on average compared to a comparable DOE 2016 transformer when feeding predominately electronic equipment in the 0-25% loading range.
- B. General Purpose Transformers do NOT meet this specification as they do not carry a UL Listing for this application.
- C. Other highlights of requirements of this specification include:
  - 1. Copper wound.
  - 2. K-7 rated.
  - 3. No load loss limits.
  - 4. Efficiency under nonlinear loading to ensure real world performance.
  - 5. 105% continuous duty overload capacity
  - 6. Performance Validation Reports for each unit shipped on project signed by a professional engineer.
  - 7. Lockable Hinged Door to reduce arc flash risk when accessing for maintenance & thermal scans.
- D. Information to be submitted with bid:
  - 1. Line-by-line compliance, deviation, exception for this specification
  - 2. Performance Guarantee by Manufacturer that ALL transformers on this project will meet specified performance.
  - 3. Failure to provide this information will result in a non-compliant proposal.

##### **1.1 REFERENCES**

- A. US Department of Energy, 10 CFR Part 431 – Energy Efficiency Program for Certain Commercial and Industrial Equipment, Subpart K – Distribution Transformers.
- B. US Department of Energy, 10 CFR Part 429 – Certification, Compliance, and Enforcement for Consumer Products and Commercial and Industrial Equipment.

- C. ANSI/NEMA ST 20 - 2014 - Dry Type Transformers for General Applications.
- E. Metering Standards:
  - 1. Computational algorithms per IEEE Std 1459-2000
  - 2. UL 916, UL 61010C-1 CAT III
- F. IEEE C57.110-2008 – IEEE Recommended Practice for establishing liquid-filled and dry-type power distribution transformer capability when feeding nonsinusoidal load currents
- G. IEEE Std C57.12.91-1995 Standard Test Code for Dry-Type Transformers
- H. IEEE-1100 – Recommended Practice for Powering and Grounding Sensitive Electronic Equipment
- I. LEED – Leadership in Energy and Environmental Design, U.S. Green Building Council.
- J. Seismic Qualification References: International Building Code, 2006/2009 Edition, California Building Code, 2007/2010 Edition, ASCE Standard 7, 2005 Edition to OSHPD CAN 2-1708A.5, Rev. , ICC-ES AC 156, Effective 01/01/2007, OSHPD
- K. ISO 9001:2008 – International Standards Organization - Quality Management System
- L. ISO 14001:2004 – International Standards Organization - Environmental Management System
- M. ISO 17025 – International Standards Organization - General requirements for the competence of testing and calibration laboratories

## 1.2 BID PROPOSAL

### A. Compliance Review

- 1. Submit a complete copy of these specifications with each subparagraph marked either "compliance", "deviation", or "exception". Fully describe all deviations and exceptions taken to this specification.
  - a. "Compliance": Comply with no exceptions.
  - b. "Deviation": Comply with deviations. For each and every deviation, provide a numbered footnote with reasons for the proposed deviation and how the intent of the Specification can be satisfied.
  - c. "Exception": Exception, do not comply. For each and every exception, provide a numbered footnote with reasons and possible alternatives.
- 2. Unless a deviation or exception is specifically noted in the Compliance Review, it is assumed that the Bidder is in complete compliance with this Specification. Deviations or exceptions taken in cover letters, subsidiary documents, by omission or by contradiction do not release the Bidder from being in complete compliance, unless the exception or deviation has been specifically noted in the Compliance Review. Bidders may submit the latest state-of-the-art components and their standard control components in lieu of the specified items. All deviations from the Specifications must be approved by the Architect/Engineer.

3. Failure to provide this information will result in a non-compliant proposal.

1.3 SUBMITTALS - Submit product data including the following:

- A. Manufacturer documentation guaranteeing that ALL units on the project will comply with the performance requirements of this specification.
- B. Where one or more of the integrated transformer options is selected for this project, provide associated documentation.
- C. Insulation system impregnant data sheet as published by supplier.
- D. Construction details including enclosure dimensions, kVA rating, primary & secondary nominal voltages, voltage taps, BIL, unit weight.
- E. Basic Performance characteristics including insulation class, temperature rise, core and coil materials, impedances & audible noise level, unit weight.
- F. Manufacturer documentation that sizing primary protection at 125% of nominal full load amps will not result in nuisance tripping on transformer inrush.
- G. Documentation of UL listing of 2" clearance from ventilated surface.
- H. Inrush Current (typical 3 cycle recovery).
- I. Short Circuit Current data: Primary & Secondary.
- J. Efficiency, Loss & Heat output Data.
- K. No load and full load losses per NEMA ST20.
- L. Linear load data @ 1/6 load.
- M. Linear load data @ 1/4, 1/2, 3/4 & full load.
- N. Linear Load efficiency @ 35% loading tested per NEMA TP-2.
- O. Efficiency under K7 load profile at 16.7%, 25%, 50%, 75%, 100% of nameplate rating.
- P. Factory ISO 9001 procedure describing nonlinear load test program.
  - 1. Meter and CT details including model, accuracy, serial numbers and calibration information.
- Q. 32 year Product and Performance Warranty Certificate.
- R. Manufacturer's ISO 14001:2004 Certification.
- S. Manufacturer's ISO 9001:2008 Certification.
- T. ISO 17025 Certificate - Efficiency Test Lab where transformers are tested.

- U. Documentation that materials used for shipment packaging meet the environmental requirements of this specification.
- V. For LEED projects, provide the following additional submittal information:
  - 1. Optimize Energy Performance: Provide savings calculations vs. DOE 2016 baseline reference.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Comprehensive Operations and Maintenance Manual.
- B. Applicable wiring diagrams, including any modifications made.
- C. Copies of completed factory and site testing reports.

#### 1.5 NONLINEAR LOAD TEST PROGRAM

- A. Efficiency shall be determined by actual measurements using a nonlinear load bank. Calculations based on software modeling is not acceptable.
- B. Nonlinear Load Testing shall be carried out by an ISO 17025 Certified Efficiency Test Lab, and follow a defined protocol, independently audited within the manufacturer's certified ISO system.
- C. Follow IEEE Std C57.12.91-1995 Standard Test Code for Dry-Type Transformers to determine efficiency. Proprietary or non-standard methodology is not acceptable.
- D. The nonlinear load bank shall consist of phase-neutral loads, representative of a mix of electronic equipment.
- E. Meters and CTs shall both be revenue class accurate and carry current calibration certificates. CTs shall be operated within their approved accuracy loading range. Dual meters shall gather simultaneous primary and secondary energy and harmonic data. Meter and CT details including model, accuracy, serial numbers and calibration information.
- F. Efficiency: Measurements shall be taken at multiple load levels and plotted to show compliance with specification and correlation to the designed efficiency curve.
- G. Harmonic data including current and Voltage THD at the different load levels shall be included with the test report.

#### 1.6 PACKAGING FOR SHIPMENT

- A. Transformers shall be packaged for shipment using materials that reduce environmental impact:
  - 1. Transformer Wrapping
    - a. Transformers shall be wrapped for shipment in material that is recyclable or compostable at the destination



2. Transformer Shipping Base
  - a. Transformers shall be shipped on a base that uses at least 50% less wood than traditional pallets.
  - b. Wood used in the shipping base shall be Forestry Stewardship Council (FSC) certified as having been sustainably harvested.
3. Shall minimize labor, risk of injury and equipment damage, while handling from initial transportation through to final placement of the transformer.

#### 1.7 DELIVERY, STORAGE AND HANDLING

- A. Store and protect products.
- B. Store in a warm, dry location with uniform temperature. Cover ventilation openings to keep out dust, water and other foreign material.
- C. Handle transformers using lifting eyes and/or brackets provided for that purpose. Protect against unfavorable external environment such as rain and snow, during handling.

#### 1.8 WARRANTY

- A. Transformer shall carry a 32-year pro-rated warranty, which shall be standard for the product line.
- B. Guaranteed Performance: Manufacturer warranty shall explicitly state that every transformer is guaranteed to meet published performance data.
- C. Manufacturer warranty shall remain in effect through a qualified seismic event.

#### 1.9 COMMERCIAL PRODUCT

- A. Transformer shall be a standard item in the manufacturer's catalog.

#### 1.10 FACTORY WITNESS TESTING

- A. At time of order, the customer may request that the project engineer or other designated customer representative witness the performance testing of one or more of the transformers on the project at the manufacturer's facility, along with a demonstration of integrated metering option if specified.

#### 1.11 PERFORMANCE VALIDATION REPORTS

- A. A Performance Validation Report shall be provided for EACH transformer shipped on this project as follows:
  1. Documentation shall be certified and signed by a (factory) professional engineer (PE), and identify each product by model and serial number.
  2. Transformers shall be tested in an ISO 17025 Certified Test Lab.

3. Validation Report shall contain two components:
  - a. Test Report per DOE Test Method for Measuring the Energy Consumption of Distribution Transformers under Appendix A to Subpart K of 10 CFR part 431, identifying no load losses, and efficiency at 35% loading.
  - b. Routine Test Report per NEMA ST20 including audible noise test for each unit.

#### 1.12 INTERNATIONAL STANDARDS ORGANIZATION REGISTRATION

- A. Registration of the manufacturer to current versions of the following ISO standards is required.
  1. ISO 9001:2008 – Quality Management System
  2. ISO 14001:2004 – Environmental Management System

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS/PRODUCT

- A. Basis of Design: E-Saver-33L by Powersmiths International Corp. (contact Andy Topinka – [andy@tgs-inc.com](mailto:andy@tgs-inc.com) 862-210-8126).
- B. Manufacturers wishing to have products evaluated for acceptability and conformance with the performance requirements of this specification, shall provide detailed compliance and/or exception statements, along with the documentation required in the submittal section, including test documentation, signed by an engineer, that confirms that the transformer(s) meets the specified performance.
- C. Failure to provide the required documentation no less than 7 days prior to the bid date will disqualify products from consideration for this project.

#### 2.2 TRANSFORMER SPECIFICATION

- A. Compatibility: This product must facilitate the ability of the electrical system to supply a sinusoidal voltage in order to improve the long-term compatibility of the electrical system with both linear and nonlinear loads.
- B. 3-phase, common core, ventilated, dry-type, isolation transformer built to UL1561, NEMA ST20 and other relevant NEMA, UL and IEEE standards; 200% rated neutral; 60Hz rated; Transformers shall be UL or cUL Listed, and/or CSA Approved. All terminals, including those for changing taps, must be readily accessible by removing a front cover plate. Windings shall be continuous with terminations brazed or welded. 10kV BIL.
- C. Lugs are not provided by the transformer manufacturer.
- D. Winding Material: Copper
- E. K-Rating: K-7 (per IEEE-C57.110)

- F. Impedance: 4.0% or greater (unless otherwise noted) in order to manage downstream fault and arc flash levels, and required downstream component fault interrupting (kAIC) ratings.
- G. Inrush: Inrush currents are managed in order to avoid nuisance tripping of the primary breaker and to enable the use of standard 125% rated primary protection, thereby avoiding expensive design changes that otherwise may be needed.
- H. Operating Temperature Rise: 130 degree C in a 40 degree C maximum ambient.
- I. Continuous Duty Overload Capacity: 105% of nominal kVA Rating.
- J. Voltage Taps: For transformers 15kVA-750kVA, provide two 2-1/2% full capacity taps above and four 2-1/2% taps below nominal primary voltage.
- K. Audible Noise levels:
1. Every unit to meet required noise level. Production Test every unit. Data to be available upon request.
  2. Must meet 3 dB quieter than NEMA ST-20 as follows:
    - a. Up to 50kVA: 42dB, 51-150kVA: 47dB, 151-300kVA: 52dB, 301-500kVA: 57dB, 501-700kVA: 59dB, 701-1000kVA: 61dB
- L. Enclosure type: Ventilated NEMA 1 enclosure with Lockable Hinged Doors
1. Provide lockable hinged doors on the transformer to facilitate access in support of NFPA 70E/CSA-Z462 Arc Flash Standard to minimize arc flash risk when opening the enclosure of live equipment.
- M. Rear Clearance: UL Listed for 2" clearance from the wall rather than standard 6". This capability shall be explicitly described on the nameplate of each unit.
- N. Exceed minimum efficiency requirements of US Department of Energy, 10 CFR Part 431 (DOE 2016), by complying with the table of Maximum No Load Losses, efficiency requirements at 1/6 load, efficiency at 35% load, and efficiency at 25% load under a K-7 load profile. Testing backed by ISO 17025 efficiency test lab.

| kVA | Max. No load losses (Watts) | Efficiency @ 1/6 load (%) | Efficiency @ 35% load (%) | Efficiency at 25% load under K-7 nonlinear load |
|-----|-----------------------------|---------------------------|---------------------------|---|
| 15  | 34                          | 98.17                     | 98.24                     | 98.18   |
| 20  | 42                          | 98.27                     | 98.34                     | 98.28   |
| 25  | 50                          | 98.37                     | 98.44                     | 98.38   |
| 30  | 57                          | 98.47                     | 98.54                     | 98.48   |
| 45  | 80                          | 98.61                     | 98.71                     | 98.62   |
| 50  | 86                          | 98.64                     | 98.73                     | 98.65   |
| 63  | 101                         | 98.71                     | 98.79                     | 98.72   |
| 75  | 114                         | 98.78                     | 98.84                     | 98.78   |
| 100 | 145                         | 98.85                     | 98.93                     | 98.85   |

|       |     |       |       |       |
|-------|-----|-------|-------|-------|
| 112.5 | 160 | 98.88 | 98.97 | 98.88 |
| 125   | 175 | 98.90 | 98.99 | 98.88 |
| 150   | 204 | 98.93 | 99.03 | 98.88 |
| 175   | 229 | 98.96 | 99.06 | 98.95 |
| 200   | 255 | 99.00 | 99.10 | 99.01 |
| 225   | 281 | 99.03 | 99.13 | 99.08 |
| 250   | 304 | 99.05 | 99.15 | 99.08 |
| 300   | 352 | 99.09 | 99.20 | 99.08 |
| 400   | 431 | 99.15 | 99.24 | 99.13 |
| 450   | 471 | 99.17 | 99.26 | 99.16 |
| 500   | 511 | 99.20 | 99.28 | 99.18 |
| 600   | 597 | 99.22 | 99.30 | 99.22 |
| 750   | 726 | 99.24 | 99.33 | 99.28 |

O. Maximum Allowable Footprint:

| kVA | Standard Case Size (in) | Alternate Smaller Case Size (in)* |
|-----|-------------------------|-----------------------------------|
| 15  | 17.5W x 17D x 27.5H     | 17.5W x 14.5D x 25H               |
| 20  | 25.5W x 18D x 30H       | 23W x 15.5D x 27.5H               |
| 25  | 25.5W x 18D x 30H       | 23W x 15.5D x 27.5H               |
| 30  | 25.5W x 18D x 30H       | 23W x 15.5D x 27.5H               |
| 45  | 25.5W x 18D x 30H       | 25.5W x 16D x 29H                 |
| 50  | 25.5W x 18D x 30H       | No Alternate                      |
| 63  | 31.5W x 21.5D x 40H     | 26.5H x 20D x 33H                 |
| 75  | 31.5W x 21.5D x 40H     | 26.5H x 20D x 33H                 |
| 100 | 31.5W x 21.5D x 40H     | 30.5H x 20D x 35H                 |
| 112 | 31.5W x 21.5D x 40H     | 30.5H x 20D x 35H                 |
| 125 | 37.5W x 26.5D x 48H     | 33W x 23D x 38H                   |
| 150 | 37.5W x 26.5D x 48H     | 33W x 23D x 38H                   |
| 175 | 37.5W x 26.5D x 48H     | 34.5W x 26.5D x 42H               |
| 200 | 37.5W x 26.5D x 48H     | 34.5W x 26.5D x 42H               |
| 225 | 37.5W x 31.5D x 52H     | 34.5W x 26.5D x 42H               |
| 250 | 37.5W x 31.5D x 52H     | 37.5W x 26.5D x 48H               |
| 300 | 37.5W x 31.5D x 52H     | 37.5W x 26.5D x 48H               |
| 400 | 51.5W x 38D x 61H       | 43.5W x 33.5D x 55.5H             |
| 450 | 51.5W x 38D x 61H       | 43.5W x 33.5D x 55.5H             |
| 500 | 51.5W x 38D x 61H       | 43.5W x 33.5D x 55.5H             |
| 600 | 64W x 47D x 67H         | 51.5W x 38D x 61H                 |
| 750 | 64W x 47D x 67H         | Contact Factory                   |

- P. Seismic Qualification: been seismically qualified in accordance with: International Building Code, 2006/2009 Edition, California Building Code, 2007/2010 Edition, ASCE Standard 7, 2005 Edition to OSHPD CAN 2-1708A.5, Rev. , ICC-ES AC 156, Effective 01/01/2007, OSHPD approved: OSP-0110-10.
1. Unit shall remain operational and shall not suffer electric or mechanical damage within the limits of a qualified seismic event.
  2. Certification Level: Short period spectral acceleration:  $SDS = 1.5\text{ g}$ , Seismic importance factor:  $I_p = 1.5$ , Installation height:  $z/h = 1.0$ , <sup>SEP</sup>Installation restrictions: None - Valid for below grade, at grade and roof installations in floor mounted configuration.
- Q. Insulation System:
1. Shall be NOMEX-based with an Epoxy Co-polymer impregnant for lowest environmental impact, long term reliability and long life expectancy
  2. Class: 220 degrees C
  3. Impregnant Properties for low emissions during manufacturing, highest reliability and life expectancy
  4. Epoxy co-polymer
  5. VOC: less than 1.65 lbs/gal (low emissions during manufacturing)
  6. Water absorption (24hrs @25C): less than 0.05% (superior insulation, longer life)
  7. Chemical Resistance: Must have documented excellent performance rating by supplier
  8. Dielectric Strength: minimum of 3200 volts/mil dry (for superior stress, overvoltage tolerance)
  9. Dissipation Factor: max. 0.02 @25C to reduce aging of insulation, extending useful life
- R. TRANSFORMER OPTIONS TO BE INCLUDED ON THIS PROJECT
- a. Enclosure Options: NEMA 3R, indoor sprinklerproof, outdoor padmount, outdoor secure space, outdoor public space, totally enclosed, stainless steel
  - b. Integrated long term Power & Energy Logger
    - i. Supports NFPA 70E/CSA-Z462 Arc Flash Standard to provide operating data without opening transformer enclosure.
    - ii. Basis of design: Equivalent or superior to Powersmiths Express Logger.
    - iii. Meter shall be factory-installed inside the transformer, connected to the transformer secondary, complete with fused voltage connections, revenue class 0.5 or better CTs.
    - iv. Access for meter setup, real time data viewing, event log, and downloading of logged data is via an integrated USB access port on the enclosure of the transformer.
    - v. Parameters measured include: V, I, PF, Hz, kW, kVA, kVAR, kWh, Ad, KWd, kVAd, kVARd, temperature, including the option to log min, max, average or instantaneous values of any of the parameters.
    - vi. The meter shall log real-time data at user selected intervals, as well as an event log when measured values have exceeded user defined thresholds.
    - vii. The logger shall be able to store a year of monthly peak demands.

- viii. The logger shall be able to log up any 2 selected data points for over 10 years, more data points for shorter period.
- c. Integrated load-side Revenue Grade Power & Energy Meter with communications options
  - i. Supports NFPA 70E/CSA-Z462 Arc Flash Standard to provide operating data without opening transformer enclosure
  - ii. Meter shall be factory-installed on the transformer, connected to the transformer secondary, complete with fused voltage connections, revenue class 0.3 CTs individually characterized to 0.1% and CT shunting block
  - iii. Provide local display of real time energy and power quality information as it relates to the load fed from the transformer.
  - iv. Parameters measured include: V, I, THD (V, I), PF, Hz, kW, kVA, kVAR, kWh, Ad, KWd, kVAd, kVARd
  - v. Communications: Modbus (serial over RS-232)
  - vi. **SELECT MODEL**
    - 1. Supply integrated meter having features described above (Basis of Design: Powersmiths SMART 2A).
    - 2. Supply integrated meter having features described above, plus access ports having 600V safety class twistlock connectors for quick and safe access to transformer primary and secondary voltages and currents with revenue 0.3 class accuracy. CTs shall be provided with error correction characterization. Accurate and dynamic temperature data shall be provided via thermistors located in each leg of the transformer, accessible by twistlock connector. (Basis of Design: Powersmiths SMART 2B).
    - 3. Supply integrated power meter having features described above, plus a built-in web server compliant with Powersmiths WOW cloud-based Sustainability Management System. It shall also be accessible to external building management system via Ethernet using Modbus TCP or BACNet selected at time of order. Live meter data shall be accessible directly through a standard web browser. (Basis of Design: Powersmiths SMART 3A).
    - 4. Supply integrated power meter having features described above, plus a built-in web server configured to push data to Powersmiths WOW cloud-based Sustainability Management System. It shall also be accessible to external building management system via Ethernet using Modbus TCP or BACNet selected at time of order. Live meter data shall be accessible directly through a standard web browser. The integrated meter shall also come with access ports having 600V safety class twistlock connectors for quick and safe access to transformer primary and secondary voltages and currents with revenue 0.3 class accuracy. CTs shall be provided with error correction characterization. Accurate and dynamic

temperature data shall be provided via thermistors located in each leg of the transformer, accessible by twistlock connector. (Basis of Design: Powersmiths SMART 3B).

d. Integrated Input and/or Output Breakers

i. General Requirements

1. Transformer integrated breaker assembly(ies) shall be separately enclosed from the main transformer coil & coil compartment, and the whole assembly shall remain rigid even with the transformer compartment covers removed.
2. The enclosure rating shall be meet or exceed the requirements for the transformer.
3. The breaker compartment(s) shall have provision for conduit access from the rear, bottom or side, and shall be front or top accessible for installation and service.
4. Each breaker shall be pre-wired to its respective transformer connection.
5. The transformer/breaker assembly shall carry as a minimum a field inspection certificate from a recognized agency assuring compliance to appropriate electrical codes.

ii. Input Breaker

1. The transformer shall be equipped with an integrated input breaker assembly.
2. The breaker shall have an overcurrent protection rating of 125% of transformer's nominal input full load current satisfying both US National Electrical Code and Canadian Electrical Code requirements. The breaker shall be rated for inrush current of a minimum of 10 times its nominal overcurrent rating.
3. The minimum breaker kAIC rating shall be determined by specifying engineer, as it depends on the service to which the assembly is connected.

iii. Single Output Breaker

5. The transformer shall be equipped with an integrated output breaker assembly.
6. The breaker shall have an overcurrent protection rating of 125% of transformer's nominal input full load current satisfying both US National Electrical Code and Canadian Electrical Code requirements. The breaker shall be rated for inrush current of a minimum of 8 times its nominal overcurrent rating.

7. The minimum breaker kAIC rating shall be sized appropriately for the available short circuit current of the transformer to which it is connected.
- iv. Dual Output Breakers
    1. The transformer shall be equipped with two integrated output breaker assemblies.
    2. Each breaker shall have an overcurrent protection rating of up to 125% of transformer's nominal input full load current, or as specified by the specifying engineer, and satisfying both US National Electrical Code and Canadian Electrical Code requirements.
    3. Each breaker shall be rated for inrush current of a minimum of 8 times its nominal overcurrent rating.
    4. The minimum breaker kAIC rating shall be sized appropriately for the available short circuit current of the transformer to which it is connected.
  - e. Integrated Access Port to Transformer Output Voltages and Currents to enable spot checks of load profile measurement without opening transformer enclosure.
    - i. Supports NFPA 70E/CSA-Z462 Arc Flash Standard to provide operating data without opening transformer enclosure.
    - ii. Supply access to transformer output voltages and currents without opening the enclosure, via twistlock connectors, in support of NFPA 70E/CSA-Z462 Arc Flash Standard to avoid arc flash risk as associated with opening the enclosure of live equipment.
    - iii. Currents shall be accessed via integrated FTRZ listed 333mV CTs.
  - f. Integrated Rotatable Infrared (IR) Viewing Port to address NFPA 70E/CSA-Z462 Arc Flash Standard.
    - i. Provide integrated rotatable IR viewing port that provides single point viewing point that enables the thermal scanning of all live connections including primary and secondary feeder terminations and taps without requiring opening of the transformer enclosure or exposure to live parts.
    - ii. The port shall be easily usable with a wide variety of makes and models of commercially available thermal scanning devices, without requiring any proprietary connectors, adapters or other components.
    - iii. Basis of performance: Powersmiths Rotatable IR Viewing Port.
    - iv. For the installation of one or more fixed IR windows to be considered an acceptable alternative on this project, the transformer manufacturer shall provide detailed drawings prepared by a qualified engineer detailing how all live terminals will be viewable. The manufacturer shall commit that should all terminals not be viewable, once installed, the manufacturer shall rectify the situation at his own expense.



- g. Lug Kit: Supply with standard screw-type lugs as specified at time of order.
- h. Lug Kit: supply with Compression lugs configured as specified at time of order.
- i. Electrostatic Shield: Each winding is independently single shielded with a full-width copper electrostatic shield [Double shields or triple shields may also be specified]
- j. TVSS: UL 1449 listed, with EMI/RFI Filtering. Rating: 80kA/mode [optional 120kA/mode, 160kA/mode]
- k. Low Inrush: less than 6 times primary full load current with a 3% source impedance.
- l. Enhanced Seismic Bracing: increases withstand to Short period spectral acceleration: SDS= 2.28 g.
- m. Wall Brackets are available for transformers up to 75kVA where specified.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Follow all national, state and local codes with respect to transformer installation.
- B. Where sound level may be of concern, utilize the services of a recognized and established Acoustical Consultant to provide the proper installation environment to minimize noise and vibration.
- C. Check for damage and loose connections.
- D. Set the transformer plumb and level.
- E. Mount transformer on vibration isolation pads suitable for isolating the transformer.
- F. Provide Seismic restraints where required.
- G. Coordinate all work in this Section with that in other sections.
- H. Verify all dimensions in the field.
- I. Adjust transformer secondary voltages to provide the required voltage at the loads.
- J. Upon completion of the installation, an infrared scan shall be provided for all bolted connections. Correct any deficiencies. Repeat thermal scan 3 months after installation and prepare a report for the customer.

### 3.2 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and review test results.
- B. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test stated in
  - 2. Follow NETA Acceptance Testing Specification.
  - 3. Certify compliance with tests.

### 3.3 PERFORMANCE VALIDATION

- A. To insure that the products shipped to the job site meet this specification, provide on-site revenue class accurate efficiency and harmonic measurements of transformers once installed and operating at customer's site. Data shall be collected from primary and secondary sides of the transformer simultaneously on a synchronized cycle by cycle basis. The use of two discrete meters that are not synchronized is not acceptable. Sampling shall be of 10% of transformers on the project once installed and operating, as selected by customer. Submit a detailed report to the project engineer.
- B. Where integrated metering has been specified to be connected to an external network, contractor to provide the required connection and commissioning to customer's specified system.
- C. Identify non-compliant products to the engineer and replace at no cost to the customer.

END OF SECTION 260675

## **SECTION 260700**

### **PANELBOARDS**

#### **PART 1 - GENERAL**

Applicable provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section. Submit shop drawings for checking and approval.

##### **1.1 WORK INCLUDED**

- A. The work under this section shall include the furnishing of all materials, labor, tools and services necessary to install the panelboards and to complete all work shown on the Drawings or specified herein.

##### **1.2 RELATED WORK**

- A. Grounding
- B. Overcurrent Protection

##### **1.3 SUBMITTALS**

- A. Submit shop drawings for equipment and component devices under provisions of Division 1.
- B. Include outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.
- C. Furnish two (2) sets of keys to Owner.

##### **1.4 REFERENCES**

- A. FS W-C-375 - Circuit breakers, molded case, branch circuit and service.
- B. FS W-P-115 - Power distribution panel.
- C. NEMA AB 1 - Molded case circuit breakers.
- D. NEMA KS 1 - Enclosed switches.
- E. NEMA PB 1 - Panelboards.
- F. NEMA PB 1.1 - Instruction for safe installation, operation and maintenance of panelboard rated 600 volts or less.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS - PANELBOARD AND LOAD CENTERS

- A. Siemens.
- B. Square "D".
- C. General Electric.
- D. Or approved equal.

### 2.2 BRANCH CIRCUIT PANELBOARDS

- A. Lighting and appliance branch circuit panelboards: NEMA PB 1; circuit breaker type.
- B. Enclosure: NEMA PB 1; Type 1.
- C. Cabinet size: Approximately 6 inches deep; 20 inches wide for 240 volt and less panelboards. Verify field conditions and alter dimensions to suit at no additional cost.
- D. Provide surface cabinet front door-in-door with concealed trim clamps, concealed hinge and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.
- E. Provide panelboards with copper bus, rating as scheduled on Drawings. Provide copper ground bus in all panelboards and isolated ground bus in those as indicated on Drawings.
- F. Minimum integrated short circuit rating: 10,000 amperes rms symmetrical for 240 volt rated for 125 amps or less, 22,000 amperes rms symmetrical for 240 volt rated greater than 125 amps to 225 amps and 30,000 amperes for emergency power panelboards (verify in field). If panelboard is noted as a main distribution panelboard, than panel shall be rated as a distribution panelboard. Contractor shall provide short circuit study to ensure adequacy.
- G. Molded case circuit breakers: Bolt-on type thermal magnetic trip handle for all poles. Provide circuit breakers UL listed as type SWD for lighting circuits. Breaker handle to indicate ampere rating.

### 2.3 DISTRIBUTION PANELBOARDS

- A. Description: NEMA PB 1, circuit breaker type. The bus of all panels rated a minimum 400 amps shall be distribution type.
- B. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard.
- C. Minimum integrated short circuit rating: 65,000 amperes rms symmetrical for 240 volt panelboards; 65,000 amperes rms symmetrical for 480 volt panelboards, unless otherwise noted on Drawings.

- D. Model Case Circuit Breakers: NEMA AB 1, circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers UL listed as Type HACR as specified on Drawings.
- E. Enclosure: NEMA PB 1, Type 1.
- F. Cabinet Front: Surface type, fastened with screws. Double hinged doors with flush lock, metal directory frame, finished in manufacturer's standard gray enamel. One hinged door to access breakers, the other to access wiring compartment.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install panelboards flush or surface mounted as indicated on Drawings.
- B. Mounting height maximum 6 ft. (2 m) to top circuit breaker.
- C. Provide filler plates for unused spaces in panelboards.
- D. Provide type written circuit directory for each branch circuit panelboard. Indicate loads served and panel name by matching that shown on panel schedules on Drawings. Revise directory to reflect circuiting changes required to balance phase loads. Provide a second copy and turn over to Owner.
- E. Provide 3/4" thick plywood backboard for mounting of panels. Paint backboard with fire retardant paint.
- F. Provide nameplates as indicated in Section 16550.

### 3.2 FIELD QUALITY CONTROL

- A. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 20 percent, rearrange circuits in the panelboard to balance the phase loads within 20 percent. Take care to maintain proper phasing for multi-wire branch circuits.
- B. Visual and mechanical inspection: Inspect for physical damage, proper alignment, anchorage and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches and fuses.
- C. Provide thermographic inspections in accordance with Section 26 0100.

### 3.3 TESTS

- A. Submit certification that each panelboard has withstood, without breakdown, a factory dielectric (Hi-Pot) test consisting of a one minute application of a 60 cycle AC test voltage applied between phase legs and from each phase leg to enclosure.
- B. The applied test voltage shall have an RMS value of at least twice the line to line system voltage to which the panelboard is to be applied, plus one thousand volts (minimum 1500V).

### 3.4 RECORD DRAWINGS

- A. Submit As-Built Drawings indicating the location of all panelboards.

END OF SECTION 260700

## **SECTION 260800**

### **FIRE ALARM SYSTEM**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section. Submit shop drawings for checking and approval.

##### **1.1 FIRE ALARM SYSTEM**

- A. The existing fire alarm system is an addressable system. The fire alarm control panel is located in the boiler room.
- B. Add and modify as required to the existing system, as specified/shown on the drawings and as per field requirements. All devices shall be suitable for operation and compatible with existing system. Provide relays modules, cards, power supplies, etc. as required.
- C. Provide sufficient quantity of relays for fan shutdown as specified/shown on Drawings.
- D. Connect, test and leave the system in first class operating condition.
- E. The system shall maintain all applicable Local, State and National Codes including the National Electrical Code, NPFA-72, NFPA-101, ADA 1971 and NEC. The system shall be listed by Underwriter's Laboratories, Inc.
- F. The Electrical Contractor shall provide a manufacturers certified technician to supervise installation, adjustments, final connection and system testing.
- G. Fire alarm wiring and cable shall be per manufacturer's requirements.
- H. Fire alarm system test shall be in accordance with NFPA-72 and local fire department requirements.

END OF SECTION 260800





## **SECTION 260825**

### **PUBLIC ADDRESS SYSTEM**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this Section. Submit shop drawings for checking and approval.

##### **1.1 DESCRIPTION OF WORK**

- A. The Contractor shall furnish all equipment, accessories and material required for the installation of communication devices in strict compliance with these Specifications and applicable Contract Drawings. Any material and/or equipment necessary for the proper operation of the system, which is not specified or described herein, shall be deemed part of this specification.

#### **PART 2 - PRODUCTS**

##### **2.1 SPEAKERS**

- A. Flush Speaker Baffles (ceiling): Ceiling Speakers shall be Rauland USO-188/ACC1000 white semi-gloss enamel steel grille with 8" speaker, 25/70 volt 7 watt transformer and 6 oz. magnet mounted on a # ACC1101 steel protective cover and a ACC1104 tile bridge support.
- B. Enhanced Staff Stations
  - 1. Room phones shall be Rauland Model 2554W-VP vandal proof, where indicated. Enhanced staff stations can dial administrative stations, initiate emergency calls, and enable or disable the reception of program material at their location. Depending upon the level of system access, enhanced staff stations can dial other staff stations, perform all-call, zone pages, conference calls and call transfer.
  - 2. Staff stations can be assigned to initiate calls at three levels; normal/emergency, urgent/emergency, and emergency. Emergency calls ring the administrative phone with a special tone and will interrupt a non-emergency call in progress. An integral emergency announce feature (no external amplifier necessary) gets prompt attention when needed by routing unanswered emergency calls to a designated emergency station. Emergency calls continue to ring until answered.
- C. Clock/Speaker Baffles (room)
  - 1. The room flush mount clock/speaker/ baffle shall be a Lowell BP-300 combination baffle mounted on a flush back box PC-312 with 8" speaker, 25 volt 7 watt transformer, 6 oz. magnet and 9" system secondary clock. Speakers shall be a Rauland USO 188 Speaker/Transformer with 8", 25/70 volt 7 watt transformer and 6 oz. magnet. Clocks shall be National Time 030-12EX-LL-SP analog synchronous secondary clocks with hourly and daily correction.

D. Analog Synchronous Clock with Minute and Second Hands

1. The secondary clock shall be a National Time 030-12EX-LL-SP series clock. It shall be designed to be 3-wire system with Rauland TC-21 Master Clock systems. The secondary clock shall have a microprocessor-based movement and shall be capable of being used as a stand-alone clock. The clock shall have a low-profile /semi-flush smooth surface metal case. The crystal shall be shatterproof polycarbonate with no visible molding marks. Glass is unacceptable. The clock shall have black hour and minute hands and a red second hand. The clock shall have U.L., CUL and F.C.C. compliances.

END OF SECTION 260825

## **SECTION 260900**

### **GUARANTEE**

#### **PART 1 - GENERAL**

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section.

##### **1.1 GUARANTEE**

- A. The Contractor shall remove, replace and/or repair at his own expense and at the convenience of the Owner, any defects in workmanship, materials, ratings, capacities and/or characteristics occurring in the work within three (3) years or within such longer period as may be provided in the Drawings and/or Section of the Specifications, which guarantee period shall commence with the final acceptance of the entire Contract in accordance with the guarantee provisions stated in the General Conditions, and the Contractor shall pay for all damage to the system resulting from defects in the work and all expenses necessary to remove, replace, and/or repair any other work which may be damaged in removing, replacing and/or repairing the work.

END OF SECTION 260900



**SECTION 274115**  
**HEARING LOOP SYSTEMS**

**PART 1 - GENERAL**

**1.1 GENERAL PROVISIONS**

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

**1.2 RELATED DOCUMENTS**

- A. Refer to hearing loop system drawings, appendix, and the project construction drawings for information related to the work specified herein.
- B. Audiovisual system documents include:
  - 1. AVE series drawings

**1.3 SCOPE OF WORK**

- A. Provide a Hearing Loop System that provides supplemental reinforcement of audiovisual system audio signals to listeners (presenters and audience members as appropriate) complete with all apparatus, equipment, power supplies, wiring, labor, and services necessary to ensure a complete working system.
- B. Verify completeness of equipment listed and correctness of type numbers.
- C. Provide supplementary equipment needed to meet system requirements, without claim for added payment.
- D. The work includes, but is not limited to, the following:
  - 1. Submission of shop drawings prior to fabrication
  - 2. Verification of dimensions and conditions at the job site
  - 3. Installation in accordance with these specifications, manufacturer's recommendations, and all applicable code requirements
  - 4. Setup and adjustment of signal processing, system tests and adjustments, written report, demonstration for approval, participation in acceptance tests, and final adjustments as required
  - 5. Coordination with the project Electrical Contractor
  - 6. Coordination with the Owner's Audiovisual Systems Contractor
  - 7. Coordination with Owner's Facilities Department
  - 8. Coordination with Owner's Audiovisual Personnel
  - 9. Performance standards, without claim for additional payment

10. System documentation
11. Instruction of owner's operating personnel
12. Maintenance services for one year
13. Guarantee
- E. Work not included
  1. Power, except for provision of power strips as noted
  2. Telephone or data system cabling
  3. Cable TV system cabling
  4. Audiovisual systems
- F. Related Work Specified Elsewhere
  1. Carefully examine all of the Contract Documents for requirements which affect the Work of this Section.
  2. Other Specification Sections which directly relate to the Work of this Section include, but are not limited to, the following:
    - a. Section 01 00 00 - General Requirements
    - b. Section 26 00 00 – Electrical
    - c. Division 27 - Communications; including all Sections contained therein

#### 1.4 CONTRACTOR QUALIFICATION AND CERTIFICATION

- A. Audiovisual Contractors shall have current certification from system manufacturer to test, install, and commission hearing loop systems.
- B. Contractor shall have the ability to issue a Certificate of Conformity in accordance with IEC 60118-4.
- C. BID SUBMITTALS
  1. Project Timeline and Project Resources
    - a. Offeror shall indicate acceptance of the attached RFP timeline with their bid. If any major exceptions are noted indicate with bid.
    - b. Offeror shall provide additional detail outlining procurement and installation time line immediately after the bid is awarded. During the bidding process offeror must verify that they have considered all of the various steps required for procurement, assembly and installation and have properly staffed the project to meet the indicated deadlines.
    - c. The submitted timeline shall indicate each task to be performed, expected resource allocation, and expected duration of each task. Also, indicate earliest start, earliest finish, latest start and latest finish for each major task. Note prominently expected task milestones, and expected payment milestones. Critical path shall be indicated in the timeline, along with a discussion as to the implications of slippage in the critical path. Offeror shall indicate any “long lead time” equipment or material items with their proposal that could hinder the timely

completion of the project. Include sufficient time for commissioning, inspection, tuning and adjustments by the Owner's designated representative at the completion of installation.

#### 1.5 DEFINITIONS

- A. Furnish – Purchase and/or fabricate the item and deliver to site.
- B. Install – Perform the physical installation of the item on the site.
- C. Provide – Furnish and install item or items, complete with any and all required accessories.

#### 1.6 MATERIALS AND EQUIPMENT

- A. Compliance
  - 1. The Hearing Loop system shall comply with IEC 60118-4:2006.
  - 2. A Certificate of Conformity to this standard shall be issued for each Hearing Loop System in the project.
- B. All systems proposed herein shall meet the best commercial practices of the applicable industries, except where alternatives are noted. Publications of issues of the following standards form a part of this specification:
  - 1. American Institute of Architects (AIA)
  - 2. Americans with Disabilities Act (ADA)
  - 3. American National Standards Institute (ANSI)
  - 4. Audio Engineering Society (AES)
  - 5. Federal Communications Commission (FCC)
  - 6. Institute of Cable Engineers (ICEA)
  - 7. Institute of Electrical and Electronic Engineers (IEEE)
  - 8. International Standards Organization (ISO)
  - 9. National Electric Code (NEC)
  - 10. National Electrical Manufacturers Association (NEMA)
  - 11. National Fire Protection Association (NFPA)
  - 12. Occupational Safety and Health Administration (OSHA)
  - 13. Underwriters Laboratories (UL)
  - 14. Nationally recognized standards of the various construction trades, as may be applicable.
- C. References shall meet the latest edition of that standard
- D. Equipment lists specify manufacturers' type numbers to indicate an acceptable standard of quality and performance. Substitutions of equal equipment beyond

the equipment listed will be permitted only if such equipment is an equal to the basis of design. Address requests for listing of substitutions to the Owner's Designated Representative. With any request for substitution, include measured data proving the equivalence of the proposed substitute in quality and performance. The Owner's Designated Representative shall be the final judge of the validity of the data submitted.

- E. Provide only current-model materials and equipment. Do not provide obsolete or discontinued models unless specifically directed to do so in the Equipment section of this specification. Review all materials and equipment immediately prior to installation, and inform the Owner's Designated Representative of any obsolete or discontinued items.

#### 1.7 FEES, PERMITS, AND NOTICES

- A. Perform all work in compliance with all applicable requirements of the authority(ies) having jurisdiction. Take out and maintain all construction permits, pay all fees, and file all notices, all at no additional cost to the Owner.

#### 1.8 COORDINATION AND CLARIFICATION

- A. Refer to the awarding authority before the bid date for coordination and clarification of any discrepancies among drawings and specifications. Where discrepancies occur and pre-bid instructions have not been obtained, abide by the Owner's Designated Representative's reasonable decisions.

#### 1.9 EXISTING CONDITIONS - EXAMINATION OF SITE AND DOCUMENTS

- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Trade Contractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.
- B. Verify all existing conditions. Refer to the Owner's Designated Representative for coordination and clarification before the bid date of any discrepancies concerning existing conditions. Clarify with the Owner's Designated Representative all locations including conduit and cable routings. Where discrepancies occur and pre-bid instructions have not been obtained, abide by the owner's designated representatives reasonable decision.
- C. Provide and terminate all required wire and cable into conduit provided by others.
- D. Comply with all requirements regarding the use of cable with respect to spread of fire. Refer to the General Construction drawings for identification of air plenum and other spaces having special cabling requirements. Field-survey the jobsite



to determine spaces having special cabling requirements. It is the responsibility of the Contractor to provide wiring that is in compliance with all applicable building codes of the authority(ies) having jurisdiction.

#### 1.10 SUBMITTALS

##### A. General

1. Refer to Submittals in Division 1 for submittal provisions and procedures.
2. Submittals that do not include all of the specified items or do not adhere to the criteria set forth below will be returned without review.
3. Copies: Submit a minimum five (5) copies of all required submittals. Include with each submittal electronic copies on CD-Rom or USB stick of all files as PDF organized by room and types in same manner as paper submittal.

##### B. Field Verification

1. At the earliest opportunity in the project, provide evidence that the background magnetic noise in the areas designated for loop coverage is within the limits defined in the standard, IEC 60118-4:2006. Where the background magnetic noise exceeds -32dB re: 400mA/m-1 [-22dB for short-term use/localized applications], the contractor shall not proceed without client approval.
2. Prior to installation, show that cross-talk between adjacent looped areas (whether part of this contract or not), and that magnetic spill from any Hearing Loop System where the signal is defined as 'confidential' will, by design, be less than -40dB with normal signal levels.
3. Prior to installation, provide evidence that the effect of metal within the structure of the building has been adequately assessed and compensated for by loop design and / or appropriate loop driver selection. Where necessary, the effect of metal shall be assessed by site survey and using test loops on relevant construction, carried out by a competent test specialist.
4. Prior to installation, provide calculations to demonstrate that the field strength of the proposed systems will meet the requirements of the standard IEC 60118-4:2006.

##### C. First Submittal

1. Timing: within 14 days of contract award
2. Conduit size verification
  - a. Review and confirm that audiovisual system conduit as shown on the Drawings and where applicable, as built drawings, is sufficient and appropriately sized for system.
  - b. Note where conduit system is not sufficient and indicate any additional conduit required for system.
3. Milestone dates

- a. Dates for each Submittal
- b. Shop fabrication complete
- c. Initial equipment ship to site
- d. Start of installation
- e. Second equipment ship to site
- f. Field testing
- g. Correction of punch list items
- h. Training

D. Second Submittal

- 1. Timing: 45 days before equipment purchase or commencement of wiring
- 2. Field Verification Report
  - a. Submit report summarizing results of field verification tests and calculations described above.
- 3. Product Data Sheets
  - a. Submit all product data sheet and drawings in a single submittal, except if specified otherwise.
  - b. Before ordering equipment or beginning work, submit to the Owner's Designated Representative for approval a list showing quantities and manufacturer and model number for items of equipment to be used in assembling this system, including all items of equipment specified herein. Attach copies of catalog sheets for all items of equipment submitted.
  - c. Submit cut sheets in same order as this specification with table of contents, specification paragraph reference and page numbers.
- 4. Shop Drawings
  - a. A block diagram indicating proposed interconnections of all equipment and indicating equipment types and model numbers.
  - b. Drawings showing cable pull assemblies and schedule complete with all wiring requirements for the project
- 5. Commissioning Plan
  - a. Submit method statement for commissioning described below.

1.11 DELIVERY, STORAGE AND HANDLING

- A. All equipment shall be appropriately packed for shipment.
- B. All shipping costs to the job site are the responsibility of the Contractor. Determination of the shipping method and company is the responsibility of the Contractor in order to meet the published project schedule.
- C. Completed systems shall be shipped FOB inside and in place.
- D. Note that drop shipment of equipment to the Owner's site directly from the manufacturer, or other supplier will not be allowed.
- E. Upon delivery all materials shall be stored under cover in a clean and dry location. Materials which are damaged during shipping, storage or handling or are

otherwise not suitable for installation shall be removed from the job site and replaced, at no additional cost to the Project, with acceptable materials.

#### 1.12 CLEANUP AND TRASH DISPOSAL

- A. Maintain a clean working area free from debris and waste materials. Clean work areas daily.
- B. Except for items to be reused or returned to the Owner, or as otherwise directed, remove trash and packing materials from the jobsite, and dispose of offsite in a legal manner. Do not allow trash to accumulate at the jobsite.

#### 1.13 FUNCTIONAL REQUIREMENTS

##### A. Hearing Loop System

- 1. Provide a magnetic induction hearing loop system for supplemental reinforcement of audio signals to audience members with hearing loss using hearing aids with T-coils or wireless beltpack receivers with earphones.
- 2. Provide continuous hearing loop system coverage throughout the entire space using phased arrays.

#### 1.14 DIAGRAMS, INSTRUCTION MANUALS

- A. Provide draft copies of all required diagrams and instruction manuals on-site for inspection during the demonstration and acceptance testing of the system; submit final copies thereafter.
- B. Simplified Line Diagram
  - 1. Show the essential parts of the completed installation and their functional relations, including connections to other system. Mount one copy of the diagram behind clear plastic on the wall near the equipment rack, or as directed. Bind one copy of the diagram into each instruction manual. Reduce the mounted copy to 11" x 17" maximum; ensure that it is legible at that size.
- C. Operating Manual
  - 1. Create system specific user manual for the complete system including user instructions for accessing all the system functionality specified in Functional Requirements. Manual should describe how to use individual components in their context as part of a larger system. A compilation of manufacturer's manuals for components does not meet this requirement.
- D. Complete Instruction Manuals
  - 1. Provide complete instruction manuals which include the following:
    - a. Table of contents.
    - b. List of loose items furnished.
    - c. List of functional requirements.
    - d. Operating manual (described above).

- e. List of settings and adjustments for semi-fixed controls.
- f. Manufacturer's sheets of specifications, operating instructions, and service information, arranged alphabetically by manufacturer and then by model number, for each item of equipment specified herein.
- g. Detailed system wiring diagrams, including cable schedule and copies of all drawings specified above. Also include all submitted shop drawings to indicate as-built conditions.
- h. List of any special tools or equipment required for system maintenance.
- i. List of consumables such as batteries or lamps and spare parts and recommended stock level.
- j. List of all manufacturers in system with addresses and support telephone numbers.
- k. Provide five (5) bound copies.

E. Record Drawings

- 1. Provide record drawings of as-built conditions in AutoCAD and PDF file format based on contractor's updated base drawings. Drawings shall include at a minimum:
  - a. Device location plan
  - b. Functional diagram with wire numbering
- 2. Provide USB memory stick with AutoCAD files and one (1) blackline print of drawings.

1.15 INSTRUCTION

- A. Provide instruction to Owner's designated operating personnel. Include a minimum of one (1) two hour session of instruction in the operation, care and maintenance of the installation.
- B. Schedule instruction at the mutual convenience of the Owner and contractor after demonstration and acceptance testing. Provide a video recording, or otherwise coordinate with the Owner the video recording, of all instruction sessions and provide a copy of each major session to the Owner.

1.16 GUARANTEE, SERVICE, MAINTENANCE AND SUPPORT

- A. Provide complete warranty, maintenance, and support program for a period of one year from the date of final acceptance of the system, regardless of the terms stated by equipment manufacturers. Final acceptance shall be deemed to include clearing all punch list items and delivering final documentation.
- B. Guarantee all equipment and installations to be free of faulty workmanship and defective components for a period of one year from date of final acceptance. Cover all equipment provided under this section. During this time, replace defective material and repair faulty workmanship at no charge to the Owner.
- C. During this period, replace defective materials and repair faulty workmanship within 24 hours of report of malfunction at no additional cost to the Owner. If

specified materials and installations cannot be made good within 24 hours of report of malfunction, provide approved temporary alternate equipment and facilities, complete and operational, within 24 hours of report of malfunction, at no additional cost to the Owner.

- D. Maintain a 10-hour-per-day, normal business hours (8AM to 6PM) telephone response facility for receipt of service calls.
- E. Provide telephone response by qualified support technician within one hour of receiving a service request,. Provide service within eight business hours by the arrival of a technician, if required. Provide this telephone and on-site service during normal business hours (8:00am - 6:00 PM), five days per week.
- F. If any equipment item is found not to be quickly repairable, and thus be unavailable for use by the Owner for a period greater than 24 hours, and upon request from the Owner, make available a functional replacement unit at no charge. Install this replacement unit in a timely fashion so that system operation is restored within a 24 hour period from the initial failure. Provide such replacement unit to the Owner until the original unit is repaired and reinstalled.
- G. At the completion of the program, provide to the Owner a record of all work performed and parts replaced.
- H. Provide at no additional charge preventive maintenance service for a period of one year after final acceptance of installation. This service shall consist of at least two semi-annual visits to the site for checking and adjustment of equipment. During these visits, install any software or firmware upgrades to the extent these upgrades are made available at no charge from the manufacturer and are approved in advance by the Owner.
- I. For the duration of the program, provide or perform all services required as part of manufacturer's annual maintenance agreements or other manufacturer-imposed conditions. Maintain all content and software use licenses. Continue or extend all specified manufacturer support agreements and extended warranties. Pay all costs and fees; provide complete services package so that no charges are incurred by the Owner during the term of the program. To the extent that any manufacturer requires direct invoicing to the Owner, carry such costs within the contract price, with the understanding that such costs may be assigned to the Owner upon further discussion.
- J. Provide with bid annual cost to extend the preventive maintenance agreement from two to five years after completion.

## PART 2 - EQUIPMENT

### 2.1 HEARING LOOP SYSTEM WIRING

#### A. Hearing Loop Drivers

1. Each induction loop driver shall have the following characteristics:
  - a. 'Current drive' output
  - b. Rated current and voltage capable of driving the designed loop without clipping or distortion of the signal with full power bandwidth up to at least 1.6 kHz
  - c. Capable of delivering the rated current and voltage into a load with 1 kHz sinewave signal for at least 20 seconds continuously without damage to the unit or interruption of the output signal
  - d. Frequency response from 80Hz to 6.5kHz
  - e. THD+N less than 0.2% at 1 kHz sine at full current
  - f. Automatic Gain Control (AGC) optimized for speech, with a dynamic range greater than 36dB
  - g. Metal loss correction with an adjustable gain slope range of at least 0 dB to +3 dB per octave
  - h. All audio inputs to be balanced.
  - i. Front panel indication of audio signal activity on the output of the unit and where possible the input
  - j. Adjustment of controls for commissioning shall be achievable without exposure of terminals carrying hazardous voltages.
  - k. All AC powered devices shall have passed testing at a Nationally Recognized Testing Laboratory (NRTL) for safety with reference to the current edition of UL 60065 and any other applicable safety standards.
2. Where two-phase systems are required, a single unit shall be provided that is capable of driving two separate outputs with a 90° phase shift accurate to  $\pm 1^\circ$  from 100 Hz to 5 kHz, or two identical drivers shall be provided unless it can be demonstrated in the system design that this is not appropriate. If two identical drivers are appropriate, in addition to the requirements above, each driver shall have the following characteristics:
  - a. Slave input/output socket providing an insert point after the input AGC but before the output drive control
  - b. Auxiliary power outlet on rear panel with  $\pm 15V$  dc, 150mA minimum capacity
  - c. Front panel indicators to indicate separate fault conditions of overload, overheat and loop error

B. Hearing Loops

1. Loops connected to the Hearing Loop system shall meet the following requirements:
  - a. The Hearing Loop System shall be designed and implemented to meet all requirements of IEC 60118-4:2006.
  - b. The implementation of the hearing loop design shall take into account the layout and construction materials of the building.
  - c. Appropriate materials for the installation location shall be used (e.g. wire in the floor/ceiling, flat copper tape under floor coverings, or a purpose-designed loop coil inside a counter vertical front).
  - d. Loop wire containment shall be of non-metallic construction (to avoid short circuit grounding paths parallel with the loop wire). This restriction does not apply to the loop feeder cables between a loop amplifier and the start of the loop itself, which may be installed in metal or non-metal containment.
  - e. Where flat copper tape is accepted for use under carpet or other floor coverings, this does not require the use of containment and shall be installed according to the manufacturer's recommendations and current best practice.
  - f. Implementation of the loops shall in general follow best practices.
2. Copper Cable Installation for direct burial within concrete floor
  - a. Provide sufficient length at the end of the copper cables to allow transitioning to the feeder cable soldering points.
  - b. Twist feeder cables tightly per manufacturer recommendations.
  - c. Provide a minimum of 12 inches of separation from other cables types.
  - d. Acceptable Direct Burial Cable
    - 1) Williams AV ACDB25###
      - a) Quantity: Length as required

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Provide appropriate cabling and/or connection points for system integration.
- B. Wire and connect to all items of equipment in accordance with the manufacturers' recommendations.
- C. Provide all necessary and supplementary grounding conductors and connections to each component or item of equipment.
- D. Follow good audio and other relevant practice to ensure that proper grounding and other cable system design does not cause degradation of this or other system performance by allowing interference in inappropriate paths.
- E. Confirm locations of all local power supply requirements and equipment spatial requirements.
- F. Supply and install any racks, wire, conduits, pull boxes, junction boxes and raceways required to provide a complete system. Unless specifically instructed to the contrary, install all system wiring in steel conduit. Do not exceed 30% fill in conduits.
- G. All wiring of loops and between equipment locations shall be installed and concealed in appropriate containment.
- H. Ensure complete segregation of the Extra-Low Voltage (ELV) wiring system, from any other ELV or Low Voltage (LV) wiring system.
- I. Secure equipment firmly in place. Make fasteners and supports adequate to support their loads with a safety factor of at least three.
- J. All wiring, including that inside equipment enclosures or racks, will be of a neat and tidy appearance. Wiring shall be identified at both ends of each cable.
- K. Take precautions to prevent electromagnetic and electrostatic hum. Install the equipment to provide safe operation.
- L. Use terminal strips or blocks in all audio lines entering or leaving the system equipment rack(s). Make all joints and connections with rosin-core solder or with mechanical connectors appropriate for the service. Execute all wiring in strict adherence to standard broadcast practices.
- M. Assemble and install equipment racks to permit access to connections and adjustments on the rear of rack-mounted components and to permit removal of components for servicing. For any components which, for purposes of adjustment or calibration, must be removed from an equipment rack while in use, provide adequate service loops on all connecting cables.
- N. Install work neatly, with boxes, equipment, etc., plumb and square. Keep the job adequately staffed at all times. Designate an employee as field supervisor to be present on the job site and in responsible charge during all phases of installation and check-out. Maintain same supervisor through completion of the work unless



the designated supervisor ceases to be an employee or unless by mutual agreement with the Owner or Architect. Install the system in cooperation with other trades in order to achieve coordinated progress and satisfactory final results. Watch for conflicts with work of other trades on the job. Execute, without claim for extra payment, moderate moves or changes as are necessary to accommodate other equipment or preserve symmetry and pleasing appearance.

- O. Clearly, consistently, logically and permanently mark switches, connectors, jacks, relays, receptacles, cables, and cable terminations. Engrave and paint-fill all panel and receptacle markings, directly on the material on which controls or receptacles are mounted. Fill engraving with black or white paint, whichever contrasts best with panel finish, or as directed by the Architect. Use no hand-lettering, embossed tape (e.g. "Dymo" labels), or any adhesive- or otherwise mechanically-attached labels for any labels visible to operators or public during normal system operation. Use adhesive- or screw-attached engraved or laminated labels (e.g., "Kroy" or "Brother") on manufactured assemblies, such as amplifiers, which otherwise would require disassembly for direct engraving. Use printed adhesive cable markers to mark cables, or other labels intended for the purpose. Use "Kroy" or "Brother" or similar machine-produced laminated labels, or "letter quality" or "near letter quality" mechanically-produced lettering for patch panel labels. Insert patch panel labels into clear plastic-covered label holders.
- P. Paint or provide approved factory finishes for all system components exposed to public view as directed by Architect. Paint or otherwise remove all visible manufacturers' trademarks exposed to public view as directed by Architect.
- Q. If any item of equipment includes exposed controls which are not used in system operation, and if those controls cannot be locked, capped, or concealed behind a security cover, mount said item of equipment recessed behind a blank rack panel.
- R. Save all unused products accessories and turn over to Owner at checkout.
- S. Coordinate with other relevant contactors to ensure that all appropriate audio signals are connected to the induction loop system and transmitted clearly.
- T. Ensure that all aspects of the installation are in accordance with appropriate (AHJ) Authority Having Jurisdiction.

### 3.2 PROTECTION AND REPAIR OF EXISTING FINISHES AND STRUCTURES

- A. Cut and patch all holes required for this installation.
- B. Make good all materials and finishes cut into or damaged during installation.
- C. On completion, remove all rubbish and unused materials from the premises, clean the premises where dirtied, and clean all equipment, removing all dirt, dust, stains, and fingerprints.

### 3.3 ELECTRONIC TEST EQUIPMENT

#### A. Field Strength Meter

1. For commissioning, the Contractor shall use a field strength meter capable of commissioning to the requirements of IEC 60118-4:2006. The meter shall have the following characteristics:
  - a. Calibrated reading of 0 dB at 400 mA/m RMS as per IEC 60118-4:2006
  - b. True RMS measurement with 125 mS time constant
  - c. Class 2 meter as defined in IEC 61672-1:2003 (Electroacoustics – Sound level meters)
  - d. A-Weighted background noise range of at least -42 dB to -12 dB
  - e. Field strength measurement range of at least -22 dB to +8 dB, with increments of 1 dB from -3 dB to +3 dB
  - f. Frequency band mode with 1/3 octave frequency bands centered on at least 100 Hz, 1 kHz, and 5kHz meeting IEC 61260:1996 and IEC 60118-4:2006
  - g. Headphone output for listening to the hearing loop signal
  - h. Instructions for setting up a Hearing Loop System to IEC 60118-4:2006 by use of the field strength meter

### 3.4 INITIAL POST-COMPLETION TESTS AND ADJUSTMENTS

#### A. Perform these tests and adjustments. Furnish equipment necessary to perform these tests, and perform work required to modify the performance of the system in accordance with this specification.

1. Freedom from Parasitic Oscillation and Radio-Frequency Pick-up
  - a. Check to ensure that the system is free from spurious oscillation and radio-frequency pick-up, both in the absence of any audio input signal and also when the system is driven to full output.
2. Gain Control Settings
  - a. Establish tentative normal settings for all gain controls. Adjust all gain controls for optimum signal-to-noise ratio and signal balance.
3. Freedom from Switching Transient Noise
  - a. Eliminate audible clicks or pops produced by the operation of any controls.
4. Listening Test
  - a. Listen to normal program material to be sure that there are no audible defects.

#### B. Commissioning

1. The Contractor shall:
  - a. Test and commission the complete system(s) in accordance with IEC 60118-4:2006.

- b. Provide a method statement for testing and commissioning. Provide all necessary test equipment to complete the works, all test results to be fully recorded, and copies provided with the Operation and Maintenance manuals.
- c. Provide a minimum of 14 days notice of all testing in order that a Client's representative may have reasonable option to attend and witness tests.
- d. When carrying out commissioning tests, use a Field Strength measurement tool with a minimum specification as in section paragraph 3.3A above.
- e. Issue Certificates of Conformity to IEC 60118-4:2006 that clearly state the results of testing and whether the system performance meets the relevant requirements of the standard.

C. Report

- 1. Upon completion of above tests and adjustments submit two copies of a written report presenting test results, including numerical values and corrective actions taken, for review by the Architect and Consultant prior to demonstration and acceptance testing. With this report, submit written certification that the installation conforms to the requirements stated herein, is complete in all respects, and is ready for inspection and testing by the Architect.

3.5 DEMONSTRATION AND ACCEPTANCE TESTING OF COMPLETED INSTALLATION:

- A. Upon approval of the above test report by the Architect and at a mutually agreeable time, demonstrate operation of each major component and of the complete installation. After demonstration, assist as required in acceptance tests.
- B. Listening Tests
  - 1. Tests will include subjective evaluation by observers listening at various positions under various operating conditions of the system, intended to test its operation in conformance with its functional requirements.
- C. Equipment Tests
  - 1. Perform any measurements of frequency response, distortion, noise or other characteristics and any operational tests deemed necessary by the Architect to determine conformity with these requirements.
  - 2. If the need for adjustment or modification becomes evident during demonstration and testing, continue working until the installation operates properly.
- D. Final Adjustments
  - 1. Make control adjustments as directed by the Architect. Make a record of these control settings. Provide covers, caps, or shaft-locks for controls not used in system operation.

END OF SECTION

## **SECTION 274116**

### **INTEGRATED AUDIOVISUAL SYSTEMS**

#### **PART 1 - GENERAL**

##### **1.1 General Provisions**

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.
- D. Throughout this specification, the term "Contractor" shall refer to the Audiovisual Systems Contractor unless otherwise indicated.

##### **1.2 Examination Of Site And Documents**

- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Trade Contractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that they are familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.

##### **1.3 DOCUMENTS**

- A. Refer to audiovisual system drawings, appendix, and the project construction drawings for information related to the work specified herein.
- B. Audiovisual system documents include this printed specification plus the following drawings:
  - 1. AVE series drawings

#### 1.4 RELATED DOCUMENTS

- A. Drawings, General Conditions of the Contract, and Division 1 General Requirements apply to the work of this Section. Examine referenced documents for requirements affecting the work.
- B. Examine all other Sections of the specifications and all other drawings for requirements which affect work under this Section, whether or not such work is specifically mentioned in this Section.

#### 1.5 Related Work Specified Elsewhere

- A. Carefully examine all of the Contract Documents for requirements which affect the Work of this Section.

#### 1.6 SCOPE OF WORK

- A. Provide all equipment outlined herein and assemble it into one complete functioning system, as described by the applicable paragraphs of this Section and as shown on the drawings. Assume responsibility for providing and installing systems that meet the performance requirements stated.
- B. The plans, specifications, and other Contract Documents are to be considered together and are intended to be mutually complementary, so that any work shown on the plans though not specified in the specifications, and any work specified in the specifications though not shown on the plans, is to be executed by the Contractor as a part of this contract. Should a conflict occur in or between or among any parts of the Contract Documents that are entitled to equal preference, the better quality or greater quantity shall govern, unless the Owner's authorized representative directs otherwise. Figured dimensions shall take precedence over scaled dimensions.
- C. To meet these performance requirements:
  - 1. Furnish all equipment, including any items not specified but required to provide a completed system. Verify the completeness of equipment listed in this Section and the correctness of type numbers.
  - 2. Use all equipment specified in the manner specified. Clarify any misunderstandings prior to bid submission, and offer alternates as appropriate.
  - 3. Verify each component's conformance with its manufacturer's published specifications and other requirements as stated in this Section.
  - 4. Check in detail each item of equipment provided, each portion of the installation, and the complete installation to ensure that the intent of this Section is achieved.
- D. The work includes, but is not limited to, the following:
  - 1. Submission of shop drawings prior to fabrication

2. Verification of dimensions and conditions at the job site
3. Installation in accordance with these specifications, manufacturer's recommendations, and all applicable code requirements
4. Setup and adjustment of signal processing, system tests and adjustments, written report, demonstration for approval, participation in acceptance tests, and final adjustments as required
5. Programming and documenting of all software controlled devices including initial setup of presets in all devices
6. Coordination with the Electrical contractor
7. Coordination with the Lighting contractor
8. Coordination with the Fire Alarm Systems Contractor
9. Coordination with Tel/Data Contractor and other Low Voltage Contractors
10. Coordination with Owner's Audio-Visual Personnel
11. Coordination with the Owner's IT department and installers
12. Performance standards, without claim for additional payment
13. System documentation
14. Instruction of Owner's operating personnel
15. Maintenance services for one year
16. Warranty

#### 1.7 SUBSTITUTIONS

- A. Furnish explanation of any suggested substitute equipment or methods, identifying the impact on equipment, installation, and change in overall price. State the system price as specified, and any change in price due to this substitution. State clearly the benefit offered by this substitution. Provide manufacturer's specifications or other descriptive literature as appropriate. If requested, make samples available, at no cost to the Owner.

#### 1.8 EXISTING CONDITIONS

- A. Verify all existing conditions. Refer to the Owner for coordination and clarification before the bid date of any discrepancies concerning existing conditions, drawings, and specifications. Clarify with the Owner all locations including conduit and cable routings. Where discrepancies occur and pre-bid instructions have not been obtained, abide by the Owner's decision.
- B. Provide all additional conduit and cable required for the installation. Refer to drawings of other Sections for identification of conduit and cable provided by other trades.
- C. Comply with all requirements regarding the proper installation of equipment for seismic considerations. It is the responsibility of the Contractor to employ installation methods that are in compliance with all applicable building codes of the authority(ies) having jurisdiction.

## 1.9 FEES, PERMITS, AND NOTICES

- A. Perform all work in compliance with all applicable requirements of the authority(ies) having jurisdiction. Take out and maintain all construction permits, pay all fees, and file all notices, all at no additional cost to the Owner.
- B. Where mounting or rigging systems require the design or design approval of a licensed Structural Engineer, pay all associated fees and expenses. Make no claim for additional payment.

## 1.10 MATERIAL AND EQUIPMENT

- A. Provide materials and equipment conforming to the applicable requirements of:
  - 1. Underwriter's Laboratories
  - 2. National Electrical Code
  - 3. American National Standards Institute
  - 4. Federal Communications Commission
- B. References shall meet the latest edition of that standard.
- C. Provide materials and equipment new and free from use, and covered by the applicable manufacturer's warranty.
- D. Notify the Owner if, in the Contractor's opinion, superior performance can be obtained from alternate materials or equipment from that identified in this specification.
- E. Certain items of equipment are specified by manufacturers' type numbers to indicate an acceptable standard of quality and performance. Substitutions of equal equipment beyond the alternatives listed will be permitted only if such equipment is listed in an addendum to this specification. Address requests for listing of substitutions to the Architect. With any request for substitution, include measured data proving the equivalence of the proposed substitute in quality and performance. The Architect shall be the final judge of the validity of the data submitted.
- F. Provide only current-model materials and equipment. Do not provide obsolete or discontinued models unless specifically directed to do so in the Equipment section of this Section. Review all materials and equipment immediately prior to installation, and inform the Owner's authorized representative of any obsolete or discontinued items.



#### 1.11 DELIVERY, STORAGE AND HANDLING

- A. All equipment shall be appropriately packed for shipment.
- B. All shipping costs to the job site are the responsibility of the Audiovisual Contractor. Determination of the shipping method and company is the responsibility of the Audiovisual Contractor in order to meet the published project schedule.
- C. Completed systems shall be shipped FOB inside and in place.
- D. Note that drop shipment of equipment to the Owner's site directly from the manufacturer, or other supplier will not be allowed.
- E. Upon delivery all materials shall be stored under cover in a clean and dry location. Materials which are damaged during shipping, storage or handling or are otherwise not suitable for installation shall be removed from the job site and replaced, at no additional cost to the Project, with acceptable materials.

#### 1.12 CLEANUP AND TRASH DISPOSAL

- A. Maintain a clean and safe working area free from debris and waste materials. Clean work areas daily.
- B. Except for items to be reused or returned to the Owner, or as otherwise directed, remove trash and packing materials from the jobsite, and dispose of offsite in a legal manner. Do not allow trash to accumulate at the jobsite.

#### 1.13 SUBMITTALS

- A. Submittal Format. Unless directed otherwise, provide submittals electronically in PDF format. Provide documents in full size and suitable for printing by the reviewer. Clearly identify each document within its file name.
- B. Equipment List. Before ordering equipment or beginning work, submit to the Owner's authorized representative for approval a detailed list showing quantities and manufacturer and model number for items of equipment to be used in assembling these systems, including all items of equipment, accessories, and installation materials specified herein. For each item, indicate quantity to be employed within each room or subsystem, and total quantity. Provide this list not later than 30 calendar days after execution of the contract. With this list, provide a statement of assurance that the system design has been reviewed in its entirety, and that the Equipment List defines all equipment and materials necessary for the project.
- C. Product Literature. With the equipment list, attach product literature for all items of equipment submitted, identifying the function, connections, weight,

dimensions, mounting method, electrical and cooling requirements, and other descriptive information for each item, and including a color photograph. Where literature serves more than one item (e.g. varying sizes, finishes, channel counts, etc.), mark to indicate intended item. Order these data sheets alphabetically by manufacturer or in sequence as the referenced equipment appears in the specification. Do not organize by space where the referenced equipment is employed. Provide manufacturers' published data sheets; do not provide third-party catalog pages or HTML pages.

- D. Shop Drawings. Submit the following items for approval by the Owner's authorized representative before starting work. Provide full-size drawings, with text size not smaller than 10-point when printed at full scale.
  - 1. Drawings showing locations and mounting methods for all wall and ceiling mounted equipment. Show geometry of any projection systems.
  - 2. Drawings showing fabrication details of custom millwork and metalwork items,
  - 3. Drawings of rack and other equipment elevations.
- E. Report of Post-Completion Tests. Prepare a report on the post-completion tests defined in this section identifying the failure of any subsystems to perform as required in this Section.
- F. System Documentation. Submit a draft of the final system documentation for approval prior to its publication. Provide draft copies of all items on-site for inspection during the demonstration and acceptance testing of the system; submit final copies thereafter.
- G. Training Materials. Submit a draft outline of the training program and preliminary copies of any materials to be distributed during the program.
- H. Acceptance Test. Submit a draft of the final system acceptance test for approval prior to its performance.

## PART 2 - EQUIPMENT

### 2.1 Installation Components

#### A. Ceiling Mounted Equipment Rack

1. Provide Ceiling mounted Equipment Rack complete with power and additional mounting kit. Provide 2RU Ceiling Rack
    - a. Atlas IED CR222 Ceiling Rack with CR222TRK
    - b. FSR CB-22S with strut hangers as needed
    - c. Chief CMS492 with additional supports
- 1) Quantity: As Shown on drawings

#### B. Flat Panel Display Storage Box and Mount

1. Provide flat panel display mount, storage box and complete integrated system. Provide system capable of fitting between standard studs without horizontal brace. Provide mount rated for 350 lbs and that supports standard VESA mounting patterns through pull-out mount. Provide with internal box space of 24 inches x 20 inches and minimum of 3.75" depth. Provide with 8 Single gang box knockout s. Provide system capable of supporting an additional 10 inch x 7 inches capacity underneath the display for optional auxiliary equipment.
    - a. RP Visual Wallmate 32 Max
    - b. Advanced Mounting and Design Custom Colossal Self Supported
    - c. Custom Display Solutions Custom
- 1) Quantity: As Shown on Drawings

## PART 3 - EXECUTION

### 3.1 SYSTEM INSTALLATION

- A. Supply racks, wire, conduits, and raceways required to provide a complete system. Unless specifically instructed to the contrary, install all system wiring in steel conduit. Do not exceed 30% fill in conduits. Insulate all conduit from the equipment rack(s); connect conduits mechanically and electrically to the system ground point. Coordinate with the Owner and the Owner's authorized representative.
- B. Use separate wiring pathways for microphone-level circuits (below -20 dBm), video and line-level audio circuits (up to +30 dBm), loudspeaker circuits (above +30 dBm), control circuits, and power circuits. Space all low-voltage pathways far from power circuits per conduit separation distances table shown on drawings.
- C. Secure equipment firmly in place, including projectors, control panels, loudspeakers, conduit, amplifiers, racks, cables, etc. For all overhead mounted devices, provide secondary attachment to provide support in case of failure of primary support. Make fastenings and supports adequate to support their loads with a safety factor of at least three.
- D. Assemble and install equipment racks to permit access to connections and adjustments on rear of rack mounted components and to permit removal of components for servicing. For any components which, for purposes of adjustment or calibration, must be removed from an equipment rack while in use, provide adequate service loops in all connecting cables.
- E. Install work neatly, with boxes, equipment, etc. plumb and square.
- F. Install the system in cooperation with other trades in order to achieve coordinated progress and satisfactory final results. Watch for conflicts with work of other trades on the job. Execute, without claim for extra payment, moderate moves or changes as are necessary to accommodate other equipment or preserve symmetry and a pleasing appearance.
- G. Install all equipment to provide safe operation.
- H. Provide ventilation as required to maintain equipment within the manufacturer's specified temperature limits.
- I. Field verify all junction box sizes prior to fabricating cover plates. Except where specifically dimensioned, control and connection plate layouts shown on drawings are not scaled. Size plates as necessary to hide joints and gaps between backboxes and surrounding wall.

- J. Where cover plates are not fitted with connectors, provide bushed hole(s) through cover plate in sizes and quantities required. Do not allow cables to enter or exit boxes without cover plates installed.
- K. For all A/V connections provide receptacle plates and panels consistent with architectural specifications. Prior to installation submit to the Architect for approval samples of proposed plates, receptacles, and panels.
- L. Provide steel blank and vent panels on all equipment racks to fill any unused rack spaces, per industry best practices for optimizing airflow. Use panels with factory-applied finishes to match the color of the rack itself unless otherwise directed by the Owner's authorized representative.
- M. Save all unused products accessories and turn over to Owner at checkout.

### 3.2 PROTECTION AND REPAIR OF EXISTING FINISHES AND STRUCTURES

- A. Cut and patch all holes required for this installation.
- B. Make good all materials and finishes cut into or damaged during installation.
- C. Maintain clean and safe working conditions. Clean the premises where dirtied, and clean all equipment, removing all dirt, dust, stains, and fingerprints. The Contractor is liable for any damage caused by his employees and subcontractors to the property of others.

### 3.3 DEMONSTRATION AND ACCEPTANCE TESTING

- A. Conduct tests to establish to the satisfaction of the Owner and the Owner's authorized representative that the system performs as required. Before beginning the acceptance testing, have reasonable assurance that such testing shall produce satisfactory results. Conduct testing in the presence of the Owner's authorized representative as well as the Owner, Architect, and General Contractor at their option, at a time mutually agreed to by all parties.
- B. Under the direction of the Owner's authorized representative, conduct tests as outlined below. Furnish any and all equipment and media necessary to perform these tests, and furnish evidence of proper calibration of all test equipment. Provide technical staff (system programmer, DSP programmer) to assist.
  - 1. System Performance Tests. Conduct spot checks of system performance to ensure performance requirements (Paragraph **Error! Reference source not found.** of this Section) are met. Perform such tests as necessary to establish confidence that spot test results are representative of system performance as a whole.
  - 2. Operating Tests. Include tests to verify that system functional requirements (Paragraph **Error! Reference source not found.** of this Section) are met, and that user controls operate properly.

3. Equipment Tests. Confirm the proper functioning of significant equipment items, and confirm required system control over these items.
  4. Final Adjustments. Make control adjustments as directed by the Owner's authorized representative. Provide covers, caps, or shaft-locks for controls not used in system operations. Make a record of these control settings for inclusion with the final documentation.
  5. Listening and Viewing Tests. Include subjective evaluations by persons listening and viewing from various positions under various operating conditions. Conduct such tests to verify system functioning under normal operating conditions.
- C. If the need for adjustment or modification becomes evident during testing, either continue testing, or interrupt testing to permit corrective action, as directed by the Owner's authorized representative. Perform retesting following any corrective action to the extent directed by the Owner's authorized representative.
- D. In addition to Contractor-directed testing, assist as required with specific testing as conducted by the Owner's authorized representative.

END OF SECTION 274116

## **SECTION 310101**

### **SITE RESTORATION**

#### **PART 1 - GENERAL**

##### **1.1 QUALITY ASSURANCE**

- A. Provide prepackaged seed readily available to the public with quality and purity equal to product of O.M. Scotts and Son, Marysville, OH 43041. On-the-job or made-to-order mixes will not be accepted.
- B. Refer to Specification 32 92 00 Lawns for more information.

##### **1.2 DELIVERY STORAGE AND HANDLING**

- A. Deliver fertilizer in manufacturer's standard size bags or cartons showing weight, analysis, and the name of the manufacturer. Store as approved by Director's Representative.
- B. Store all seed at the site in a cool dry place as approved by the Director's Representative. Replace any seed damaged during storage.

##### **1.3 SCHEDULING**

- A. Time For Seeding: Optimum period to sow permanent grass seed is generally between April 1st and May 15th or between August 15th and October 1<sup>st</sup>. Schedule application for when weather conditions permit or as Directed.
  - 1. Provide temporary seed and mulch when final grading is complete while waiting for optimal seeding period.
  - 2. Provide temporary seed and mulch for temporary cover on disturbed ground not to be worked on for more than 7 days.
  - 3. Provide temporary seed and mulch on disturbed earth prior to temporary shutdown of construction.

#### **PART 2 - PRODUCTS**

##### **2.1 TOPSOIL**

- A. Provide topsoil conforming to the following:
  - 1. Original loam topsoil, well drained homogeneous texture and of uniform grade, without the admixture of subsoil material and entirely free of dense material, hardpan, sod, or any other objectionable foreign material.
  - 2. Containing not less than 4 percent nor more than 20 percent organic matter in that portion of a sample passing a 1/4 inch sieve when determined by the wet combustion method on a sample dried at 105 degrees C.

3. Containing a Ph value within the range of 4.5 to 7 on that portion of the sample that passes a 1/4 inch sieve.
4. Containing the following gradations:

| SIEVE DESIGNATION | PERCENT PASSING                 |
|-------------------|---------------------------------|
| 1 inch            | 100                             |
| 1/4 inch          | 97 - 100                        |
| No. 200           | 20 - 65 (of the 1/4 inch sieve) |

## 2.2 FERTILIZER

- A. Fertilizer: Mixed commercial fertilizers shall contain total nitrogen, available phosphoric acid and soluble potash in the ratio of 10-6-4 (50% N/UF). 50% of total nitrogen shall be derived from ureaform furnishing a minimum of 3.5% water insoluble nitrogen (3.5% WIN). The balance of the nitrogen shall be present as methylene urea, water-soluble urea, nitrate and ammoniacal compounds.
- B. Other fertilizers meeting DOT Specification Section 713-03 Fertilizer can be used.

## 2.3 SEED

- A. Furnish fresh, clean, new-crop seed mixed in the proportions specified for species and variety, and conforming to Federal and State Standards.
- B. Acceptable material in a seed mixture other than pure live seed consists of nonviable seed, chaff, hulls, live seed of crop plants and inert matter. The percentage of weed seed shall not exceed 0.1 percent by weight.
- C. All seed will be rejected if the label indicates any noxious weed seeds.
- D. Provide seed mixture per Specification 32 92 00 Lawns.

## 2.4 MULCH

- A. Hydroseed Application: Do all slurry preparation at the job site:
  1. Water, mulch, fertilizer, binder and other ingredients shall be added to the tank simultaneously so that the finished load is a homogenous mix of the specified ingredients.
  2. Seed shall be added last and shall be discharged within 2 hours. Loads held over 2 hours will be recharged with ½ the seed rate before application.
  3. Once fully loaded, the complete slurry shall be agitated for 3-5 minutes to allow for uniform mixing.



|    |  |                                     |
|----|--|-------------------------------------|
| B. | HydroSeeding Application: One Step Hydroseed |                                     |
|    | Lbs/Ac                                       | Material                            |
|    | 2,000 lbs                                    | 100% Cellulose or Wood Fiber        |
|    | 80 lbs                                       | Fertilizer (3.04 Fertilizer 10-6-4) |
|    | 16 lbs                                       | Seed as per section (2.02 Seed)     |

## PART 3 - EXECUTION

### 3.1 GRADING

- A. Rough Grading: Trim and grade lawn areas within the Contract Limit to a level of 4 inches below the finish grades indicated unless otherwise specified herein or where greater depths are indicated. Provide smooth uniform transition to adjacent areas.
- B. Finish Grading: Finish surfaces free from irregular surface changes, and as follows:
  - 1. Grassed Areas: Finish areas to receive topsoil to within 1 inch above or below the required subgrade surface elevations.

### 3.2 SPREADING TOPSOIL

- A. Perform topsoil spreading operations only during dry weather.
- B. To insure a proper bond with the topsoil, harrow or otherwise loosen the subgrade to a depth of 3 inches before spreading topsoil.
- C. Spread topsoil directly upon prepared subgrade to a minimum depth measuring 4 inches after natural settlement in areas to be seeded. Smooth out unsightly variations, bumps, ridges, and depressions that will hold water. Remove stones, litter, or other objectionable material. Finished surfaces shall conform to the contour lines and elevations indicated on the drawings or fixed by the Director's Representative.

### 3.3 PREPARATION FOR SEEDING

- A. Seed Bed: Scarify soil to a depth of 2 inches in compacted areas. Smooth out unsightly variations, bumps, ridges, and depressions that will hold water. Remove stones, litter, or other objectionable material.

### 3.4 FERTILIZING

- A. Apply 10-6-4 fertilizer evenly at the rate of 40 pounds per 1000 sq ft.

### 3.5 SEEDING

- A. Assume all risks when seed is sowed before approval of seed analysis.
- B. Do not seed when the wind velocity exceeds 5 miles per hour.

- C. Application Rate: 8 pounds per 1000 sq ft.
- D. Dry Application: Sow seed evenly by hand or seed spreader on dry or moderately dry soil.
- E. Wet Application: Refer to Hydroseeding Application.

### 3.6 MULCHING

- A. Dry Application: Within 3 days after seeding, cover the seeded areas with a uniform blanket of straw mulch at the rate of 50 pounds per 1000 sq ft of seeded area.
- B. Wet Application: All hydroseed applications are to be applied in a sweeping motion to form a uniform application and form a mat at the specified rates.
  - 1. Unused Loads: If mixture remains in tank for more than 8 hours it shall be removed from the job site at contractor's expense.
  - 2. Reseeding: After "Final Acceptance", reseeding will be done at the request of the owner and shall be considered extra.

### 3.7 LAWN ESTABLISHMENT

- A. Maintain the grass at heights between 2-1/2 inches and 3-1/2 inches and include a minimum of 2 mowings.
- B. Water and protect all seeded areas until final acceptance of the lawn.

### 3.8 IRRIGATION SYSTEM MODIFICATIONS

- A. Adjust irrigation system sprays and rotors within lawn areas to provide full head to head coverage.
- B. Replace spray and rotor heads removed during demolition phase with in-kind make/model and nozzle type.

### 3.9 FINAL ACCEPTANCE

- A. Final acceptance of seeded areas will be granted when a uniform stand of acceptable grass is obtained, with a minimum of 95 percent coverage. Portions of the seeded areas may be accepted at various times at the discretion of the Director's Representative.
- B. Unacceptable seeded areas, dry application: Reseed as specified and fertilized at one-half the specified rate.
- C. Once accepted, the State will assume all maintenance responsibilities.

END OF SECTION 310101

## SECTION 311100

### CLEARING AND GRUBBING

#### PART 1 - GENERAL

##### 1.1 WORK INCLUDED:

- A. The Contractor shall do all required clearing and grubbing as indicated on the drawings or herein specified in the area required for construction operations on the Owner's land or in the Owner's permanent or temporary easements and shall remove all debris resulting therefrom.
- B. Unless otherwise noted, all areas to be cleared shall also be grubbed.
- C. The Contractor shall not clear and grub outside of the area required for construction operations.

##### 1.2 RELATED WORK:

Any trees and shrubs specifically designated by the Owner not to be cut, removed, destroyed, or trimmed shall be saved from harm and injury in accordance with Section 01 57 19, ENVIRONMENTAL PROTECTION.

#### PART 2 - PRODUCTS: NOT APPLICABLE

#### PART 3 - EXECUTION

##### 3.1 RIGHT TO WOOD AND LOGS:

The Owner shall have the right to cut and remove logs and other wood of value in advance of the Contractor's operations. All remaining logs and other wood to be removed in the course of clearing shall become the property of the Contractor.

##### 3.2 CLEARING:

- A. Unless otherwise indicated, the Contractor shall cut or otherwise remove all trees, saplings, brush and vines, windfalls, logs and trees lying on the ground, dead trees and stubs more than 1-foot high above the ground surface (but not their stumps), trees which have been partially uprooted by natural or other causes (including their stumps), and other vegetable matter such as shags, sawdust, bark, refuse, and similar materials.
- B. The Contractor shall not remove mature trees (4-inches or greater DBH) in the Owner's temporary easements.
- C. Except where clearing is done by uprooting with machinery or where stumps are left longer to facilitate subsequent grubbing operations, trees, stumps, and stubs to be

cleared shall be cut as close to the ground as practicable but not more than 6-inches above the ground surface in the case of small trees, and 12-inches in the case of large trees. Saplings, brush and vines shall be cut close to the ground.

3.3 GRUBBING:

- A. Unless otherwise indicated, the Contractor shall completely remove all stumps and roots to a depth of 18-inches, or if the Contractor elects to grind the stumps, they shall be ground to a minimum depth of 6-inches.
- B. Any depression remaining from the removal of a stump and not filled in by backfilling shall be filled with gravel borrow and/or loam, whichever is appropriate to the proposed ground surface.

3.4 DISPOSAL:

All material collected in the course of the clearing and grubbing, which is not to remain, shall be disposed of in a satisfactory manner away from the site or as otherwise approved. Such disposal shall be carried on as promptly as possible and shall not be left until the final clean-up period.

END OF SECTION 311100

## **SECTION 311111**

### **SITE DEMOLITION**

#### **PART 1 – GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

##### **1.2 SUMMARY OF WORK**

- A. Specifically included without limiting the generality of drawings and specifications are:
  - 1. Selective Demolition for site work. Refer to architectural/ structural demolition as described elsewhere in specifications.

##### **1.3 SELECTIVE DEMOLITION**

- A. Removal of all existing components and construction where shown, implied, and/or required to execute the reconstruction.
- B. Removal and storage on site of all items/materials which at the Owner's direction, are to remain property of the Owner. All other items/materials are to be deemed demolition refuse.
- C. Removal of all abandoned services and utilities within the work area.
- D. Remove and legally dispose of all demolition refuse from the Project Site.
- E. Protect from damage existing finish work that is to remain in place and becomes exposed during demolition operations.
- F. Protection of all existing services and utilities which are to remain functioning and in use during the construction period. Provide temporary services as required until all new systems are operational.
- G. Disconnect and remove all project abandoned, or previously abandoned utility service connectors in accordance with regulations of authorities concerned.
- H. Demolition and complete removal of existing system(s) unless otherwise noted.
- I. Conduct demolition operations and removal of debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks, or other occupied or used facilities without permission from the Owner. Provide alternate routes around closed or obstructed traffic ways as required by the Owner.
- J. Protect all site utilities at demolition work and placement of new work.
- K. Bury NO demolition refuse on Site.

## 1.4 CONTROL DEVICES

- A. Furnish and install construction fencing, dust and noise control barriers, etc. as required. Conduct selective demolition work in manner that will minimize need for disruption of Adjacent Neighbor's normal operations. Provide minimum of 72 hours advance notice to Owner of demolition activities that will impact Owner's use of site.
  - 1. Provide temporary sheeting, shoring, bracing as required to protect and support adjacent elements which remain.

## PART 2 - PRODUCTS (Not used)

## PART 3 - EXECUTION

### 3.1 EXECUTION OF THE WORK

- A. Perform all work in strict accordance with all applicable Codes, Laws, and Ordinances having jurisdiction over the Work and specifically in accordance with the following to the extent that such provisions are not in conflict with applicable local laws.
  - 1. NYS Workmen's Compensation Law.
  - 2. Rules of the Workmen's Compensation Board of the State of New York.
  - 3. Manual of Accident Prevention in Construction, published by the Associated General Contractors of America, Inc.
  - 4. New York State Uniform Fire Prevention and Building Code.
  - 5. Industrial Code Rule 23, Protection of Persons Employed in Construction and Demolition Work, State of New York, Department of Labor.
  - 6. New York State Labor Law.
- B. Submit a coordination Schedule for Shut-off, capping, removal, and continuation of any utility services.
  - 1. Protection of Persons and traffic.
    - a. Ensure safe passage of pedestrians and vehicular traffic around areas of removal.
    - b. Conduct operations in a manner to prevent injury to persons or property.
    - c. Erect temporary passageways as required or directed by authorities having jurisdiction.
  - 2. Avoid overloading portions of the existing structure with demolition debris, new materials, and/or equipment.
  - 3. All materials resulting from the removal operation shall become the property of the Contractor except that identified or required to remain the property of the Owner.
  - 4. All salvage and debris resulting from the demolition operations shall be immediately removed from the site and shall not be stored or permitted to accumulate or be sold at the site.
  - 5. The Contractor shall comply with the applicable laws and ordinances governing the disposal of materials, debris, rubbish and trash off the project site, and shall commit no trespass on public or private property in any operation hereto or connected with this Contract.
  - 6. No burning shall be permitted on the Project Site.

7. All uncharted conduits, mains, lines, etc. encountered in the project shall be taken care of properly and safely by the Contractor, who upon encountering them, shall notify the Owner of the findings and arrangements made for modification necessary as not to interfere with the work.
8. Promptly repair damages caused to adjacent facilities by demolition work at no cost to Owner.

### 3.2 DUST CONTROL

- A. The Contractor shall be responsible for providing all the necessary precautions and measures to prevent and control the spread of dust during all phases of this project. These measures shall be implemented as required and as required by the Architect/Engineer throughout construction.

### 3.3 NOISE CONTROL

- A. All operations shall be conducted as quietly as reasonably possible.
- B. Personnel shall be instructed to avoid unnecessary noise and reminder signs shall be posted conspicuously.
- C. Before starting any work that involves unavoidable noise, the Contractor shall notify the Architect/Engineer and Owner in writing sufficiently in advance to allow for special preparation, if any are possible.
- D. Whenever persons are subjected to sound exceeding those listed on OSHA Standards table; feasible administrative or engineering controls shall be utilized.
- E. Sound levels shall be measured on the A-scale of a standard sound level meter at low response. Genuine loss of hearing can result if a person is repeatedly exposed to levels greater than 85-90 dba during the workday.

### 3.4 CLEANUP

- A. On completion of the work, the Contractor shall remove all temporary construction no longer needed, equipment, salvaged materials, trash and debris of all kinds and shall leave the area in a finished condition.

END OF SECTION 311111





## **SECTION 312213**

### **ROUGH GRADING**

#### **PART 1 – GENERAL**

1.1 RELATED DOCUMENTS: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### **1.2 WORK INCLUDED**

A. Cutting, filling and compacting to establish subgrade for:

1. Pavements.
2. Lawns and landscape areas.

B. Compaction of embankments.

C. Disposal of unsuitable material.

D. Disposal of excess material.

E. Install grade stakes at 50-ft o.c. (or less) grid pattern to ensure all grades comply with allowable tolerances. This is true for subgrades and finished grades.

#### **1.3 RELATED SECTIONS**

Section 02 30 00: Soil Testing Services.

Section 31 23 00: Earthwork.

Section 31 23 16: Trenching, Backfilling and Compaction.

Section 32 10 00: Roadway and Miscellaneous Subbase.

Section 32 91 13: Soil Preparation and Soil Mixes.

Section 32 92 00: Lawns.

Section 33 40 00: Storm Sewer Systems.

#### **1.4 QUALITY ASSURANCE**

A. Requirements of Regulatory Agencies.

1. Comply with requirements of:
  - a. OSHA.
  - b. New York State Department of Labor.
  - c. U.S. Army Corps of Engineers
  - d. Other agencies with jurisdiction.

2. Obtain all permits required for the completion of the project.

B. Testing Laboratory Requirements:

1. Obtain a testing laboratory to perform soil testing and inspection for quality control during rough grading operations.
2. Before commencing work, obtain approval from Owner and Landscape

Architect/Engineer of:

- a. Testing laboratory.
- b. Testing schedule.

C. Reference Standards:

1. NYSDOT Specs.
2. ASTM.

D. Allowable Tolerances:

1. Subgrades for areas other than roadways and miscellaneous surfaces should be:
  - a. Graded parallel to finished grade.
  - b. Within one inch of required grade.
  - c. Without depressions which hold water.

## 1.5 SUBMITTALS

A. Test Requirements:

1. Testing laboratory.
2. Testing schedule.
3. Gradation test reports: For all materials specified in this section.
4. Optimum moisture and maximum density:
  - a. Structural Fill.
  - b. Native, on-site general fill.
5. Field density test reports.

B. Manufacturer's Data:

1. Geotextile.
2. Compaction equipment.
3. All Products.

## 1.6 PROJECT CONDITIONS

A. Notify:

1. UFPO at 1-800-962-7962 not less than 72 hours prior to starting rough grading for location of underground utilities such as gas, telephone, electric lines, etc.
2. Other private and public utilities in the work area.
3. Landscape Architect/ Engineer and Construction Manager.
  - a. At least 24 hours prior to commencing rough grading.
  - b. When rough grading has established final subgrade elevations.
  - c. When unsuitable material is encountered at required subgrades.
  - d. When unauthorized excavations have taken place.

- e. When rock is encountered.
- f. When suitable subgrades become unsuitable due to lack of dewatering.
- g. When uncharted, unidentified, incorrectly charted or incorrectly located underground utilities are encountered.

B. Existing Conditions:

- 1. Data regarding subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil borings and test pits. It is expressly understood that the Owner or Landscape Architect/ Engineer will not be responsible for interpretations or conclusions drawn therefrom by Contractor. Data are made available for convenience of Contractor.
- 2. Additional test borings and other exploratory operations may be made by Contractor at no cost to Owner.
- 3. Do not interrupt existing utilities servicing facilities occupied and used by Owner and others except when permitted in writing, and then only after acceptable temporary utility services have been provided, or permission to interrupt service is granted by utility authority. Provide minimum of 48 hour notice to utility company, and receive written notice to proceed before interrupting any utility.

C. Environmental Conditions:

- 1. Do not commence rough grading if ground is frozen, muddy or covered with snow.
- 2. Do not commence or continue rough grading when precipitation is falling.
- 3. Protect established subgrades against freezing when atmospheric temperature is less than 35° F.
- 4. Do not place embankment on frozen subgrade.

## 1.7 SEQUENCING AND SCHEDULING

A. Do not commence rough grading until:

- 1. Site preparation is complete within the Contract Limit Line.
- 2. Site preparation is complete within substantial portions of the Project as approved by the Landscape Architect/ Engineer.
- 3. Adequate grade stakes have been established to guide work as required by the Landscape Architect/ Engineer.
- 4. All protective measures are in place.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Select Fill: Conforming to DOT Specs, Item 203.06 specified in Section 203-2.02B, sound, durable sand, gravel, stone or blends of these materials, free from organic material, other deleterious material and frozen sections. Material furnished shall have the following gradation:

| <u>SIEVE SIZE</u> | <u>PERCENT PASSING BY WEIGHT</u> |
|-------------------|----------------------------------|
|-------------------|----------------------------------|

|         |        |
|---------|--------|
| 4 inch  | 100    |
| No. 40  | 0 - 70 |
| No. 200 | 0 - 15 |

Fines passing No. 200 shall be non-plastic.

- B. Select Granular Subgrade: Conforming to DOT Specs, Item 203.20, specified in Section 203.2.02E.

1. Well-graded rock may be used. Particles should not exceed 12 inches in greatest dimension nor 2/3 of the loose lift thickness, whichever is less.
2. All materials, other than well graded rock, furnished under this item shall have no particles greater than 6 inches in maximum dimension. Of the portion passing the 4 inch square sieve, the material shall have the following gradation:

| <u>SIEVE SIZE</u> | <u>PERCENT PASSING BY WEIGHT</u> |
|-------------------|----------------------------------|
|-------------------|----------------------------------|

|          |          |
|----------|----------|
| 1/4 inch | 30 - 100 |
| No. 40   | 0 - 50   |
| No. 200  | 0 - 10   |

Where the Owner elects to test for this requirement, a material with a Magnesium Sulfate Soundness Loss exceeding 35 percent will be rejected.

3. Materials should be free from organic materials, other deleterious material and frozen sections.
- C. Native Material: Subsoils found at the site may be used as fill that will not support structures, roadways, artificial turf field or miscellaneous surfaces, as approved by Engineer.
1. Saturated native materials should be stockpiled in windrows to dry.
  2. Use native materials in embankments only after optimum moisture content has been reached.
  3. Material should be free from organic materials, other deleterious materials and frozen sections.
- D. Geotextile: Woven, polypropylene reinforcement fabric.
1. Amoco 2006 or,
  2. Mirafi 500 X or,
  3. Approved equivalent.
  4. Or as indicated on the plans.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities on and adjacent to Owner's property from damage caused by settlement, lateral movement, undermining, washout and other hazards created by rough grading operations.
- B. Protect survey markers on and adjacent to Owner's property including but not limited to iron pipes and rods, concrete and stone monuments, hubs, stakes, etc.
- C. The following are prohibited within the drip line of all vegetation to remain:
  - 1. Stockpiling construction materials, including soil.
  - 2. Vehicular traffic.
  - 3. Parking of any vehicle or equipment.
  - 4. Discharging solid or liquid waste.
  - 5. Servicing vehicles, machinery or equipment.
  - 6. Placing shanties, sheds and other temporary enclosures.
- D. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shut-off of services if lines are active. Comply with regulations and requirements of utility authority. (Provide temporary means of conveyance for all disturbed utilities as required until such a time the new systems are operational).
- E. Bench existing slopes where embankments are to be placed on slopes steeper than 1 (vertical) on 5 (horizontal).
  - 1. Bottom of bench: Sloped at approximately 2 percent, draining downhill, without depressions.
  - 2. Sideslope of bench: At a stable angle of repose suitable to sustain itself until placement of embankment material.
  - 3. Place embankment material as soon as each bench is complete.

### 3.2 INSPECTION

- A. Examine the site to verify:
  - 1. All protective measures are in place.
  - 2. Field stake-out has been completed.

### 3.3 SPECIAL PRECAUTIONS

- A. The use of explosives is not permitted. Do not bring explosives onto the site or use in the work of this Contract.
- B. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner. Report findings to Landscape Architect and/or Engineer.
- C. Perform excavation within drip line of trees to remain by hand, and protect the root system from damage or dry out.

- D. Protect newly graded areas from traffic and erosion, and keep them free of trash and debris until completion of the work of this Contract.
- E. Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace in accordance with applicable laws and codes where sloping is not possible because of space restrictions or stability of material excavated.
- F. Maintain sides and slopes of excavations in safe condition until completion of backfilling.
- G. The Contractor is responsible for all means of erosion control during all phases of construction, at his expense. Any damage due to erosion conditions shall be repaired by the Contractor at no cost to the Owner and to the satisfaction of the Landscape Architect/ Engineer.

### 3.4 HANDLING MATERIALS

- A. The moisture content of a material may be such that its use will require extensive manipulation. It is the Contractor's responsibility to determine the economics of using, or disposing and replacing such materials. Material determined by the Contractor to be uneconomic for use may be disposed of as specified and replaced with other material at no additional cost to the Owner.
- B. Stockpile satisfactory excavated materials until required for backfill or fill. Place, grade and shape stockpiles for proper drainage and drying. Protect from contamination.
- C. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.
- D. Where subgrade or lifts of soil material must be moisture conditioned before compaction, uniformly apply water to surface or subgrade, or lifts of soil material, to prevent free water appearing on surface during or subsequent to compaction operations.
- E. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
- F. All excavated unsuitable and excess materials are the Contractor's responsibility for disposal at an off-site location in a legal manner.

### 3.5 ROUGH GRADING

- A. Establish required subgrades by cutting, filling and compacting.
  - 1. Subgrades should conform to cross sections, elevations and grades of finished grades with allowances for depth of finish improvements. Subgrades shall comply with allowable tolerances. Failure to do so shall be at the contractor's risk and cost.

### 3.6 GRADING BELOW REQUIRED SUBGRADES

- A. Fill all unauthorized excavation in subgrade areas with compacted select granular subgrade material without altering required subgrade elevations.
  - 1. Concrete fill may be used to bring subgrades to required elevations only

- when approved in writing by the Landscape Architect/ Engineer.
2. Notify Landscape Architect/Engineer of unauthorized excavation before commencing remedial work.

- B. Unauthorized excavation in lawn and landscape areas may be filled with the material otherwise specified for placement on subgrade at no additional cost to the Owner.
- C. If unsuitable bearing materials are encountered at required subgrade elevations, notify the Owner and Landscape Architect/ Engineer and proceed with the following operations at no additional cost to the owner.
  1. Carry excavations deeper until suitable bearing material is encountered or as required.
  2. Remove unsuitable material and dispose of in a lawful manner.
  3. Place geofabric on undercut subgrade.
  4. Place select granular subgrade material and compact in lifts to required subgrade elevations.
- D. If established subgrades on suitable material become unsuitable because of saturation due to Contractor's failure to provide de-watering, or other construction operations, proceed with the operations specified in the preceding paragraph at no additional cost to the Owner.

### 3.7 ROCK

- A. Where footings, foundations or other work requiring soil support rest entirely on rock, remove all loose soil and rock at required subgrade elevations.
- B. Where footings, foundations or other work requiring soil support rest partially on rock and partially on soil, notify the Landscape Architect/ Engineer immediately, before backfilling or placing other work.

### 3.8 DEWATERING

- A. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
- B. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations at no additional cost to the Owner.
- C. Establish and maintain temporary drainage ditches and other diversions outside grading limits to convey rain water and water removed from excavations to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.
- D. The Contractor is responsible for providing all the necessary means of dewatering for the duration of the project. Areas damaged due to improper dewatering methods shall be repaired at no cost to the Owner to the satisfaction of the

### 3.9 FILLING AND COMPACTING

- A. Place geofabric on subgrade according to manufacturer's instructions so it lays flat without creases, folds, or other irregularities. Minimum overlap at joints: 18 inches.
- B. Place embankment materials in lifts not exceeding 12 inches in loose depth according to DOT Specs, Section 203-3.10.
  - 1. Stumps, logs and other decomposable materials are not to be used in any part of embankments.
- C. Compact each lift of embankment material as specified in DOT Specs, Section 203-3.12.
  - 1. In all areas other than those supporting lawns and landscape areas: to at least 95% of Modified Proctor Maximum Dry Density.
  - 2. In all lawn and landscape areas: to a minimum of 85% and maximum of 90% of Modified Proctor Maximum Density.
  - 3. In detention basin fill areas: to a minimum of 80% and maximum of 85% for the basin bottom and at least 95% of Modified Proctor Maximum Density for weir or berm (earth containment) areas.

### 3.10 PROOF ROLLING

- A. Immediately prior to final trimming of the subgrade and placement of subbase materials for roadways and miscellaneous surfaces, all areas of the subgrade should be proof rolled.
  - 1. On embankments conforming to DOT Specs, Section 203-3.13.
  - 2. In cut sections conforming to DOT Specs, Section 203-3.14.
- B. If proof rolling reveals unsatisfactory bearing conditions:
  - 1. In cut sections: proceed according to paragraph 3.6 C of this specification as directed.
  - 2. On embankments: proceed according to paragraph 3.6 D of this specification as required, at no additional cost to the Owner.

### 3.11 REMEDIAL ACTION

- A. If field density reports or inspection by the Owner or Landscape Architect/ Engineer reveal that subgrades or embankments have been constructed below specified density, provide additional compaction and testing at no additional cost to the Owner until specified densities are achieved.
- B. Repair and re-establish grades in settled, eroded and rutted areas to specified tolerance.
- C. Where completed, compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape, and compact to required density prior to further construction.



- D. Where settling is measurable or observable during general project warranty period, remove surface (pavement, lawn or other finish), add originally specified material, substituting select granular subgrade material for native material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.
- E. Subgrade areas which do not comply with the allowable tolerances set forth in these specifications. Shall be reestablished to such tolerances and approved by the Landscape Architect/ Engineer for substantial compliance.

END OF SECTION 312213



**SECTION 312300**  
**EARTHWORK**

**PART 1 – GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Section, apply to this Section.

**1.2 SUMMARY**

- A. Work Included:

- 1. Excavation, backfill, grading, and compaction relating to all phases of construction.
  - 2. Importing and exporting material fill as required to meet final grades.

- B. Related Sections include the following:

- Section 02 30 00: Soil Testing Services.
  - Section 31 11 00: Clearing and Grubbing.
  - Section 31 22 13: Rough Grading.
  - Section 31 23 16: Trenching, Backfilling & Compaction.
  - Section 32 12 16: Asphalt Concrete Paving, Surfacing and Striping.
  - Section 32 91 13: Soil Preparation and Soil Mixes.
  - Section 32 92 00: Lawns.

**1.3 UNIT PRICES**

- A. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the following:

- 1. 24 inches outside of concrete forms other than at footings.
  - 2. 12 inches outside of concrete forms at footings.
  - 3. 6 inches outside of minimum required dimensions of concrete cast against grade.
  - 4. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
  - 5. 6 inches beneath bottom of concrete slabs on grade.
  - 6. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

- B. Unit prices for rock excavation include replacement with approved materials.

- C. Unit prices for unsatisfactory soils include excavation of soils and replacement with approved materials.

**1.4 DEFINITIONS**

- A. Backfill: Soil materials used to fill an excavation.

- 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.

2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Layer placed between the subbase course and asphalt paving.
  - C. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.
  - D. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.
  - E. Drainage Course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.
  - F. Excavation: Removal of material encountered above subgrade elevations.
    1. Additional Excavation: Excavation below subgrade elevations as required by the Landscape Architect. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
    2. Bulk Excavation: Excavations more than 10 feet in width and pits more than 30 feet in either length or width.
    3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without a request by the Landscape Architect. Unauthorized excavation, as well as remedial work required by the Landscape Architect, shall be without additional compensation.
  - G. Fill: Soil materials used to raise existing grades.
  - H. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material exceeding 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, or blasting, when permitted:
    1. Excavation of Footings, Trenches, Pits and Bulk Excavations: Late-model, track-mounted hydraulic excavator; equipped with a 42 inch-wide, short-tip-radius rock bucket; rated at not less than 120-hp flywheel power with bucket-curling force of not less than 25,000 lbf and stick-crowd force of not less than 18,700 lbf; measured according to SAEJ-1179.
    2. If the material can be removed by ripping, plowing or excavating equipment from any direction, the material shall not be classified as rock.
  - I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
  - J. Subbase Course: Layer placed between the subgrade and base course for asphalt paving, or layer placed between the subgrade and a concrete pavement or walk.
  - K. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
  - L. Utilities on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

- M. Unsatisfactory soil: Soil which in the opinion of the Engineer is incapable after compaction of properly supporting the utility pipe or structure. The ability of soils listed in paragraph 2.1 C to provide proper support will be based upon field conditions.

## 1.5 SUBMITTALS

- A. Product Data: For the following:

- 1. Drainage fabric.
- 2. Separation fabric.
- 3. All Products.

- B. Samples: For the following:

- 1. Soil gradation results for each proposed soil material.
- 2. 12-by-12-inch sample of drainage fabric.
- 3. 12-by-12-inch sample of separation fabric.

- C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:

- 1. Classification according to ASTM D 2487 of each on-site or borrow soil material proposed for fill and backfill.
- 2. Laboratory compaction curve according to ASTM D 698 for each on-site or borrow soil material proposed for fill and backfill.
- 3. Laboratory compaction curve according to ASTM D 1557 for each on-site or borrow soil material proposed for fill and backfill.

## 1.6 QUALITY ASSURANCE

- A. Comply with latest requirements of:

- 1. OSHA.
- 2. NYS Department of Labor.
- 3. NYS Department of Transportation
- 4. NYS Department of Environmental Conservation.
- 5. Other agencies with jurisdiction.

## 1.7 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Landscape Architect/ Engineer and then only after arranging to provide temporary utility services according to requirements indicated:

- 1. Notify Landscape Architect/ Engineer not less than two days in advance of proposed utility interruptions.
- 2. Do not proceed with utility interruptions without Landscape Architect /Engineer written permission.
- 3. Contact utility-locator service for area where Project is located before excavating.

- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

## PART 2 - PRODUCTS

### 2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations. (Geotechnical Report referenced material).
- B. Satisfactory Soils: ASTM D 2487 in classification groups GW, GP, GM, SW, SP, and SM, or a combination of these group symbols; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT, or a combination of these group symbols.
  - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Backfill and Fill: Satisfactory soil materials in accordance with Geotechnical Report.
- E. Backfill and Fill Material for Utility Trenches Outside of Building (use under paving): Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; meeting gradation of NYSDOT Section 304, Type 4.
- F. Subbase (use under pavement, walks and running track components where applicable.): Material shall consist solely of approved blast furnace slag or of stone which is the product of crushing ledge rock; meeting gradation of NYSDOT Section 304.13, Type 2. (Crusher Run) depth as indicated on plans.
- G. Structural Fill: Artificially graded mixture of crushed stone meeting gradation of NYSDOT Section 304, Type 4, and in accordance with Geotechnical Report.
- H. Pipe Bedding and Pipe Zone Backfill Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone or slag, meeting gradation of NYSDOT Section 703, Table 703-4 Type 1 or 1A, as indicated.
- I. Drainage Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; meeting gradation of NYSDOT Section 304, Type 4 (where applicable.)
- J. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state. (Shall be approved by Landscape Architect/ Engineer).

### 2.2 ACCESSORIES

- A. Filter Fabric: (Separation Fabric) Manufacturer's standard nonwoven geotextile fabric of polypropylene, nylon or polyester fibers, or a combination, with the following properties: Amoco 4545 or equivalent:
  - 1. Grab Tensile: 90 lbs., ASTM D 4632.
  - 2. Grab Elongation: 50%, ASTM D 4632.
  - 3. Mullen Burst: 225 psi, ASTM D 3786.
  - 4. Puncture: 65 lbs., ASTM D 4833.

5. Trapezoidal Tear: 45 lbs., ASTM D 4533.
6. U.V. Resistance (Strength Retained): 70%, ASTM D 4355.
7. Equivalent Opening Size: 70 min. U.S. Sieve Number, ASTM D 4751.
8. Permittivity: 2.5 sec.<sup>-1</sup>, ASTM D 4491.
9. Flow Rate: 175 gal/min/ft<sup>2</sup>, ASTM D 4491.

- B. Soil Reinforcement/Erosion Control Matting: Shall be a three dimensional geomatrix of heavy nylon monofilaments fused at their intersections, with 95% of the geomatrix being open space, meeting the following properties unless otherwise indicated.

| <u>Property</u>                      | <u>Value</u> |
|--------------------------------------|--------------|
| Carbon Black content by weight       | 2%           |
| Nominal Weight (02/yd <sup>2</sup> ) | 12.0         |
| Minimum Weight (02/yd <sup>2</sup> ) | 11.1         |
| Thickness (inches)                   | 0.75         |
| Minimum Filament Diameter (inches)   | 0.016        |
| Tensile Strength (lbs/ft length)     | 250          |
| Tensile Strength (lbs/ft length)     | 120          |
| Tensile Elongation - Length (%)      | 75           |
| Tensile Elongation - Width (%)       | 75           |

- C. Pavement Fabric for walks, track events and artificial turf field: As indicated on plans.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.
- C. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, as ordered by Landscape Architect/ Engineer as required and/or as required by the Landscape Architect/ Engineer during all phases of construction.

### 3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project Site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
  1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required. Damage to existing and/or new components of the site due to excess water shall be repaired at no cost to the Owner and to the satisfaction of the Landscape Architect/Engineer.

### 3.3 EXPLOSIVES

- A. Explosives: Do not use explosives.

### 3.4 EXCAVATION, GENERAL

- A. Classified Excavation: Excavation to subgrade elevations classified as earth and rock. Rock excavation will be paid for by adjusting the Contract Sum according to unit prices included in the Contract Documents.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.
2. Rock excavation includes removal and disposal of rock.
  - a. Do not excavate rock until it has been classified and cross-sectioned by Landscape Architect/ Engineer.

### 3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. Extend excavations a sufficient distance from structures for placing and removing concrete form work, for installing services and other construction, and for inspections.

### 3.6 EXCAVATION FOR WALKS AND PAVEMENTS (where applicable)

- A. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades. Refer to Section 312213 for subgrade tolerances.

### 3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
  1. Beyond building perimeter, excavate trenches to allow installation of pipe to the depths required by the Contract Documents. Refer to Section 312316.
- B. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
  1. Clearance: 12 inches on each side of pipe or conduit, unless otherwise indicated.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove



projecting stones and sharp objects along trench subgrade. Refer to Section 31 23 16: Trenching, Backfilling and Compaction, and Contract details.

### 3.8 APPROVAL OF SUBGRADE

- A. Notify Landscape Architect/ Engineer and Construction Manager when excavations have reached required subgrade.
- B. If the Landscape Architect/ Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
  - 1. Additional excavation and replacement material will be paid for under time and material as approved by the Landscape Architect/ Engineer.
- C. Proof roll subgrade with a 10-ton vibratory roller to identify soft pockets and areas of excess yielding. Soft pockets should be excavated and backfilled with Controlled Fill material. Do not proof roll wet or saturated subgrades. Proof roll to be witnessed by the Landscape Architect/ Engineer.
- D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as required by the Landscape Architect/ Engineer at no cost to the Owner.
- E. Subgrade compaction shall be as stated in Section 31 22 13: Rough Grading. Methods are the responsibility of the contractor.
- F. The Site Contractor is completely responsible for establishing the grades indicated within the tolerance indicated for the establishment of the subgrade. The subgrade shall be sloped mirroring the final grades of the turf field at those respective elevations allowing for the proper construction of the subbase system. The Site Contractor shall provide an as-built survey once the subgrade has been established to ensure it meets the required grades. The survey shall include spot grades at 20 feet on center in all directions. The Contractor shall make all necessary grade adjustments/corrections until such time that the subgrade has been approved.
- G. Subgrade shall be established using laser grades equipment only.

### 3.9 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavations under other construction or utility pipe as required by the Landscape Architect/ Engineer at no cost to the Owner.

### 3.10 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow materials and satisfactorily excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of trees to remain.
  - 2. Stockpile at location approved by the Owner.

### 3.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
  - 1. Construction below finish grade including, where applicable, damp roofing, waterproofing, and perimeter insulation.
  - 2. Surveying locations of underground utilities for record documents.
  - 3. Inspecting and testing underground utilities.
  - 4. Removing concrete formwork.
  - 5. Removing trash and debris.
  - 6. Removing temporary shoring and bracing, and sheeting.
  - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

### 3.12 UTILITY TRENCH BACKFILL

- A. Place and compact bedding course on trench bottoms and where required by the contract documents. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- B. Backfill trenches excavated under footings and within 18 inches of bottom of footings; fill with concrete to elevation of bottom of footings.
- C. Provide 4-inch-thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in minimum of 4 inches of concrete before backfilling or placing roadway subbase.
- D. Place and compact initial backfill of subbase material, free of particles larger than 1-inch, to a height of 12 inches over the utility pipe or conduit.
  - 1. Carefully compact material under pipe haunches and bring backfill evenly up on both sides along the full length of utility piping or conduit to avoid damage or displacement of utility system.
- E. Coordinate backfilling with utilities testing.
- F. Fill voids with approved backfill materials while shoring and bracing, and as sheeting is removed.
- G. Place and compact final backfill of satisfactory soil materials to final subgrade.
- H. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

### 3.13 FILL

- A. Preparation: Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface before placing fills.
- B. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

- C. Place and compact fill material in layers to required elevations as follows:
  - 1. Under steps and ramps, use Structural Fill.
  - 2. Adjacent to pavement areas: Structural Fill.
  - 3. Under Asphaltic Pavement and Portland Cement Pavement: As indicated on Plans

### 3.14 MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.
  - 1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
  - 2. Remove and replace, or scarify and air-dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

### 3.15 COMPACTION OF BACKFILLS AND FILLS

- A. Place backfill and fill materials in layers not more than 12 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D-1557.
  - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill material at 95 percent.
  - 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 95 percent.
  - 3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at a minimum of 85% and maximum of 90%.

### 3.16 GRADING

- A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
  - 1. Provide a smooth transition between adjacent existing grades and new grades.
  - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

### 3.17 SUBSURFACE DRAINAGE (where applicable)

- A. Drainage Piping: As indicated on Plans.

- B. Subsurface Drain: Place a layer of drainage fabric around perimeter of drainage trench as indicated. Place a 6-inch course of filter material on drainage fabric to support drainage pipe. Encase drainage pipe in a minimum of 12 inches of filter material and wrap in drainage fabric, overlapping sides and ends at least 6 inches. (Perimeter drain shall be as indicated on Plans.)

- 1. Compact each course of filter material to 95 percent of maximum dry unit weight according to ASTM D 698.

- C. Drainage Backfill: Place and compact filter material over subsurface drain, to width indicated, to within 12 inches of final subgrade. Overlay drainage backfill with one layer of drainage fabric, overlapping sides and ends at least 6 inches.

- 1. Compact each course of filter material to 95 percent of maximum dry density according to ASTM D 698.
  - 2. Place and compact impervious fill material over drainage backfill to final subgrade.

### 3.18 DRAINAGE COURSE

- A. Under slabs-on-grade, place drainage course on prepared subgrade and as follows:

- 1. Compact drainage course to required cross sections and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D-1557.
  - 2. When compacted thickness of drainage course is 6 inches or less, place materials in a single layer.
  - 3. When compacted thickness of drainage course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.

### 3.19 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verifications and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by the Landscape Architect/ Engineer.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at locations and frequencies indicated in Specification Section 313200 - Soil Testing Services.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil depth required; recompact and retest until specified compaction is obtained.

### 3.20 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
  - 1. Scarify or remove and replace soil material to depth as required by the Landscape Architect Engineer; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material compact, and reconstruct surfacing.
  - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

### 3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

### 3.22 SPECIAL SITE CONDITIONS

- A. Contractor shall fully familiarize himself with the Geotechnical Report that describes the conditions at this site. Contractor shall follow site development guidelines identified in Geotechnical Report.

END OF SECTION 312300



## **SECTION 312316**

### **TRENCHING, BACKFILLING AND COMPACTION**

#### **PART 1 – GENERAL**

1.1 RELATED DOCUMENTS: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### **1.2 WORK INCLUDED**

- A. Unclassified earth excavation for construction of pipe, conduit, manholes, catch basins, appurtenances, and structures outside of building lines.
- B. Disposal of excavated materials, salvage of material for backfill, and removal of excess or material not suitable for re-use.
- C. Maintenance of excavations including sheeting, dewatering, bridging and fencing outside of building lines.
- D. Construction of bedding, pipe zone and trench backfill, outside of building lines.
- E. Protection of utilities, outside of building lines.
- F. Protection of trenches and open excavations, outside of building lines.
- G. All work shall be in strict compliance with the Geotechnical Report.

#### **1.3 RELATED SECTIONS**

Section 02 30 00: Soil Testing Services.  
Section 31 22 13: Rough Grading.  
Section 31 23 00: Earthwork.  
Section 33 40 00: Storm Sewer Systems.

#### **1.4 QUALITY ASSURANCE**

- A. Requirements of Regulatory Agencies:
  - 1. Comply with New York State Department of Labor Board of Standards and Appeals Part 23 of Title 12.
  - 2. Comply with Subpart P, "Excavations, Trenching and Shoring" of United States Department of Labor OSHA Regulations for Construction.
  - 3. Comply with rules, regulations, and laws concerning construction activity in roads of the applicable jurisdiction.
  - 4. Comply with all other applicable regulations.
- B. Testing Laboratory: As specified in Section 023000 Soil Testing Services.

C. Reference Standards: NYSDOT Specifications.

D. Allowable Tolerances:

1. Alignment of Excavation: To permit construction of pipe, structures, and appurtenances to the tolerances specified under pertinent drawings and specifications.
  - a. Trench bottom vertical alignment: Excavate to the required elevations below proposed pipes and other structures for proper vertical alignment. Do not over excavate below dimensions indicated for the proposed utilities.
  - b. Trench sides horizontal alignment: Do not excavate less than dimension shown on Contract Drawings. Note and comply with any limit of payment dimensions shown on plans or as specified.
2. Bedding: Construct bedding with specified material as indicated.

## 1.5 SUBMITTALS

- A. Reports: Before using material for special trench backfill, pipe zone backfill, or bedding, submit samples from each typical source to an approved soils testing laboratory and submit reports for approval as follows:
1. Submit six copies of the gradation analysis of gravel from each source used for trench backfill, bedding, or subbase.
  2. Submit six copies of the gradation analysis of crushed stone from each source.
  3. Submit six copies of the gradation analysis and compaction requirements for each typical class of select backfill used for trench backfill as shown on the plans:
    - a. Report from soils testing laboratory should state any special manipulation or compaction requirements required to achieve specified density or supportive value for each class of type of select backfill.
    - b. Re-testing of backfill compacted in place may be required at any time or place as required by the Landscape Architect/ Engineer.
- B. Shop Drawings: Prior to start of work, submit shop drawings and details, for all materials to be incorporated into the work.
- C. Samples: Prior to the start of backfill grading, submit the number and size of samples requested by the Owner and Landscape Architect/ Engineer for acceptance.
- D. Product Data: Submit products data for all materials, including but not limited to:
1. Plastic Warning Tape (each type).
  2. Geotextiles.
  3. Controlled low-strength material, including design mixture.
  4. Geofoam.
- E. All submittals must receive approval prior to being incorporated into work. Failure to do so shall be at the Contractor's risk and expense.



## 1.6 DELIVERY, STORAGE AND HANDLING

- A. Store and stockpile material suitable for backfilling away from interference with traffic, and nearby residents. Use all stockpiled material as soon as practical. Do not allow material to become contaminated. Do not allow material to erode or wash into trench, onto road or adjacent property.
- B. Load and haul away excavated material not suitable for other uses at the site. Use haul routes approved by the municipality having jurisdiction.

## 1.7 PROJECT CONDITIONS:

- A. Notify: Dig Safely, 1-800-962-7962, not less than 72 hours prior to starting excavation for location of gas, telephone and electric lines.
- B. Notify other private and public utilities in the work area.
- C. Notify Owner and Landscape Architect/ Engineer at least 24 hours prior to commencing trenching and backfilling.

## 1.8 PROTECTION OF PERSONS AND PROPERTY

- A. It shall be noted and stressed that this contractor's installations will be made during a period when the existing building(s) are in use. Contractor shall schedule and conduct their operations so as to cause the least amount of inconvenience to the Owner. Contractor shall provide all possible safe-guards to protect students and others at the site.
- B. Barricade open excavations occurring as part of this work. Furnish night lighting as required.
- C. Contractor shall furnish, erect and maintain barriers where feasible or directed to separate construction activities from other operations on site. Gates may be provided where required. Contractor shall limit operations and activities to fenced areas where applicable.
- D. Protect structures, utilities, pavements and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards caused by earthwork operations.
- E. Perform any shoring and bracing required to safely do the work required. Maintain sides and slopes of elevations in a safe manner. Provide necessary sheet piling and/or shoring needed for protection of workman, materials, buildings, other properties, and the public.
- F. Locate excavations support and protection systems clear of permanent construction so that forming and finishing of concrete surfaces is not impeded.
- G. Monitor excavations support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.

- H. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.
- I. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.
- J. Contractor is responsible for all sheet piling and shoring required, any sheet piling provided is to be installed under supervision and approval of a Registered Professional Engineer in the State of New York.

#### 1.9 EXISTING UTILITIES

- A. Locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations.
- B. Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Landscape Architect, and then only after arranging to provide temporary utility services according to requirements indicated.
  - 1. Notify Landscape Architect not less than (2) days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Landscape Architect's written permission.
  - 3. Contact utility-locator service for area where Project is located before excavating.
- C. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner and Landscape Architect immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to the satisfaction of the utility owner.

#### 1.10 WATER CONTROL

- A. Contractor shall furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control ground-water flow into excavations if required and permit construction to proceed on dry, stable subgrades.
  - 1. Maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
  - 2. Prevent surface water from entering excavations by grading, dikes, or other means.
  - 3. Accomplish dewatering without damaging existing buildings adjacent to excavation.
  - 4. Remove dewatering system if no longer needed.
- B. It is the responsibility of the Contractor to examine all available information prior to bidding to determine existing water table elevation. Dewatering must be covered in Base Bid, no extra compensation for dewatering will be allowed.

- C. Comply with water disposal requirements of authorities having jurisdiction.
- D. Installation: Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
- E. Before excavating below ground-water level, place system into operation to lower water below excavation depth. Operate system continuously until construction is complete and fill materials have been placed, or until dewatering is no longer required.
- F. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
- G. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed.

#### 1.11 PIPING TRENCH EXCAVATION

- A. Excavation shall allow for direct buried anchors. The trench bottom must give uniform support along the entire length of any pipelines. Where several pipelines are located in a common trench, the trench must be wide enough to maintain the specified distances between adjacent lines. The excavation should be in a straight line except where fittings are located.
- B. The width of the trench at the top of the pipe should be held to the minimum required for efficient and proper installation but in accordance with current OSHA Standards.
- C. Where suitable soil exists, pipe shall be installed to comply with ANSI/ AWWA C151/ A21.51 Laying Condition Type 2. This shall consist of a flat bottom trench with undisturbed earth backfilled and lightly consolidated to centerline of pipe. Where drainage pipe is installed, bottom of trench shall be uniformly sloped. In all cases, pipe bells shall be excavated to provide uniform support.
- D. Where unsuitable material exists, pipe shall be installed to comply with ANSI/ AWWA C151/ A21.51 Laying Condition Type 4. This shall consist of a pipe bedded in sand, gravel or crushed stone ASTM D2940; except 100% passing a 1" (25mm) sieve and not more than 8% passing a No. 200 (.075mm) sieve; to depth of 1/8 pipe diameter, 4" minimum. Backfill compacted to top of pipe 80% Standard proctor factor AHSHTO T-99.
- E. If necessary to remove unsuitable material to a depth greater than specified, refill excavations carried below the depth indicated or directed with specified bedding material in 6-inch lifts compacted to 95% of maximum density in accordance with ASTM D1557, Method D. Excavate and replace soil disturbed and weakened by the Contractor's operations or soils permitted to soften from exposure to weather, with bedded material and compact with a plate-type vibratory compactor to the specified density.

#### 1.12 REMOVALS

- A. Perform the work of demolition at the existing sites as indicated on the drawings and/or as required by the new construction. All materials removed shall be examined by the

Owner. Those materials designated by the Owner as "scrap" shall become the property of the Contractor and removed from the site; Materials to be retained by the Owner shall be delivered to the Owner at location as directed.

- B. All excess soil removed from excavations, existing concrete sidewalks, etc. not to be reused as backfill, shall be trucked from the site and disposed of by the Contractor.

#### 1.13 MAINTENANCE & REPAIR OF EXISTING FACILITIES

- A. Before work is started, the contractor shall inspect the existing work which will be affected by his operations. For the contractor this will include, but is not limited to, driveway, roads, lawn area, walks, shrubbery, etc.
- B. Contractor shall report in writing any observed defects to the Owner in order to avoid his being held responsible for damage which may not be his fault.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Imported Pipe Bedding:
  - 1. Crushed stone meeting New York State Department of Transportation (NYSDOT) Designation 703-4, Type 1A stone.
- B. Sand: An imported or native natural run-of-bank sand graded from fine to coarse particles, free of lumps and frozen material. It shall not contain slag, cinders, ashes, rubbish, vegetation, or other foreign material (shall not contain any stones larger than 1/2" diameter). (Native material must be approved by Landscape Architect/ Engineer).
- C. General Fill: Native onsite soils capable of meeting compaction requirements, and in accordance with the Geotechnical Report. (Material shall be approved by Landscape Architect/ Engineer).
- D. Processed Gravel: Gravel meeting NYSDOT 304-2.02 Type 4.
- E. Temporary Fencing (where required by site conditions):
  - 1. Materials may be new or used.
  - 2. Wire Fabric: 0.083 inch diameter (No. 14 B.W.D.) with maximum size openings of 2 inches wide, 4 inches high.
  - 3. Minimum height: Five feet.
  - 4. Posts: Metal. T or U Type, minimum length eight feet, driven into ground at least two feet.
  - 5. Signs: Size 16 inches by 24 inches with 5 inch black letters on orange background, message:  
"DANGER-KEEP OUT".

## 2.2 SUITABLE BACKFILL MATERIAL

- A. Excavated or borrow material shall be predominantly granular, non-expansive and free from roots, rocks or lumps over 3" and deleterious matter.
  - 1. Gravel: Run of bank gravel, reasonable free of loam, silt and clay.
  - 2. Stone: Select, graded crushed stone, free from organic, frozen or deleterious matter.

## 2.3 GRASS RESTORATION

- A. Grass Seed: Provide fresh, clean, new-crop seed complying with tolerance for purity and germination established by Official Seed Analysts of North America.
- B. Refer to Specifications 32 92 00 Lawns for more information.

## 2.4 PAVEMENT RESTORATION

- A. Provide Asphalt concrete base course per N.Y.S.D.O.T Section 401-2 Type 1 as noted below:
  - 1. Heavy Duty – 8" (in 2" lifts)
  - 2. Medium Duty – 3"
  - 3. Light Duty – 0"
- B. Provide Concrete 8" concrete base per N.Y.S.D.O.T Section 503 concrete class C or F.
- C. Provide 2" asphalt concrete binder course per N.Y.S.D.O.T. Section 401-2 Type 3.
- D. Provide 1-1/2" asphalt concrete top coat per N.Y.S.D.O.T. Section 401-2 Type 7F.
- E. Cap seams with bituminous asphalt filler per N.Y.S.D.O.T material designation 702-05 or 702-3401.

## 2.5 SOIL MATERIALS

- A. Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Sand: ASTM C 33; fine aggregate, natural, or manufactures sand.

## 2.6 GEOTEXTILES

- A. Refer to Section 33 46 26: Geotextiles Fabrics.

## 2.7 ACCESSORIES

- A. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils. thick, continuously inscribed with a description of the utility, with

metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, Oil, Steam, and Dangerous Materials.
3. Orange: Telephone and other Communications.
4. Blue: Water Systems.
5. Green: Sewer Systems.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Prior to all work, carefully inspect the site and verify that construction may properly commence.
  1. Before excavation, verify:
    - a. Work layout, horizontal and vertical, and conformance of layout with Contract Drawings.
    - b. Limits of construction.
    - c. Utility locations including, but not limited to: aerial, pole lines, buried, underground, transmission, local service, and individual connections.
  2. After excavation, verify that pipe, structures and appurtenances to be placed in trenches may be installed in accordance with pertinent drawings and specifications.
  3. Before backfilling, notify the Owner and Engineer at least 24 hours in advance and verify:
    - a. Pipe, structures and appurtenances have been installed in accordance with pertinent drawings and specifications, and joints are secure.
    - b. Utilities are adequately continued, supported and maintained without damage.
- B. In the event of discrepancy or unsatisfactory condition, immediately notify the Owner and Landscape Architect/ Engineer.

### 3.2 PREPARATION

- A. Utility Protection and Changes: Where public and/or private utilities are encountered:
  1. Maintain, support, and save from damage all public utilities.
  2. Allow reasonable time and space for owner of private utilities to cooperate in maintaining their facilities.

### 3.3 PERFORMANCE

- A. Excavation: Perform all trenching for construction of pipe, appurtenances, structures,

bedding, and backfill. Remove surface materials and drainage facilities:

1. Disposal of excavated material:
    - a. Store material suitable for backfill. Protect from contamination.
    - b. All surplus earth, rock and other unsuitable or unsatisfactory material shall be disposed of off project site by Contractor.
  2. Perform excavation in such manner and to such widths as will give ample room for installing the pipe, appurtenances and structures, and for sheeting, bracing, pumping and draining. Dewater the excavation and maintain the dewatered condition as required to perform the construction and install compacted backfill.
  3. Do not disturb bottom of excavation at structures requiring a cast-in-place concrete base. In case material is disturbed or saturated, carefully excavate to undisturbed level and fill with concrete at no additional cost to Owner.
  4. Unauthorized Excavation: Unauthorized excavations carried outside lines and grades shown on Contract Drawings shall be filled by Contractor at no additional cost to Owner as follows:
    - a. Below concrete cradle, concrete encasement or concrete foundation, fill unauthorized excavations with 3000 psi concrete.
    - b. Below specified bedding, fill unauthorized excavations with compacted bedding material.
  5. Maintenance of Trench:
    - a. Keep sides of excavation from slides, cave-ins. Use any method including but not limited to: temporary sheeting, shoring, bracing, and cribbing.
    - b. Keep excavations free from water. Use any method including but not limited to gravity flow, pumping, sumps. Maintain excavation in a dry condition until backfill has been placed and compacted a minimum of 18 inches above top of pipe. In all cases, maintain dry trench at backfill level.
  6. Schedule:
    - a. Advance excavation operations ahead of pipe laying to allow for field conditions.
    - b. Limit excavations ahead of pipe laying a maximum of 200 feet, unless more is approved by the Engineer in writing.
- B. Bedding and Pipe Zone Backfill: The trenches for pipelines shall have bottoms as shown on the Contract Drawings conforming to the required grades. All excavations for pipe lines shall be made to the depths shown for pipe bedding.
1. If the bottom of trench becomes unsuitable for pipe laying due to Contractor's operations, he shall provide extra excavation and backfill suitable to the conditions at the area and bedding specified, at no additional cost to Owner.
  2. If the undisturbed bottom of the trench is soft and, in the opinion of the Engineer,

cannot support the pipe or structure, additional trench depth shall be excavated as ordered by the Engineer and refilled with specified bedding material.

3. Bedding and Pipe Zone Placement:

- a. Place and compact bedding material in trench bottom.
- b. Install pipe conforming to the required line and grade.
- c. Place and compact pipe zone backfill material in six-inch-thick layers as shown on the Contract Drawings.

4. Bedding and Pipe Zone Compaction:

- a. Below pipe and structures: Compact to not less than 95% of modified proctor maximum density, at or below optimum moisture content in conformance with ASTM D 1557.
- b. Material shall be deposited evenly on both sides of the pipe in tamped layers not exceeding 6 inches in depth until at least three-fourths the depth of the pipe has been reached. For wide trenches, tamping shall be done for a distance on each side of the pipe equal to at least the diameter of pipe. Any pipe that is damaged or moved out of alignment, regardless of cause, shall be replaced or realigned at the Contractor's expense.

5. Ditch Line Dikes: Construct an impervious earth dike at trench bottom, as required, and at property lines to keep free water from traveling downstream along solid pipes and eroding pipe bedding. Ditch line dikes are not to be installed in underdrain trenches.

- a. Construct dike of clay or other impervious material.
- b. Construct one foot thick and from bottom of trench to top of pipe and at every catch basin and manhole, at 100 foot intervals and at the inlet end of culverts.

C. Backfill - General:

1. Backfill excavations as shown on the Contract Drawings. Materials shall be placed and compacted from the top of the pipe zone backfill to the surface of the ground or the bottom of any special surface treatment, such as pavement subbase or topsoil.
  - a. Do not backfill against masonry walls or other structures until they have attained sufficient strength to safely resist the thrust of fill materials.
  - b. Do not backfill with frozen materials.
  - c. If settlement or washout occurs before Final Inspection, furnish, place and compact additional material to resurface the low places as required by the Owner.
  - d. Maintain dust control at all times.
2. Heavy equipment shall not be allowed to pass over the pipe until a fill of at least two (2) foot depth has been placed over the top of the pipe. In any case, movement of construction equipment and all other vehicles and loads over and adjacent to any pipe shall be done at the Contractor's risk. When determined by the Owner,



any pipe that is damaged or disturbed through any cause, shall be replaced as required by the Owner, at the expense of the Contractor and at no cost to the Owner.

3. Methods of Compaction:

- a. Hand Compaction: Tamping by hand with flat hand tampers.
- b. Mechanical Compaction: Compaction by means of vibratory or other mechanical tampers.

4. Compact Backfill to 95% Modified Proctor Density Compaction:

- a. Backfill material shall be placed in horizontal layers not exceeding six (6) inches thick and be thoroughly compacted by mechanical compaction.

D. Utility Protection:

1. Contractor shall hold the Owner harmless against:

- a. Injury to electric, telephone lines, gas, water lines, and other underground and overhead utilities.

E. Temporary Wire Fence:

- 1. Where trenches and open excavation are left unattended during non-working hours or days, furnish and maintain temporary fences.
- 2. A temporary wire fence will be required except where temporary sheeting is extended a minimum of three feet above ground surface, and no void exists between sheeting and side of excavation.
- 3. Provisions for this fencing are in addition to provisions the Contractor would normally make to safeguard his work operations and in no way diminish his obligations in this respect.
- 4. Construction Details:
  - a. Construct temporary fence to completely surround all excavations.
  - b. Mount "DANGER-KEEP OUT" signs at intervals not exceeding 50 feet along fence line.
  - c. Provide posts or adequate supports for fencing at intervals not in excess of 10 feet. Stretch and fasten wire fabric at top, middle and bottom of each support.

3.4 FIELD QUALITY CONTROL

- A. Quality Control Testing During Construction: Testing laboratory must inspect and approve subgrades and fill layers before further construction work is performed thereon. Refer to Section 313200.
- B. If testing laboratory subgrade and/or fill reports are below specified density, provide additional compaction at no expense to Owner.

### 3.5 PAVMENT PATCHING

- A. Existing pavement shall be saw cut to obtain a straight and neat edge for paving. Saw cut shall be made prior to paving after backfill of trench to bottom of new pavement.
- B. All seams between existing and new asphalt surfaces shall be sealed with an asphalt filler corresponding to the material requirements of N.Y.S.D.O.T. Material designation 702-05 or 702-3401.
- C. Concrete for new base shall correspond to requirements of N.Y.S.D.O.T. section 503. Concrete class C or F.
- D. Top of new concrete base shall be even with or lower than top of existing concrete base to provide full thickness of asphalt top and binder and minimum 8" of concrete base.
- E. No asphalt shall be placed on concrete until the concrete develops a minimum strength of 2000 P.S.I. The minimum duration between placement of concrete and asphalt shall be 48 hours. Tack coat surface of the concrete prior to receiving asphalt. Tack coat shall correspond to the material requirement of N.Y.S.D.O.T. material designation 702-30.
- F. If an asphalt base course is present, the bottom of new asphalt base course shall match the bottom of or be set below bottom of existing asphalt pavement. Minimum thickness shall be:
  - 1. Heavy Duty Pavement – 8" (placed in 2-4" lifts)
  - 2. Medium Duty Pavement – 3"
  - 3. Light Duty Pavement – 0"
- G. Top of conduit shall be a minimum of 7'±0" below the surface of State highways and 30" below other paved roadways.

### 3.6 GRADING

- A. Uniformly grade areas within limits of this work, including adjacent transition areas. Compact with uniform levels or slopes between finished elevations and adjacent existing grades.
- B. Grade areas to achieve drainage away from structures and to prevent ponding.
- C. Soft spots are to be re-excavated and backfilled with suitable material.

### 3.7 MAINTENANCE

- A. Protect newly graded areas from traffic and erosion and keep free of trash and debris.
- B. Where compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape and re-compact to required density.

3.8 DISPOSAL OF EXCESS AND WASTE MATERIALS

- A. If specifically directed by Owners Representative, transport acceptable excess excavated material to designated soil storage areas on the Owner's Property.

END OF SECTION 312316



## **SECTION 312500**

### **SEDIMENT AND EROSION CONTROL**

#### **PART 1 – GENERAL**

##### **1.1 SUMMARY**

- A. Applicable provisions of the Contract Documents govern work under this section.

##### **1.2 SUBMITTALS**

- A. In accordance with Shop Drawings, Product Data, and Samples Specification Section, designate erosion control and maintenance activities on submitted Project Schedule.
- B. Submit pre-construction photographs and short narrative of erosion control implementation plan as specified herein.
- C. Project Schedule: Contractor shall provide construction schedule indicating schedule of work with key milestones for each phase of construction.
- D. Complete required forms and documentation as indicated in the project Stormwater Pollution and Prevention Plan (SWPPP).
- E. Qualified Inspector Certifications: Contractor shall provide Certifications of all Qualified Inspectors performing monitoring of Erosion & Sediment Control measures.

##### **1.3 RELATED SECTIONS**

Section 31 11 00: Clearing and Grubbing.  
Section 31 23 00: Earthwork.  
Section 31 23 16: Trenching, Backfilling and Compaction.  
Section 32 12 16: Asphaltic Concrete Paving, Surfacing, and Striping.  
Section 32 92 00: Lawns.

##### **1.4 WORK INCLUDED**

- A. Provide all labor, equipment and materials necessary to install and maintain erosion control blankets, silt fence, hay bale dikes, sediment traps, inlet protection, and to implement erosion control measures as shown on the plans, as specified, as required by regulatory permits, as required by the Landscape Architect/ Engineer if measures are not indicated on the plans, and as job conditions dictate.

##### **1.5 QUALITY ASSURANCE**

- A. All Erosion/Sediment Control activities and water quality objectives performed by the contractor shall be in compliance with the following standards of practice:
  - 1. NYSDEC's SPDES General Permit for Stormwater Discharges for Construction Activity Permit No. GP-0-15-002.
  - 2. NYSDEC's "New York Standards and Specifications for Erosion and Sediment Control" published by the Empire State Chapter of the Soil and Water Conservation

3. Society, latest edition.
  4. NYSDEC's "New York State Stormwater Management Design manuals" prepared by Center for Watershed Protection, latest edition.
  5. USDA Soil Conservation Service "Guidelines for Urban Erosion and Sediment Control, latest revision.
  6. NYSDEC Erosion and Sediment Control Guideline for New Development T.O.G.S. 5.1.10.
  7. Geotechnical Report for this project (See Appendix).
- B. Local Guidelines for Erosion and Sediment Control.
1. NYSDEC "Reducing the Impacts of Stormwater Runoff for New Developments", latest revision.
  2. NYSDOT Specifications.
- C. Contractor is responsible for all monitoring, reporting, and repair of erosion control measures as required by the SWPPP specific permit requirements throughout the duration of construction. Contractor shall provide a qualified inspector performing all Erosion & Sediment Control inspections.
- D. Directives of Owner, Owner's Representative, and/or regulatory personnel of authority having jurisdiction requiring further control measures as warranted.

## PART 2 - PRODUCTS

### 2.1 MULCHES

- A. Mulches shall be suitable material acceptable to the Landscape Architect/ Engineer and reasonably clean and free of noxious weeds and deleterious materials. The following materials are acceptable:

| Application Rates         |   |   |                               |              |
|---------------------------|---|---|-------------------------------|--------------|
| <u>Mulch Material</u>     | <u>Quality Standards</u>  | <u>Per 1000 SF</u>                                      | <u>Per Acre</u>               | <u>Depth</u> |
| Wood Chips or Shavings    | Green or air-dried. Free of objectionable coarse material                 | 500-900 lbs.  | 10-20 tons                    | 2 - 7"       |
| Straw                     | Air-dried; free of undesirable seeds & surface coarse materials           | 90-100 lbs.<br>2-3 bales                                | 2 tons cover<br>100-120 bales | about<br>90% |
| Excelsior Wood Fiber Mats | Interlocking web of excelsior fibers with Photodegradable plastic netting | 48" x 100" 2 sided plastic,<br>48"x 180"1 sided plastic | -----                         | -----        |

## 2.2 GRASS

- A. Grass shall be quick growing species suitable to the area and as a temporary cover which will not compete with the grasses sown later for permanent cover.

B. Seed Mixtures

1. Temporary Seeding

| <u>Type</u>                      | <u>Lbs./Acre</u> | <u>Lbs./1000 SF</u> |
|----------------------------------|------------------|---------------------|
| Ryegrass (Annual or Perennial)   | 80               | 1.9                 |
| Certified "Aroostook" Winter Rye | 100              | 2.5                 |

Use winter rye if seeding in October/November.

## 2.3 SOIL AMENDMENTS

- A. Fertilizer and soil conditioners shall be a standard commercial grade acceptable to the Landscape Architect/ Engineer.
1. Lime: pH of 6.
  2. Fertilizer: Meeting New York State Department of Transportation Specification 713-03 type 1 or as approved. 1-2-1 N.P.P. ratio.

## 2.4 JUTE MESH

- A. Jute mesh and appurtenances shall comply with NYSDOT Specification Section 612, latest revision.

## 2.5 SILT FENCE

A. Field Assembled Units

1. Fabric shall meet the following minimum criteria:

| <u>Property</u>                      | <u>Minimum Acceptable Value</u> | <u>Test Method</u>       |
|--------------------------------------|---------------------------------|--------------------------|
| Grab Tensile Strength (lbs.)         | 90                              | ASTM D1682               |
| Elongation at Failure (%)            | 50                              | ASTM D1682               |
| Mullen Burst Strength (psi)          | 190                             | ASTM D3786               |
| Puncture Strength (lbs.)             | 40                              | ASTM D751<br>(Modified)  |
| Slurry Flow Rate (gal/min/sf)        | 0.3                             |                          |
| Equivalent Opening Size              | 40-80                           | US Std Sieve<br>CW-02215 |
| Ultra-Violet Radiation Stability (%) | 90                              | ASTM G-26                |

2. Posts

- a. Wood: Oak or similar quality hardwood, 3.0 square inches cross-sectional area

minimum.

- b. Steel: Standard T or U section weighing 1.00 pound per linear feet minimum.

3. Mesh

- a. 14-1/2 gauge minimum with 6 inch maximum mesh opening, plastic safety fence, orange or black, or as approved.

B. Prefabricated Units

- 1. Pre-assembled units meeting the material requirements of 2.5 A may be used in lieu of field assembled units.

2.6 CHEMICAL BINDER

- A. Non-toxic conforming to Item 713-12 of NYSDOT Specifications.

2.7 RIP-RAP

- A. Per NYSDOT Specifications.

2.8 FILTER STONE

- A. Sound durable stone per NYSDOT Specification Section 703, size(s) per plans.

2.9 TURF REINFORCEMENT MATTING

- A. VMAX Model SC250 UV-stable polypropylene permanent matting as manufactured by RollMax Rolled Erosion Control or approved equivalent.

- 1. 70% Straw Fiber / 30% Coconut Fiber.
- 2. Thread: Polypropylene UV Stable.
- 3. Thickness: 0.62 in.
- 4. Resiliency: 95.2%.
- 5. Density: 0.891 g/cm<sup>3</sup>.
- 6. UV Stability: 100%.
- 7. Light Penetration: 4.1%.
- 8. Porosity: 99%.
- 9. Tensile Strength: 709 lbs/ft.
- 10. Elongation: MD=23.9% / TD=36.9%.

PART 3 - EXECUTION

3.1 GENERAL

- A. **The contractor is responsible for completing all monitoring, and reporting as required throughout the duration of construction as required, and provide reports to the Owner's Representative, and Landscape Architect for acceptance.**



- B. Contractor shall implement erosion control measures as indicated in the SWPPP, shown on the plans, as job conditions dictate, and to comply with the local municipality. Intent is to minimize erosion and pollutants at the source, capture sediment at regular intervals and prevent sediment intrusion into storm sewer pipes, structures, and waterways. Work includes, but is not limited to, hay bales, mulching, temporary silt fences, filter fabric, expeditious grading, stormwater diversion, prompt turf establishment, sediment dikes, and maintenance of same. **The contractor is responsible for controlling all runoff from the site during the period of construction.** If erosion control measures are not shown on the Plans, he will be instructed by the Landscape Architect/ Engineer on where to implement them at no cost to the Owner.
- C. The Contractor shall initiate stabilization measures as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased. If disturbed soil surfaces are to be left exposed for a period of greater than 14 days, stabilize the soil with temporary seeding and/or mulch to limit erosion. Where the initiation of stabilization measures by the 14<sup>th</sup> day after construction activity temporarily or permanently ceased is precluded by snow cover or frozen ground conditions, stabilization measures shall be initiated as soon as practicable. The onset of seasonally adverse weather shall not be used as an excuse for not implementing the necessary erosion controls. The Contractor shall use foresight in his activities to only disturb areas that he can stabilize before adverse weather conditions prevail. The Contractor is encouraged to schedule his work such that final land surface restoration closely follows initial disturbance to the maximum extent possible in order to limit bare soil exposure and dependence on the temporary systems discussed above.
- D. Sediment shall be removed from sediment traps or sediment ponds whenever their capacity has been reduced by fifty (50) percent from the design capacity and/or as required to ensure intent. Prior to fine grading and restoration, the Contractor shall remove and dispose of accumulated sediments and silts as required.

### 3.2 AUTHORITY OF WORK

- A. The Landscape Architect/ Engineer has the authority to limit the surface area of erodible earth material exposed by clearing and grubbing, the surface area of erodible earth material exposed by excavation, borrow and fill operations and to require the Contractor to provide immediate permanent or temporary pollution control measures to prevent contamination of adjacent streams or other watercourses/ waterbodies.

### 3.3 POLLUTION CONTROL

- A. Provide methods, means and facilities required to prevent contamination of soil, water or atmosphere by the discharge of noxious substances from construction operations. Promptly repair equipment leaks. Provide equipment and personnel to perform emergency measures required to contain any spillages, and to remove contaminated soils or liquids.
- B. Notify Owner, Landscape Architect/ Engineer and regulatory authority having jurisdiction if contaminated soil, groundwater or other form of pollution is encountered. Excavate and dispose of any contaminated earth immediately in accordance with Federal, State and local regulations off-site, and replace with suitable compacted fill.

- C. Pollutants such as fuels, lubricants, bitumen's, raw sewage and other harmful materials shall not be discharged into or near rivers, streams, and impoundments or into natural or man-made channels leading thereto. Wash water or waste from concrete mixing operations or trucks shall not be allowed to enter live streams.

### 3.4 STREAM CROSSINGS

- A. Frequent forging of live streams will not be permitted; therefore, temporary bridges, or other structures, shall be used wherever an appreciable number of stream crossings are necessary. Unless otherwise approved in writing by the Landscape Architect/Engineer, mechanized equipment shall not be operated in a live stream.

### 3.5 DEWATERING AND WASHWATERS

- A. Water from aggregate washing, equipment washing, dewatering or other operations containing sediment, shall be treated by filtration, settling basin or other means sufficient to reduce the turbidity, so as not to cause a substantial visible contrast to natural conditions.

### 3.6 DIVERSION BERMS/SWALES

- A. Slopes of significantly barren slopes exceeding 15 percent require special treatment such as water diversion berms/swales, straw bale sediment barriers, sodding, approved mulch tacking agent over straw mulch applied over seeded areas, or a combination thereof.

### 3.7 SILT FENCE INSTALLATION

- A. A silt fence may be used subject to the following conditions:

1. Maximum allowable slope lengths contributing runoff to a silt fence are:

| <u>Slope Steepness</u> | <u>Maximum Slope Length (Ft)</u> |
|------------------------|----------------------------------|
| 2:1                    | 50                               |
| 3:1                    | 75                               |
| 4:1                    | 100                              |
| 5:1                    | 150                              |
| Flatter than 5:1       | 150 or as shown on the plans     |

2. Maximum drainage area for overland flow to a silt fence shall not exceed ½ acre per 100 feet of fence.
3. Erosion would occur in the form of sheet erosion.
4. There is no concentration of water flowing to the barrier.

- B. Woven wire fence to be fastened securely to fence posts with wire ties or staples.
- C. Filter cloth to be fastened securely to woven wire fence with ties spaced every 24 inches at top and mid-section.
- D. Embed silt fence material a minimum of 6 inches below finished grade.

- E. When two sections of filter cloth adjoin each other, they shall be overlapped by six inches and folded.
- F. Maintenance shall be performed as needed and material removed when “bulges” develop in the silt fence, or when 6 inches of sediment has accumulated against it, whichever occurs first. All sediment barriers shall be repaired or replaced when they no longer function as a barrier.

### 3.8 CONSTRUCTION OPERATIONS

- A. When borrow material is obtained from other than commercially operated sources, erosion of the borrow site shall be so controlled, both during and after completion of the work so that erosion will be minimized and sediment will not enter streams or other bodies of water. Waste or disposal areas and construction roads shall be located and constructed in a manner that will minimize sediment-entering streams. Install sediment containment devices around stockpiles and waste areas. Stabilize the surface of temporary haul roads to minimize sediment creation.
- B. Install stabilized construction entrances at all ingress/ egress points to local and state roads as required and as detailed on the plans.

### 3.9 CONSTRUCTION PHOTOGRAPHS

- A. The Contractor shall take good quality photographs of streams, ditches, channels, ponds or other water bodies immediately adjacent to project work area that will receive runoff from construction activity. Document existing conditions such as existing sediment deposition, water turbidity, eroded streambed/ streambanks and condition of vegetation.

### 3.10 CONSTRUCTION SCHEDULE

- A. Prior to beginning construction, the Contractor shall submit a detailed project schedule which outlines his program for controlling erosion, limiting conveyance of silt and sediment, pollution prevention, maintenance of devices/ controls, and restoration of graded surfaces for the duration of the project and the one-year warranty period, for review and acceptance.
- B. The Landscape Architect/ Engineer may limit the area of clearing and grubbing, excavation, trenching and embankment operations in progress, commensurate with the Contractor’s capability, responsiveness, and progress in keeping the finish grading, mulching, seeding and other such permanent control measures current in accordance with the accepted schedule. Should season limitations make such coordination unrealistic, temporary erosion control measures shall be taken immediately to the extent feasible.

### 3.11 FINAL STABILIZATION

- A. Final stabilization is defined as all soil disturbing activities at the site have been completed, and that a uniform perennial vegetative cover with a density of at least 80% has been established or equivalent stabilization measures (such as the use of mulches or geotextiles) have been employed on all unpaved areas and areas not covered by

permanent structures.

3.12 REMOVAL OF TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES

- A. Remove erosion control devices when final stabilization has occurred for the respective areas of the site and are no longer needed.

3.13 CONTRACTOR'S RESPONSIBILITY

- A. Contractors are responsible for the performance of their subcontractors and to ensure they properly comply with the Erosion Control Measures, where applicable.
- B. The actual scheduling and implementation of Erosion Control Measures and Maintenance of required water quality is the responsibility of the Contractor(s). The erosion and sediment control plan and devices shown are considered to comprise the majority of efforts needed, but not necessarily all that will be required. Weather, site and unforeseen conditions can dictate that greater efforts will be necessary.

END OF SECTION 312500

## **SECTION 321000**

### **ROADWAY AND MISCELLANEOUS SUBBASE**

#### **PART 1 – GENERAL**

- 1.1 RELATED DOCUMENTS: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications Sections, apply to this Section.

1.2 WORK INCLUDED

- A. Construction of roadway subbase and miscellaneous surface subbase (drives, parking, concrete walk), or as indicated on the Plans.

1.3 RELATED SECTIONS

Section 02 30 00: Soil Testing Services.

Section 31 22 13: Rough Grading.

Section 31 23 16: Trenching, Backfilling, and Compacting.

Section 32 12 16: Asphalt Concrete Paving, Surfacing and Striping.

Description of System: Roadway and miscellaneous surfaces subbase shall be constructed in all excavations within paved areas.

1.4 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies:

1. Comply with rules, regulations, laws concerning construction activity in roads of the applicable jurisdiction.
2. Comply with all other applicable regulations.

- B. Testing Laboratory: As specified.

- C. Reference Standards: NYSDOT Specs.

- D. Comply with Geotechnical Report.

1.5 SUBMITTALS

- A. Samples: Before using material for roadway or miscellaneous surface subbase, submit samples from each typical source to the testing laboratory and submit reports for approval as follows:

1. Submit six copies of the gradation analysis and compaction requirements for material used.
  - a. Report from soils testing laboratory should state any special manipulation or compaction requirements required to achieve specified density or supportive value for all material.
  - b. Retesting of material compacted in place may be required at any time or

place as required by the Engineer or Landscape Architect.

- B. Manufacturer's Data: Geotextile.

## 1.6 PROJECT CONDITIONS

- A. Notify Owner, Landscape Architect, and Construction Manager at least 24 hours in advance of commencing the Work of this Section.
- B. Existing Conditions: Subgrade should be dry and not spongy before commencing the Work of this Section.
- C. Environmental Conditions: Do not commence the Work of this Section if subgrade is wet, frozen or covered with snow, or if forecasts predict such conditions within 8 hours.

## 1.7 SEQUENCING AND SCHEDULING

- A. Schedule the Work of this Section to commence as soon as possible after:
  - 1. Underground systems have been installed.
  - 2. Subgrades have been established.
  - 3. Subgrades have been proof-rolled.
  - 4. Subgrades have been accepted.

## PART 2 - PRODUCTS

- 2.1 All products shall be as shown on the Plans.

## PART 3 - EXECUTION

- 3.1 Subgrades which are spongy or otherwise unacceptable during proof-rolling shall be dug out and filled with subbase material at no additional cost to the Owner. Failure to do so shall be at the Contractor's risk and cost.
- 3.2 Roadway and Miscellaneous Surface Subbase shall be spread in such depths that the maximum thickness of any layer, after compacting, shall be 6 inches. Water shall be added in such amounts in order to obtain satisfactory compaction.
- 3.3 Compaction shall be to 95% Modified Proctor density in accordance with ASTM D-1557 accomplished with either a smooth steel wheeled roller having a minimum weight of 10 tons, or a pneumatic tired roller having an operating weight of not less than 1000 pounds per tire.
- 3.4 Testing laboratory must inspect and approve subgrades and fill layers before further construction work is performed thereon. Refer to Section 02 30 00 – Soil Testing Services. If testing laboratory subgrade and/ or fill reports are below specified density, provide additional compaction at no expense to Owner.

END OF SECTION 321000

## SECTION 32 12 16

### **ASPHALT CONCRETE PAVING, SURFACING, AND STRIPING**

#### PART 1 – GENERAL

- 1.1 RELATED DOCUMENTS: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- 1.2 WORK INCLUDED: Construction of two course pavements, pavement markings, stamped asphalt and pavement overlays at the locations shown on the drawings and as specified.
- 1.3 RELATED SECTIONS
  - Section 31 11 00: Clearing and Grubbing.
  - Section 31 23 00: Earthwork.
  - Section 31 23 16: Trenching, Backfilling, and Compaction.
  - Section 32 10 00: Roadway and Miscellaneous Subbase.
- 1.4 SUBMITTALS
  - A. Product Data: For each type of product.
  - B. Qualifications: Stamped asphalt material to be installed by an applicator certified by product manufacturer's instructions.
  - C. Compaction Tests: Contractor shall provide compaction test results for all products and certify that all tests comply with or exceed specified requirements.
- 1.5 QUALITY ASSURANCE: Contractor shall provide material certifications for all products and certify that all material items comply with or exceed specified requirements.

#### PART 2 - PRODUCTS

- 2.1 TRUING AND LEVELING (if required): These mixtures shall meet the requirements of New York State Department of Transportation (NYSDOT) Specification 401-2.02 Type 7 Top and Type 5 Shim, as thicknesses dictate.
- 2.2 TOP COURSE: This mixture shall meet the requirements of NYSDOT Specification 403.13 Type 6 Top. Asphalt content shall be between 6.0 and 8 percent. Thickness per plans.
- 2.3 BINDER COURSE: This mixture shall meet the requirements of the NYSDOT Specification 403.13 Type 3 Binder. Asphalt content shall be between 4.5 and 6.5 percent. Thickness per plans.
- 2.4 PAVEMENT MARKING PAINT: Chlorinated rubber-alkyd type, FS TT-P-115, Type III as follows:
  - A. White: DOT Specification Section 727-03. (1985)

- B. Yellow: DOT Specification Section 727-04.
- C. Blue: Franklin Paint Company, Hydrophast Waterborne Traffic Paint, or approved equivalent.

2.5 TACK COAT: NYSDOT approved, asphalt emulsion, material designation 702-90.

2.6 STAMPED ASPHALT: Durable, textured topical treatment applied to the asphalt pavement surface. This impressed asphalt consists of an impressed aggregate reinforced preformed thermoplastic pavement marking system.

- A. TrafficScapes – TrafficPatternsXD impressed surface system, as manufactured by Ennis-Flint, Inc. or approved equivalent.

1. Preformed thermoplastic panels

- a. Must be composed of an ester modified rosin impervious to degradation by motor fuels, lubricants, etc. in conjunction with aggregates, pigments, binders, and anti-skid/anti-slip elements. Pigments and anti-skid/anti-slip elements must be uniformly distributed throughout the material. The material conforms to AASHTO designation M249, with the exception of the relevant differences due to the material being supplied in a preformed state, being non-reflective, and potentially being of a color different from white or yellow.
- b. Material to be resistant to the detrimental effects of motor fuels, antifreeze, lubricants, hydraulic fluids, etc. The material must also be resistant to environmental deterioration due to exposure to sunlight, water, salt or adverse weather conditions and impervious to oil and gasoline.
- c. Color: to be determined by the owner and architect.
- d. Skid Resistance: The surface of the material shall contain factory applied anti-skid/anti-slip elements with a minimum hardness of 6 (Mohs scale). Upon application the material shall provide a minimum skid resistance value of 60 BPN when tested according to ASTM E 303.
- e. Slip Resistance: The surface of the material shall contain factory applied anti-skid/anti-slip elements with a minimum hardness of 6 (Mohs scale). Upon application the material shall provide a minimum static friction of coefficient of 0.6 when tested according to ASTM C 1028 (wet and dry), and a minimum static coefficient of friction of 0.6 when tested according to ASTM D 2047.

2. Stamping grid

- a. A wire rope grid is required in the installation. The grid is used for impressing the defined patterns once the preformed thermoplastic has been applied. The wire rope diameter for the impressing template used for the specified pattern is 3/8 in. (9.5mm). The stamping grids are distributed by the System manufacturer.
- b. Pattern: to be determined by the owner and architect.

3. Sealer: A two-part epoxy sealer specified and distributed by the manufacturer must be applied to the substrate prior to material application to ensure proper adhesion, and to provide reinforcement for larger areas of material.



4. Aggregate: Supplemental anti-skid/anti-slip elements to be applied to the surface of the molten preformed thermoplastic as needed, if the factory applied anti-skid/anti-slip elements embed too deeply into the surface of the molten preformed thermoplastic material during the heating process.

### PART 3 - EXECUTION

- 3.1 Prior to placing pavements, ensure area to be paved matches all dimensions as indicated on Contract Drawings, and verify that surfaces to be paved have been properly prepared.
- 3.2 INTERFACE: Edges of existing bituminous pavement to be restored or extended shall be saw-cut in straight lines. Apply tack coat on edges before paving against. Appropriate time for tack coat to set varies with temperature.
- 3.3 An asphalt concrete truing and leveling course shall be placed at locations where the existing pavements require filling to provide a uniform surface upon which pavement resurfacing can be installed.
- 3.4 COMPACTION: Immediately after the bituminous mixture has been spread, struck off and surface irregularities adjusted, it shall be thoroughly and uniformly compacted by rolling. The surface shall be rolled when the mixture is in the proper condition and when the rolling does not cause undue displacement, cracking or shoving. All courses shall be initially rolled with the roller travelling parallel to the centerline of the pavement beginning at each edge and working toward the center. Banked curves shall be rolled starting at the low side edge and working toward the super-elevated edge. When the compaction procedure used by the Contractor fails to produce results acceptable to the Engineer, the procedure shall be adjusted to obtain the desired results. Rollers shall move at a slow and uniform speed. The roller drive roll or wheel shall be nearest the paver.

Any displacement occurring as a result of the reversing of the direction of a roller, or from other causes, shall be corrected at once by the use of rakes and addition of fresh mixture as required. Care shall be exercised in rolling not to displace the line and grade of the edges of the bituminous mixture. To prevent adhesion of the mixture to the rollers, the wheels shall be kept properly moistened with water or water mixed with small quantities of detergent or other approved material, but in no case shall a solvent having effect upon the bituminous pavement be used.

Along forms, curbs, headers, walls and other areas not accessible to the rollers, the mixture shall be thoroughly compacted with mechanical tampers as required to achieve compaction equivalent to compaction produced by the roller. On depressed areas, a trench roller or a small vibratory roller approved by Architect may be used. Cleated compression strips also may be used under the roller to transmit compression to the depressed area.

Suitable means shall be provided to keep pavers and other equipment and tools free from bituminous accumulations. The surface of the pavement shall be protected from drippings of oil, kerosene, or other materials used in paving and cleaning operations.

Any mixture that becomes loose and broken, mixed with dirt, or is in any way defective, shall be removed and replaced with fresh hot mixture, which shall be compacted to conform to the surrounding area. Any area showing an excess or deficiency of bituminous material shall be corrected to the satisfaction of the Engineer.

All bituminous concrete courses shall be initially rolled with an approved steel-wheel roller. The roller shall overlap the previous roller pass by one-half the width of the roller.

3.5 SURFACE TOLERANCE:

- A. Grade: The contractor shall perform grade conformance tests (witnessed by the Owner's Representative) on both the binder course and the top course. Both surfaces should have positive drainage.
- B. Planarity: After completion of the finish rolling operations on each course, the contractor shall test (witnessed by the Owner's Representative) the compacted surface with a 10-foot straightedge. Measurement shall be made perpendicular to and across all mats at a distance not to exceed 25 feet. The maximum allowable planarity deviation with a pass shall be 1/8 inch in 10 feet when measured in any direction. Variations exceeding the allowable tolerances shall be corrected at no additional cost to the satisfaction of the Engineer, including completely relaying the pavement if required. The general contractor shall be completely responsible for establishing this slope. Any areas not in compliance shall be corrected at the cost of the general contractor.

Material which is part of a truing or leveling course will not be considered in pavement thickness determinations.

- 3.6 TEMPERATURE: Bituminous concrete shall have a mixing and placing temperature range between 250°F and 325°F and shall be placed only when the roadway surface is 50°F or above and rising, or as required by Engineer.

- 3.7 Existing pavement shall be cleaned by the use of approved mechanical sweepers in a manner approved by the Engineer. Ruts and depressions below the general surface that are not adequately cleaned by the use of mechanical sweeper shall be cleaned by hand brooms to the Engineer's satisfaction. The pavement and shoulders, if applicable, shall be kept clean until the overlay operations are completed.

- 3.8 Potholes and areas that are determined by the Engineer to be in need of repair shall be cleaned of debris before the new pavement is placed, receive a tack coat, as specified and as required, and shall be filled with bituminous material, asphalt concrete Type 5.

- 3.9 TACK COAT EQUIPMENT: The Contractor shall provide a distributor for applying the tack coat. The distributor shall be designed, equipped, maintained and operated so that the tack coat can be heated and applied uniformly on variable widths of surface up to 15 feet at readily determined and controlled rates from 0.05 to 2.0 gallons per square yard. Distributor equipment shall include a tachometer, accurate metering device or a calibrated tank, and a thermometer for measuring temperatures of tank contents. Distributors shall be equipped with a power unit for the pump, and full circulation spray bars adjustable laterally and vertically. Smaller power spray units of hand spray equipment will be permitted only in areas where the Engineer determines that the use of a distributor is impractical.

- 3.10 APPLICATION OF TACK COAT: The tack coat shall be uniformly applied by a pressure distributor to a prepared clean pavement immediately prior to the placing of the new overlay. Tack coat shall be applied as approved by the Engineer to offer the least inconvenience to traffic, to permit one-way traffic, where practical, to prevent pickup or tracking of the bituminous material.

Tack coat shall not be applied on a wet pavement surface or when the surface temperature is below 45 degrees Fahrenheit. The temperature and areas to be treated shall be approved by the Engineer prior to application. The application rate shall be 0.05 to 0.07 gallons per square yard as approved by the Engineer.

- 3.11 INSTALLATION OF STAMPED ASPHALT: refer to manufacturer's instructions for application.
- 3.12 Prior to painting pavements, sweep clean all surfaces to remove loose material and dirt.
- 3.13 Apply paint with mechanical equipment to produce uniform straight edges without fogging. Apply two coats at manufacturer's printed recommended rates. Apply paint as specified in New York State Department of Transportation Specification Section 640.
- 3.14 Following painting, provide the necessary protective measures to properly cure the painted areas. Allow sufficient time for proper curing as per the paint manufacturer's printed recommendations.

END OF SECTION 321216



## **SECTION 321313**

### **PORTLAND CEMENT CONCRETE PAVEMENT**

#### **PART 1 – GENERAL**

- 1.1 **RELATED DOCUMENTS:** Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- 1.2 **RELATED SECTIONS**  
  
Section 31 23 00: Earthwork.  
Section 32 10 00: Roadway and Miscellaneous Subbase.  
Section 32 16 40: Granite Curbing.
- 1.3 **WORK INCLUDED:** Construct Portland Cement sidewalk slabs and miscellaneous items as shown on the plans or as indicated.
- 1.4 **SUBMITTALS:** Contractor shall submit design mixes for all concrete products intended for use. Also submit detailed plan and necessary drawings for the Landscape Architect/Engineer's review and approval. Plan submitted shall indicate pour sequencing and incorporate specified time lag before pouring adjacent sections of concrete.
- 1.5 **SPECIAL CURING REQUIREMENTS:** The Contractor shall leave concrete forms in place a minimum of five (5) days after each pour. In addition, the Contractor shall moist cure the concrete during this period.
- 1.6 **APPLICABLE MATERIAL AND INSTALLATION STANDARDS**
  - A. American Society for Testing Materials:
    1. Specification for concrete aggregates.
    2. Method of test for soundness of aggregates by the use of sodium sulfate or magnesium sulfate.
    3. Specification for ready-mix concrete.
    4. Specification for Portland cement.
    5. Air-Entraining Portland cement.
    6. Test for scratch hardness of soft fragment particles.
    7. Air-entraining admixtures for concrete.
    8. Specification for preformed expansion joint fillers for concrete paving and structural construction (non-bituminous types).
  - B. American Concrete Institute:
    1. ACI 318 Building Code Requirements for Reinforced Concrete.
    2. ACI 604 Recommended Practice for Winter Concreting.
    3. ACI 605 Recommended Practice for Hot Weather Concreting.

4. ACI 613 Recommended Practice for Selecting Proportions for Concrete.
5. ACI 614 Recommended Practice for Selecting Proportions for Structural Lightweight Concrete.
6. ACI 614 Recommended Practice for Measuring, Mixing and Placing Concrete.
7. ACI 315 Manual of Standard Practice for Detailing Reinforced Concrete Structures.
8. ACI 544 Manual of Concrete Practices for Fiber Reinforced Concrete.

## PART 2 - PRODUCTS

2.1 CONCRETE: 4500 PSI compressive strength concrete at the end of 28 days.

Air Content:  $6\% \pm 1\%$ , W/C, = 0.38, batch with high-range water reducer.

Slump: 4-6" with high-range water reducer.

- A. Portland Cement: ASTM C150, Type 1, natural color. Minimum mix content 575 lbs/cy.
  - B. Fine Aggregate: ASTM C-33 except as noted below. Contain maximum of two percent (2%) by weight of the following: shale, schist, alkali, earth, loam, mica, coated grains, soft and flaky particles. No more than four percent (4) clay by volume. 95% pass No. 4 sieve. Less than 3 percent (3%) pass No. 100 sieve.
  - C. Coarse Aggregate: Crushed quarried stone, ASTM C-33. Aggregate Size No. 57.
- 2.2 WATER: Clean and free from oil, acid and injurious materials and amounts of vegetable matter, alkalis, and other salts.
- 2.3 WATER REDUCING AGENT: Shall be listed on the current approved list of the NYSDOT Materials Bureau.
- 2.4 AIR ENTRAINING AGENT: Shall be listed on the Current Approved List of the NYSDOT Materials Bureau.
- 2.5 Non-shrink grout shall be "EMBECO" as manufactured by Master Builders.
- 2.6 CONCRETE FORMS: Wood or metal designed to support concrete at time of placement, reinforcing, placement equipment and personnel involved during pouring and finishing operations. Form design shall provide for leak-proof joints. Include bracing and shoring required to prevent deflection of joints.
- 2.7 FORM TIES
- A. Exposed Concrete: Plastic cone snaptie, similar and equal to Superior<sup>®</sup> Type 3M; with Superior<sup>®</sup> 1 inch concrete plugs, color to be selected.
  - B. Unexposed Concrete: Snap-off metal ties, designed to prevent form deflection, and prevent spalling surfaces upon removal. Portion remaining after removal shall be at least 1 inch from

concrete surface.

- 2.8 FORM COATINGS: Commercial formulation form-coating compounds shall not bond with, stain, nor adversely affect concrete surfaces, and shall not impair subsequent treatments, nor impede wetting of surfaces to be cured with water or curing compound.
- 2.9 EXPANSION JOINT MATERIAL: 1/2" thick ASTM D994 pre-molded expansion joint filler strips; full slab depth, except top portion shall be removable after concrete placement to accommodate sealant placement.
- 2.10 JOINT SEALANT
  - A. Premium grade, high performance, moisture cured, one component, polyurethane base, non-sag elastomeric sealant.
  - B. Federal Specification TT-S000230C, Type II, Class A.
  - C. Sikaflex 1A, as manufactured by the Sika Corporation, or approved equivalent.
- 2.11 CURING SHEET MATERIAL: ASTM C-171.
- 2.12 BACKER ROD: Sonofoam polyethylene foam by Sonneborn, or approved equivalent, unless otherwise instructed by the sealant manufacturer.
- 2.13 WELDED WIRE FABRIC: As indicated on Drawings

### PART 3 - EXECUTION

- 3.1 The Contractor shall coordinate and schedule an independent testing laboratory 24 hours in advance of any concrete pours. The Contractor shall employ and pay for services for an independent testing laboratory to perform specified inspection and testing. It shall be the responsibility of the Contractor to schedule the concrete testing laboratory to be on site during all concrete pours. Reschedule planned concrete pours as necessary to ensure the on-site presence of the concrete testing laboratory. Caution: No concrete shall be installed without on-site testing by the concrete testing laboratory. The Contractor shall not be entitled to additional compensation for concrete which cannot be incorporated into the work due to the failure to schedule and have a concrete tester on site. The Contractor's independent testing laboratory shall be approved by the Landscape Architect and Construction Manager.
- 3.2 MIX PROPORTIONING
  - A. The responsibility for selection of proportions to be submitted to meet the NYSDOT Specification shall be that of the concrete supplier.
  - B. The proportions of ingredients shall be such as to produce a mixture which can be satisfactorily placed and consolidated by the methods to be employed.
- 3.3 PRODUCTION

- A. Ready Mixed Concrete: Except as otherwise provided in these specifications, ready mixed concrete shall be batched, mixed, and transported in accordance with "Specifications for Ready Mixed Concrete" (ASTM C-94).
- B. Mixing Water Control:
  - 1. Concrete which arrives at the site with slump below that suitable for placement may be adjusted by the addition of water to increase slump provided that the maximum slump is not exceeded. Any addition of water to increase slump shall be followed by mixing of at least 30 revolutions of the drum.
  - 2. After adjustment to the proper slump, discharging shall be allowed for as long as the concrete retains its workability without the addition of water.

### 3.4 INSTALLATION

- A. Forms:
  - 1. Forms, cores, molds, etc. shall be constructed so that the finish concrete will conform to the shapes, lines, grades, and dimensions indicated on the drawings. All forms shall remain in place for a minimum of 120 hours after completion of all concrete work, including finish work.
  - 2. Slots, chases, recesses, inserts, keys and temporary openings:
    - a. Box out for all slots, chases, recesses, or openings as shown on the drawings and as required by the work of all other trades.
    - b. Build bulkheads with keys in walls and footings for stopping concrete. Keys shall be clean, reused or new chamfered 2 x 4's.
    - c. Box out for all temporary openings such as shafts, pipe spaces, etc., and build forms to seal up when and as required.
    - d. Build into concrete all inserts, anchors, PVC or metal reglets, ties, hangers, collars, sleeves, thimbles, sockets, nailing blocks, miscellaneous and ornamental iron as required to secure the work of other trades.
    - e. General - Ample opportunity and full cooperation shall be given to the various trades and other contractors to install their required embedded items. Suitable templates or instructions, or both, will be provided for setting such items as are not placed in the forms by the trades themselves. Openings in floor slabs shall be provided for pipes, ducts, etc., prior to or at the time of placing the form work. All embedded items shall be subject to inspection by the Landscape Architect. Engineer before concrete is placed.
- B. Preparation for Placing Concrete:
  - 1. Notify the Landscape Architect/ Engineer 24 hours in advance of the beginning of the following stages of work:
    - a. Final grade for slab bearing.
    - b. Pouring concrete slabs, foundations or walls.
    - c. Schedule date and time of pour with Owner's concrete testing laboratory.
  - 2. Remove water from excavations or forms before depositing concrete. Divert any water



flow through proper side drains. Remove without washing over freshly deposited concrete, debris, foreign materials from form interiors, from mixing, conveying equipment inner surfaces.

3. Provide runways or other means for wheeled equipment to convey concrete to deposit points. Do not wheel equipment used to deposit concrete over reinforcement. Do not support runways on reinforcement.
4. Spray existing concrete surfaces with water to a surface saturated condition prior to pouring concrete.

C. Placing Concrete:

1. Re-tempered concrete shall not be allowed. Air-slaked or lumpy concrete shall not be used. The contents of the mixer shall be completely discharged before each new batch is loaded.
2. In form work, spade or vibrate thoroughly to ensure contact with concrete. Tamping shall be done with an internal mechanical vibrator. Vibrators shall not be used to move or flow concrete.
3. No honeycombed work will be accepted.
4. Vertical and/ or horizontal plumb bulkheads with keys shall be used at joints (locations shown on plans) for ending day's work and arranged at right angles to planes of stress and in areas of minimum shear. Provide waterstop(s) where watertightness is required as shown on the plans. Watertightness is required for structures designed to contain fluid.
5. Concrete shall be placed in lifts not to exceed 18 inches.
6. Continuous vibration shall be used with the interval of insertion not to exceed 18 inches in any direction.
7. Placing shall be performed so as to prevent the forming of cold and/or irregular joints.
8. No free fall of concrete over 4'-0" will be permitted.
9. Maximum concrete pours shall be as follows:

Slabs: 25'-maximum dimension, 600 sq. ft. maximum area, maximum length to width ratio of 2.

Walls: 30'-adjacent concrete shall not be placed for a period of five (5) days, unless otherwise indicated. Note requirements for leaving forms in place under paragraph 3.4.

3.5 CONSTRUCTION JOINTS, CONTROL JOINTS AND EXPANSION JOINTS

- A. All joints shall be formed and caulked joints made at such locations shown on plans as will least impair the strength of the structure, and as may be required by the Landscape Architect/ Engineer.
- B. Furnish and install keying and supplementary reinforcement at each construction joint and stoppage. Install waterstops as shown on plans, as required for watertight structures or as required by Landscape Architect/ Engineer.
- C. Before pouring next section, clean exposed reinforcement, clean and roughen exposed

concrete and slush with neat cement grout.

- D. Install expansion joint material at all locations where new concrete is cast against existing structures, walls, etc. Install expansion joints at 20' intervals within all new walks and as shown on the Contract Drawings, other than the above noted structures, walls, etc.
- E. Construct control joints, in slabs, at the locations shown on the drawings or at 5 foot intervals in each direction.

### 3.6 TOLERANCES

- A. Unless otherwise indicated, all concrete work to be faced with other materials shall have a tolerance not to exceed 1/4" as measured on a ten-foot straight edge.
- B. If any concrete varies beyond tolerances indicated, Contractor may be required to grind it down at no extra cost. Ground surface may require surface treatment. Provide required treatment as ordered by Landscape Architect/ Engineer at Contractor's expense.

### 3.7 PATCHING CONCRETE

- A. Immediately after removal of forms, patch all holes including those at form ties, honeycombing, and other voids in concrete surfaces. Remove all fins and other projections on concrete surfaces.
- B. Wet the surface to be patched and patch with stiff mortar of one part Portland cement to two parts sand. All exposed surfaces: The cement portion shall be one part white Portland and one part regular cement. Sand shall pass #30 sieve. Permit patching grout, before use, to set 20 to 30 minutes and re-temper without adding additional water.
- C. Compact mortar thoroughly into place and screed it off a little higher than adjacent work and finish flush after initial set.
- D. Work that cannot be properly patched, in the opinion of the Landscape Architect/ Engineer, shall be rejected.

### 3.8 SLABS ON GRADE

- A. Construct structures as shown on the drawings. Include all material, forms, etc. required.
- B. Compacted porous fill shall be placed before installing concrete slabs which bear on the ground. See applicable specifications and details on plans. Place vapor barrier over gravel base as shown on plans.
- C. Upon the prepared base, place a monolithic concrete slab, reinforced as indicated.

### 3.9 CONCRETE FINISHING

- A. No concrete finishing operation shall be conducted while there is free water on the surface, and no dusting of cement, sand or cement-sand mixture is to be used to dry up the surface water on the concrete. Power finishing tools may be used except that area adjacent to electrical trench header ducts, vertical surfaces, electrical fittings, etc. shall be hand finished.
- B. All concrete slabs shall be, after finishing, true and level to within 1/8" of 10' unless indicated to have drainage slopes. Remedial action at the Contractor's expense may be required, at the Landscape Architect/ Engineer's discretion, for any slab not meeting the above standards.
- C. Should spalling occur in surface of concrete, the slab shall be removed and replaced at the Contractor's expense. Patching surface of the concrete after initial set has taken place will not be accepted.

### 3.10 SPECIFIC SLAB FINISHES

- A. All slabs shall receive the following preliminary finish:
  - 1. Bring the concrete to the correct level and, at the proper times, screed, darby and float with a magnesium float. Additional operations shall be applied as indicated.
- B. Broom Finish (Final): Provide a medium broom finish or as noted on the plans, where broom finish is scheduled.
- C. Trowel Finish (Final): All other slab surfaces: Immediately following floating, steel trowel, steel trowel a second time at the proper time for a dense, hard surface.

### 3.11 PROTECTION AND CURING

- A. General:
  - 1. The following rules are for the minimum requirements of protection only and the Contractor shall remain fully responsible to produce concrete which has not been weakened or injured on the surface by frost or freezing or by incomplete protection during hot weather.
  - 2. Protection shall consist of heating the materials, fully enclosing the concrete, and maintaining the temperature of the enclosure at not less than 50° F. for five (5) days.
  - 3. Aggregates and water shall be heated to not more than 140° F. and the concrete shall not be less than 50° F, nor more than 90° F. when deposited.
  - 4. Contractor shall provide adequate protection during hot weather against rapid drying and cold joints. Accelerating, retarding, or anti-freeze admixtures will not be permitted. Provide facilities necessary for moist curing.
  - 5. Prevent use of concrete for a period of five (5) days after installation.
  - 6. Forms shall be left in place a minimum of 120 hours after completion of each pour.
- B. Cold Weather Concreting:

1. When placing concrete at or below a temperature of 40° F., or whenever atmospheric temperatures will probably fall below this limit within the next 24 hours and after placing concrete, the mixing water and aggregates shall be heated and the freshly placed concrete protected by adequate housing or covering and heating.
2. The Contractor shall have on the job ready to install adequate equipment for heating the materials and for maintaining the proper temperatures and atmospheric moisture for the freshly placed concrete, and for enclosing the work in accordance with the requirements specified herein. Do not use salamanders or open fires. Submit diagrams showing type of equipment to be used and how it will be placed in order to maintain proper temperatures required during cold weather concreting for approval of the Landscape Architect/ Engineer.
3. Either aggregates or water or both, as may be necessary, shall be heated with steam coils or other approved devices so that the average temperature of the concrete as it is deposited in a form shall fall within the limits specified herein. Aggregates containing frozen lumps shall be independently heated and no materials containing frozen lumps, ice or snow shall be allowed to enter the mixer.
4. Before placing the concrete in any form or on any surface, or around any reinforcement, heat shall be applied in such manner that ice or snow will be completely removed and the reinforcement will be at the same temperatures as the concrete being placed. No concrete shall be placed on a subgrade that is frozen or on one that contains frozen materials.
5. Concrete, when placed in the forms, shall have a temperature of not less than 70° F. and not above 80° F. Freshly placed concrete shall be maintained at a temperature of not less than 50° F. for five (5) days for normal concrete, and not less than 50° F. for three (3) days for high early strength concrete. Cooling of the concrete to outside temperatures shall not be at a rate faster than one (1) degree each hour for the first day, and two (2) degrees each hour thereafter.
6. The use of salts, chemicals, or other foreign materials in the mix to lower the freezing point of the concrete is prohibited.
7. Before concreting any section of a structure, the section shall be completely housed or enclosed in a manner that will ensure the maintenance of the specified temperatures. The housing shall be left in place for the curing period specified except that sections may be temporarily removed as required to accommodate the placing of column forms or concrete provided that they are replaced immediately after the form or concrete is in its final position.
8. A permanent temperature record shall be kept showing the date, hour, outside temperature, and temperatures at several points within the enclosure to show the most favorable and unfavorable condition to which the concrete is subjected. Thermometer readings will be taken at the start of the work in the morning and again in the late afternoon and the data so obtained shall be recorded in such manner that it will show the location of each reading and any conditions which might have an effect on the temperature. A copy of the temperature records shall be furnished to the Landscape Architect/ Engineer upon request.

C. Hot Weather Concreting:

1. Hot weather, for the purposes of this specification, shall be defined as 80° F. and rising, or 85° F. and falling.
2. During hot weather, Contractor shall plan for prompt placement by assuring an adequate number of personnel to handle and place concrete, and he shall provide adequate protection during finishing and during operations.
3. Forms, reinforcing subgrade should be sprinkled with cold water just prior to concrete placement.
4. Concrete with a temperature exceeding 90° F shall not be placed and an attempt shall be made to keep the concrete temperature well below 90° F. Contractor shall check the temperature of concrete just prior to placement and after placement. This information shall be recorded together with the location that the particular concrete was placed.
5. Cooling of concrete materials before mixing and during mixing using methods as recommended by the American Concrete Institute shall be adhered to.
6. Concrete shall be placed as soon as possible after mixing and/or delivery. On flat work, all finishing operations should be conducted promptly.
7. Protection and Curing: Exposed surfaces shall be protected from accelerated drying by using continuous water curing methods and surfaces shall be kept moist for at least 120 hours. On flat slab or other work exposed to wind or other evaporate conditions, surfaces shall be protected by wet sand or sisal-kraft paper. If water is used directly on new surfaces, the temperature of water should not be much cooler than the concrete.
8. Test of concrete conducted during hot weather shall be in accordance with latest ACI and PCA Standards and/or recommendations.
9. During hot weather, a log shall be kept indicating air temperature, weather condition, relative humidity, and temperature of concrete before and after placement. These tests shall be conducted at frequent intervals and as required by the Landscape Architect/Engineer.
10. Admixtures to delay setting time will not be permitted.

D. Curing:

1. Concrete shall be protected against loss of moisture, rapid drying, or temperature changes, mechanical injury, or injury from rain or flowing water for a period of seven (7) days. Concrete shall be maintained above 50° F., and in a moist condition during curing period.
2. Curing shall commence as soon as free water has disappeared from the surfaces after finishing. Curing of formed soffits of beams, girders, floor slabs, and similar surfaces shall be accomplished by moist curing with forms for full curing period.
3. Except where specified methods of curing are specified, curing may be accomplished by any one of the following methods:
  - a. Moist Curing: Surfaces shall be kept continuously wet by covering with burlap, mats, or sand, thoroughly saturated with water and covering kept wet by spraying or hosing. Place materials to provide complete surface coverage and lap all joints minimum 3 inches.

- b. Impervious-Sheeting Curing: Surfaces shall be thoroughly wetted with a fine spray of water and then covered with waterproof paper, polyethylene sheeting, or polyethylene coated waterproof paper. Edges and ends of sheeting shall be overlapped not less than 4" and securely cemented or taped to form a continuous cover. Sheetting shall be weighted down to prevent displacement and shall be repaired or replaced if torn, damaged, or removed during curing period. Under this curing method, the surface of the concrete shall at all times be covered with a water film. Spray concrete surface periodically to ensure that at no time will concrete cure under "dry" conditions.
- 4. Concrete curing of exposed floor slabs shall incorporate one of the two methods described above. Use of a concrete cure, seal agent is not acceptable for curing of exposed floor slabs or sidewalks. Use of this product for sealing and/or curing in other locations may be allowed at Landscape Architect/ Engineer's discretion.

### 3.12 CONCRETE TESTING STANDARDS (Testing Provided by Owner)

#### A. American Society for Testing Materials:

- 1. Method of making and curing concrete compression and flexure test specimens in the field.
- 2. Method of test for compressive strength of molded concrete cylinders.
- 3. Method of test for securing, preparing and testing specimens from hardened concrete for compressive and flexural strengths.
- 4. Method of test for weight per cubic foot, yield, content (gravimetric) of concrete.
- 5. Method of test for slump of Portland cement concrete.
- 6. Standard method for sampling fresh concrete.
- 7. Method of test for air content of freshly-mixed concrete by the volumetric method.
- 8. Method of making and curing concrete compression and flexure test specimens in the laboratory.
- 9. Method of test for air content of freshly mixed concrete by the pressure method.

### 3.13 CONCRETE TESTS

- A. During the progress of the work, compression test specimens shall be made and cured in accordance with the "Standard Method of Making and Curing Compression and Flexure Test Specimens in the Field" (ASTM Standard C-31). Not less than five specimens (2 for 7 day, 2 for 28 day tests and one spare specimen) shall be made for each test, nor less than one test for each 50 cubic yards of concrete of each class or fraction thereof placed in one day. Specimens shall be cured under laboratory conditions. Except that when, in the opinion of the Landscape Architect/ Engineer, there is a possibility of the surrounding air temperature falling below 40° F., and he may require additional specimens to be cured under job conditions. Cost for laboratory tests for compression test cylinders shall be borne by the Contractor.
- B. Specimens shall be tested in accordance with the standard method of test for compressive strength of molded cylinders (ASTM Standard C-39).
- C. Slump tests shall be conducted for each individual concrete batch or as frequently as may

be required to assure that no concrete shall have more than the required slump. All tests shall be conducted in the presence of the Landscape Architect/ Engineer or his representative. Tests shall be performed in accordance with ASTM requirements. Tolerance is  $\pm 1/2"$ .

- D. Entrained air tests for air-entrained concrete shall be conducted every hour and/or as frequently as may be required to assure that the concrete shall contain the air content specified. All tests will be conducted in the presence of the Landscape Architect/ Engineer or his representative, and testing of each batch will be made by the same representative of the testing laboratory. Take tests at point of placement for pumped concrete.
- E. All cylinders, air content test, and slump tests shall be made by qualified personnel acceptable to the Landscape Architect/ Engineer.
- F. The standard age test shall be 28 days, but 7-day tests may be used provided that the relation between 7-day and 28-day strengths of the concrete is established by tests for materials and proportions used. In the event that 28-day tests fall below the compressive strengths called for in the specifications, the spare test cylinder shall be broken at 56 days as a final check.
- G. If the average strength of the laboratory-cured field cylinders for any portion of the structure falls below the compressive strengths called for in the specifications, the Engineer may require tests in accordance with the "Standard Methods of Securing, Preparing, and Testing Specimens of Hardened Concrete for Compressive Flexural Strength" (ASTM Standard C-42) or order load tests to be made on the portions of the building so affected. Costs for hardened concrete tests and load tests shall be borne by the Contractor.
- H. If the average strength of the laboratory-cured field cylinders falls below the compressive strength called for, the concrete covered by these tests shall be assumed as inadequate for the structure and the Landscape Architect/ Engineer may require that load tests be placed on the portions of the structure in question. Loading shall be in accordance with Section 203 of the ACI Building Code Requirements for Reinforced Concrete, and the method of loading and conducting the test shall be submitted in advance to the Engineer for his approval. If the tested portion of the structure does not fulfill the requirements of the test, it shall be deemed to have failed and shall be removed and replaced. The Engineer reserves the right to reject sub-standard concrete work as indicated by hardened concrete field cylinders regardless of the load tests.
- I. The laboratory shall furnish copies of all tests as follows:
  - Construction Manager..... 1 copy
  - Landscape Architect/ Engineer ..... 1 copy
  - General Contractor ..... 2 copies
  - Concrete Supplier ..... 1 copy
- J. At the end of the week, the Contractor shall submit to the Landscape Architect/ Engineer a record showing the results of all slump and air tests made during the previous week. This record shall indicate the location in the project where this particular concrete was used.

### 3.14 EVALUATION AND ACCEPTANCE

- A. Evaluation: Test results of standard cylinders, molded, cured and tested according to ASTM C-31 and C-39, shall be evaluated separately for each concrete mix according to the "Recommended Practice for Evaluation of Compression Test Results of Field Concrete" (ACI 214).
- B. Acceptance: The criteria for acceptance of concrete shall be detailed in "Building Code Requirements for Reinforced Concrete" (ACI 318, Chapter 4, Paragraph 4.3).

END OF SECTION 321313



## **SECTION 32 16 40**

### **GRANITE CURBS**

#### **PART 1 – GENERAL**

##### **1.1 DESCRIPTION**

###### **A. Work Included in this Contract:**

1. Furnishing and installing flush granite curbs.
2. Furnishing and installing tapered granite curbs.
3. Furnishing and installing vertical granite curbs.

###### **B. Related Work Specified Elsewhere:**

1. All requirements of Division 01.
2. Section 312300: Earthwork.
3. Section 321216: Asphaltic Concrete Paving Surfacing and Striping.

##### **1.2 QUALITY ASSURANCE**

###### **A. Reference Standards:** New York State Department of Transportation, Standard Specifications, May 1, 2019 and latest revision, herein known as DOT Specs.

###### **B. Allowable Tolerances:** Per Section 714-01 DOT Specs.

###### **C. Acceptable Manufacturers and Subcontractors:**

1. Regularly engaged in the manufacture and installation of granite curb with a minimum of 5 years of documented experience.
2. Manufacturers and installers accepted by the Owner.

##### **1.3 SUBMITTALS**

###### **A. Manufacturer's Certification**

1. Letter of confirmation that the final product is within the required size, dimensions and thicknesses.

##### **1.4 PRODUCT DELIVERY, STORAGE AND HANDLING**

###### **A. Product will not be accepted at the site without manufacturer's certification.**

###### **B. Handle and store materials to prevent cracking and chipping.**

###### **C. Curb that has been cracked, chipped, or otherwise damaged will be rejected.**

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Granite curbing conforming to Section 714-01, DOT Specs.
- B. Size conforming to Contract Drawings.

### 2.2 EQUIPMENT

- A. All equipment necessary to properly erect the curb in the position shown on the Contract Drawings.

### 2.3 MIXES

- A. Bedding: Processed Gravel, Type 4.
- B. Backing: Portland Cement, Type II.
- C. Joint Mortar: NYSDOT Spec. 705-21.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Inspect subgrade to verify that elevations are as required and surface is free of water, snow, debris, and frozen, wet or spongy soil. Do not place any work of this Section if subgrade is wet, covered with snow or debris, frozen or spongy.
- B. Inspect curbing for chips and cracks and remove damaged pieces from the site.
- C. Remove curbing damaged during installation and replace at no additional cost to the Owner.
- D. Exposed arris lines at the joints shall not project beyond the plane of a split face and shall not fall under the plane of a split face more than  $\frac{1}{4}$  inch.
- E. Place backing continuously in back of all curb before backfilling, mortaring or placing pavement subbase. Concrete backing shall extend 6 inches behind the curb and to a height as shown on curb detail.
- F. Place mortar in all joints top-to-bottom and neatly strike all joints before placing pavement subbase.
- G. Do not place pavement subbase or paving materials until curb installation has been inspected and accepted.

END OF SECTION 321640

## **SECTION 32 30 00**

### **SITE IMPROVEMENTS**

#### **PART 1 – GENERAL**

- 1.1 RELATED DOCUMENTS: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- 1.2 WORK INCLUDED

Provide site improvements in the locations shown or as described herein, complete with anchorages and associated site work.
- 1.3 RELATED SECTIONS
  - A. SECTION 31 23 00 EARTHWORK.
  - B. SECTION 32 12 16 ASPHALT CONCRETE PAVING SURFACING AND STRIPING.
  - C. SECTION 32 13 13 PORTLAND CEMENT CONCRETE PAVEMENT.
- 1.4 SUBMITTALS
  - A. Contractor shall submit catalog information for the following site improvements:
    - 1. Bollards.

#### **PART 2 – PRODUCTS**

- 2.1 BOLLARDS
  - A. Permanent Bollard
    - 1. Model #TF6010 Concrete Bollard with Reveal Line, as manufactured by Wausau Tile, or approved equivalent.
    - 2. Color and Finish: See construction details.
    - 3. Height: 30"
    - 4. Diameter: 12"
    - 5. Material: Reinforced concrete.
    - 6. Mounting: 4" core with steel pipe anchored in concrete footing per manufacturer's recommendations.

B. Removable Bollard

1. Model #MTB 100-B3, as manufactured by Maglin, or approved equivalent.
2. Color: see construction details.
3. Height: 35"
4. Material:
  - a. Decorative aluminum top and bottom casting.
  - b. 5" HS steel tube with 1/4" wall thickness.
5. Mounting: Anchor bolted per manufacturer's recommendations.

C.

PART 3 – EXECUTION

- 3.1 Any site improvement materials which are constructed of steel and not galvanized or factory coated with a finish system shall be painted in the field in accordance with the manufacturer's specifications. Colors as noted above.

END OF SECTION 323000

## SECTION 329113

### SOIL PREPARATION AND SOIL MIXES

#### PART 1 – GENERAL

##### 1.1 DESCRIPTION

###### A. Work Included in this Contract:

1. Screening, spreading and amending native topsoil as required from on-site stockpiles.
2. Furnishing topsoil from an off-site source, screening, and spreading, if needed.
3. Seed bed preparation.

###### B. Related Sections:

Section 02 30 00: Soil Testing Services.  
Section 31 23 00: Earthwork.  
Section 31 11 00: Clearing and Grubbing.  
Section 31 23 16: Trenching, Backfilling and Compaction.  
Section 31 25 00: Sediment and Erosion Control.

##### 1.2 QUALITY ASSURANCE

###### A. Testing Laboratory: Provided by Contractor. Refer to Section 023000.

###### B. Reference Standards: NYSDOT Specifications.

##### 1.3 SUBMITTALS

###### A. Certificates: Manufacturers' or suppliers' certification that content of materials meets specification requirements.

1. Fertilizer.
2. Lime (if required).
3. Off-site topsoil.
4. Compost.

###### B. Test Reports: Supply Soil Testing Reports for topsoil to be used for turf areas.

##### 1.4 DELIVERY, STORAGE AND HANDLING

###### A. Fertilizer and lime: Deliver to site in unopened, undamaged containers.

###### B. Store fertilizer and lime materials so they are protected from all forms of moisture such as rain, snow, surface drainage, ground water, condensation, etc.

###### C. Do not use wet, mildewed or caked material.

## 1.5 PROJECT CONDITIONS

- A. Environmental requirements: Do not prepare or place frozen soils or soils in a muddy condition. Do not spread topsoil on frozen or muddy subsoil.
- B. Protection: Protect other parts of this Contract from damage.

## PART 2 - PRODUCTS

### 2.1 MATERIAL-TOPSOIL

- A. Native topsoil: from on-site stockpiles.
  - 1. General Lawn Areas: Screen topsoil to meet the following gradation:

| <u>SIEVE SIZES</u> | <u>PERCENT PASSING BY WEIGHT</u> |
|--------------------|----------------------------------|
| 2 inch             | 100                              |
| 1 inch             | 85 to 100                        |
| 1/4 inch           | 65 to 100                        |
| No. 200 Mesh       | 20 to 50                         |

- 2. Turf Areas: Amend the soil to meet the same specifications as off-site topsoil.

- B. Off-site topsoil:
  - 1. The surface layer of dark colored humus soil, free from refuse, any material toxic to plant growth, subsoil, woody vegetation, stumps, roots, brush, stones, clay lumps or similar objects larger in greatest dimension than specified below. Sod and herbaceous growth such as grass and weeds shall be thoroughly broken up and mixed with the soil.
  - 2. pH: between 5.5 and 7.6.
  - 3. Organic content: Not less than 2 % or more than 8%.
  - 4. Gradation:

| <u>SIEVE SIZES</u> | <u>PERCENT PASSING BY WEIGHT</u> |
|--------------------|----------------------------------|
| 2 inch             | 100                              |
| 1 inch             | 85 to 100                        |
| 1/4 inch           | 65 to 100                        |
| No. 200 Mesh       | 20 to 50                         |

### 2.2 MIXES

- A. Lawn Fertilizer: Available nutrients, percent by total weight.
  - 1. 9 nitrogen-at least 50 % from organic source.
  - 2. 23 phosphorus.
  - 3. 14 potassium.
  - 4. Must contain a pre-emergent crabgrass control.
- B. Limestone: Ground limestone with a minimum total neutralizing value of 88 % calcium carbonate equivalence, minimum 90 % passing the 20 mesh sieve and minimum 60 % passing the 100 mesh sieve.

- C. Compost shall contain organic matter or material of a generally humus nature capable of sustaining the growth of vegetation, with no "foreign" matter (i.e. glass, plastic, etc.) or material toxic to plant growth. It shall be free from stones, lumps or similar objects larger than two inches in greatest diameter, roots, and brush. Composts that have been derived from organic wastes such as food and agriculture residues, animal manures and sewage sludge that meet the above requirements and are approved by the State Environmental Agency are acceptable compost sources.

Compost for USE ON TURF shall have the following properties:

| <u>Parameters</u> | <u>Range</u> |
|-------------------|--------------|
| pH                | 5.5 - 8.5    |
| Moisture content  | 35% - 55%    |
| Particle Size     | <1/2"        |
| C:N ratio         | 15 - 30:1    |

- D. Water:
1. Water used during the installation, "grow-in", and Maintenance period shall be provided and paid for by the Contractor. The Sports Field Contractor shall be responsible for appropriate water application. Water utilized shall be suitable for irrigation and free from ingredients harmful to plant life.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Examine areas to receive soil preparation to assure work of other trades has been completed.
- B. Remove jute mesh, staples, hay bales and other erosion control measures in the line of work.
- C. Completely disc subsoil that has become compacted and re-grade to required subgrade.
- D. Verify that all subsoils are positively drained and free of ponded areas and debris.
- E. Perform topsoil analysis for pH with recommendations for adjustment to specified pH limits.
- F. Do not proceed with soil preparation until unsatisfactory conditions are corrected.

### 3.2 PREPARATION

- A. If the subsoil has become overly compacted after discing, in the opinion of the Engineer, just prior to placing the topsoil, the subsoil material shall be scarified to a minimum depth of 3 inches so as to ensure a proper bond between the subsoil material and the topsoil.
- B. Screen topsoil to remove particles larger than 3/4".

### 3.3 INSTALLATION

#### A. Topsoil:

1. Spread topsoil on all disturbed areas within Contract Limit Lines to a depth of 6 inches as shown on plans.
2. Import topsoil if stockpiled topsoil is insufficient to attain specified depth.
3. Fine rake topsoil to break up lumps and remove stones, debris, and foreign material one inch or larger in any dimension, and to establish a smooth uniform surface.
4. Final grades shall not vary more than one-tenth of a foot from elevations shown on Contract Drawings.
5. No unsightly variations, bumps, ridges, or other depressions which will hold water shall be acceptable.

#### B. Fertilization:

1. Apply fertilizer at a rate of 500 pounds per acre, or roughly 11.5 pounds per thousand square feet to all topsoil.
2. Lightly work fertilizer into the topsoil.

#### C. Liming:

1. Based on laboratory analysis and recommendations. Adjust pH of all areas to be between 5.5 pH and 6.5 pH, as follows:

|                            |                  |
|----------------------------|------------------|
| Existing pH, less than 4.0 | 170 lbs./1000 SF |
| 4.1 - 4.5                  | 155 lbs./1000 SF |
| 4.6 - 5.0                  | 125 lbs./1000 SF |
| 5.1 - 5.5                  | 95 lbs./1000 SF  |

#### D. Compaction:

1. Exercise extreme caution in all topsoil areas that soil is not overly compacted.
2. Soil that has become overly compacted, in the judgment of the Architect, shall be re-worked to achieve a satisfactory condition at no additional cost.
3. Topsoil on sloped areas may be lightly rolled to prevent erosion if application of seed is delayed.

### 3.4 CLEAN-UP

- A. Immediately clean up spills of soil and conditioners on paved and finished surface areas.
- B. Remove debris and excess materials from project site.

### 3.5 STOCKPILES

- A. Hydroseed excess topsoil remaining in stockpiles. Do not remove excess topsoil from Owner's property. Coordinate with school on spreading out excess topsoil, prior to hydroseeding.

END OF SECTION 329113



## SECTION 329200

### LAWNS

#### PART 1 – GENERAL

- 1.1 RELATED DOCUMENTS: Drawings and general provisions of Contract, including General and supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- 1.2 WORK INCLUDED
- A. Application of seed and mulch by broadcasting.
  - B. Application of seed and mulch by mechanical means.
  - C. Application of seed and mulch by hydroseeding.
  - D. Establish dense lawn to the satisfaction of the Landscape Architect.
  - E. Repair all unestablished lawns.
- 1.3 RELATED SECTIONS
- Section 31 23 00: Earthwork.
  - Section 31 23 16: Trenching, Backfilling and Compaction
  - Section 32 91 13: Soil Preparation and Soil Mixes.
- 1.4 QUALITY ASSURANCE
- A. Reference Standards: NYSDOT Specifications.
  - B. Source Quality Control: Producer's tests for purity and germination of seed, dated within nine months of application.
- 1.5 SUBMITTALS
- A. Manufacturer's or supplier's certification that materials meet specification requirements.
  - B. Certification of grass seed from seed vendor for each grass-seed mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
    - 1. Certification of each seed mixture for sod, identifying sod source including name and telephone number of supplier. (where applicable)
    - 2. Certification by product manufacturer that the following products supplied comply with requirements:
      - a. Limestone.
      - b. Fertilizers.

- C. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and address of Landscape Architect/ Owners, and other information specified.
- D. Material test reports from qualified independent testing agency indicating and interpreting test results relative to compliance of the following materials with requirements indicated.
  - 1. Analysis of existing surface soil.
  - 2. Analysis of imported topsoil.
  - 3. Analysis of pH of subbase soil and topsoil, (Native and/or Imported).
  - 4. Analysis of chemical composition of subbase soil and topsoil.
- E. Planting schedule indicating anticipated dates and locations for each type of planting.
- F. Maintenance instructions recommending procedures to be established by Owner for maintenance of landscaping during an entire year. Submit before expiration of required maintenance periods.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed landscaping work similar in material, design, and extent to that indicated for this Project and with a record of successful grass establishment. The installer shall have specific experience with the installation of athletic field sod.
  - 1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on the Project site during times that grass planting is in progress.
- B. Testing Agency Qualifications: To qualify for acceptance, an independent testing agency must demonstrate to Landscape Architect's satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM E 699, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.
- C. Topsoil and subbase soil analysis: Furnish a soil analysis made by a qualified independent soil-testing agency stating percentages of organic matter, inorganic matter (silt, clay, and sand), deleterious material, pH, and mineral and plant-nutrient content of topsoil.
  - 1. Report suitability of topsoil for lawn growth and sod growth. State recommended quantities of nitrogen, phosphorus, and potash nutrients and any limestone, aluminum sulfate, or other soil amendments to be added to produce a satisfactory topsoil capable of supporting growth of lawns.
  - 2. Testing shall be performed at a rate of one (1) test per ten thousand (10,000) square feet for lawns and athletic fields.

#### 1.7 DELIVERY, STORAGE AND HANDLING

- A. Seed, Hydroseed Mulch and Binder: Deliver to site in unopened, undamaged containers.
- B. Store materials so they are protected from all forms of moisture such as rain, snow, surface drainage, ground water, condensation, etc.

- C. Do not use wet or mildewed materials.

## 1.8 PROJECT CONDITIONS

- A. Existing Conditions: Apply seed only after preceding work affecting ground surface is complete.
- B. Environmental Requirements:
  - 1. Do not apply seed when soil is in a frozen, muddy or overly compacted condition.
  - 2. Do not apply seed when wind exceeds 5 mph.
  - 3. Time of seed application:
    - a. August 15 through September 30.
    - b. April 1 through May 15.
    - c. These periods may be extended or reduced according to prevailing weather conditions, upon approval by the Landscape Architect.
- C. Protection: Restrict foot and vehicular traffic from seeding areas after application of seed and mulch until the end of establishment period.

## 1.9 MAINTENANCE

- A. Begin maintenance of lawns immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:
  - 1. Seeded Lawns: 60 days after date of Substantial Completion.
    - a. When full maintenance period has not elapsed before end of planting season, or if lawn is not fully established at that time, continue maintenance during next planting season.
- B. Maintain and establish lawns by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, re-grade, and replant bare or eroded areas and re-mulch to produce a uniformly smooth lawn. Sodded areas which die shall be replaced with new sod.
  - 1. Replant bare areas with same materials specified for lawns.
  - 2. Add new mulch in areas where mulch has been disturbed by wind or maintenance operations sufficiently to nullify its purpose. Anchor as required to prevent displacement.
- C. Watering: Provide and maintain temporary piping, hoses, and lawn-watering equipment to convey water from sources and to keep lawns uniformly moist to a depth of 4 inches.
  - 1. Lay out temporary lawn-watering system and arrange watering schedule to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly seeded, plugged, or sprigged areas.
  - 2. Water lawn at the minimum rate of 1 inch (25 mm) per week.
- D. Mow lawns as soon as there is enough top growth to cut with mower set at specified

height for principal species planted. Repeat mowing as required to maintain specified height without cutting more than 40 percent of the grass height. Remove no more than 40 percent of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain following grass height:

1. Mow grass to a height of 2 inches when the overall height reaches 3 to 4 inches.
- E. Post-fertilization: Apply fertilizer to lawn after first mowing and when grass is dry.
1. Use fertilizer that will provide actual nitrogen of at least 1 lb. per 1000 sq. ft. of lawn area.

## PART 2 - PRODUCTS

- 2.1 Seed: Fresh, clean, new crop seed, weed content not exceeding 0.03 percent. It shall conform to Federal and State Standards. Each type of seed in the mixture shall meet or exceed the minimum percentage of purity and germination listed for that type of seed.
- 2.2 Mulching shall consist of paper or wood cellulose fibers, processed to contain no growth- or germination-inhibiting factors and dyed an appropriate color to facilitate visual metering of the materials application. The mulch material shall be supplied in packages having a maximum gross weight of 100 pounds. The mulch will have a maximum 10% moisture content, air dry weight basis.
- 2.3 The binder material shall be a biodegradable type as manufactured under the trade names of TERRATAACK or CURASOL or equal. The manufacturer's suggestions for storage, mixing, and application shall be strictly adhered to and the Landscape Architect may sample the binder for testing purposes at any time. Other binders may be used if it can be demonstrated to the Landscape Architect's satisfaction that they are at least equal to the binders mentioned in all respects.
- 2.4 Straw mulch shall be stalks of oats, wheat, rye or other acceptable herbaceous growth that is free of noxious weeds. Materials that are low grade and unfit for farm use, such as "U.S. Sample Grade" will be acceptable. Hay will not be used.
- 2.5 Chemical Binder: Conform to Item 713-12 of Reference Standards.
- 2.6 All water used shall be potable.
- 2.7 FERTILIZER
  - A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast-and slow-release nitrogen, 50 percent derived from natural organic sources of urea-form, phosphorous, and potassium in the following composition:
    1. Composition: Nitrogen, phosphorous, and potassium in amounts of starter fertilizer recommended in soil reports from a qualified soil-testing agency to facilitate plant growth. Fertilizer shall have a ratio of 1 part nitrogen; 2 parts phosphorous; 1 part potassium, and shall be 12-24-12 or comparable fertilizer.

## 2.8 MIXES

### A. Seed:

1. Seed shall be a mixture of the species specified mixed in the proportion as listed below:

- a. "Lawn Mix" (Lawn Mix A) (For use on disturbed/damaged lawns)

| SPECIES  | PERCENT BY WEIGHT | GERMINATION | PURITY |
|--|-------------------|-------------|--------|
| Rebel II or Rebel III<br>Tall Fescue<br>(or equivalent)          | 30                | 95%         | 80%    |
| Relient Hard Fescue<br>(or equivalent)                           | 15                | 95%         | 80%    |
| Baron Kentucky Bluegrass<br>(or equivalent)                      | 25                | 85%         | 75%    |
| Palmer II or Prelude II<br>Perennial Ryegrass<br>(or equivalent) | 30                | 95%         | 85%    |

- B. Tall Fescue variety shall provide heat and drought tolerance and produce leaves which are up to 30% finer and 188% denser than the standard Kentucky 31 Tall Fescue.
    - C. Perennial Ryegrass variety shall provide heat and drought tolerance and produce a leafy turf-type, fine textured, low growing turf of a dark green color.
    - D. Hard Fescue variety shall produce dark green, fine textured turf under minimal maintenance, especially where the use of fertilizer is discouraged or banned.
    - E. That portion of the above mixtures listed as inert and other shall consist of non-viable seed, chaff, hulls, live seeds of crop plants and harmless inert matter.
    - F. All seed mixtures shall be mixed by the vendor and shall be delivered in standard sized bags of the vendor, showing the weight, analysis, and vendor's name.
    - G. If the Contractor feels a different seed mixture will perform better within the zone specified, he may submit on such a mix.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Check that preceding work affecting ground surface is complete.
- B. Verify that soil is unfrozen and within acceptable range of moisture content.
- C. Do not start until conditions are satisfactory.

### 3.2 PLANTING SOIL PREPARATION

- A. Limit subgrade preparation to areas that will be planted in the immediate future.
- B. Preparation of Unchanged Grades: Where lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface soil stripping operations, prepare soil as follows:
  - 1. Remove and dispose of existing grass, vegetation, and turf. Do not turn over into soil being prepared for lawns.
  - 2. Till surface soil to a depth of at least 6 inches. Apply required soil amendments and initial fertilizers and mix thoroughly into top 4 inches of soil. Trim high areas and fill in depressions. Till soil to a homogenous mixture of fine texture.
  - 3. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
  - 4. Remove water material, including grass, vegetation, and turf, and legally dispose of it off the Owner's property.
- C. Grade lawn and grass areas to a smooth, even surface with loose, uniformly fine texture lightly. Roll and rake to provide a firm surface, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future. Remove trash, debris, stones larger than 1-1/2 inches in any dimension, and other objects that may interfere with planting or maintenance operations. Do not compact soils within athletic fields. (Compaction within athletic field areas should be at a minimum 80% and maximum 85%) The soil should be lightly rolled with a one (1) ton maximum non-vibratory roller. Roll the subgrade at a 45° horizontal angle to the proposed direction of sod placement, followed by a 2nd pass rolled at 90° to the first pass.

### 3.3 APPLICATION

- A. Apply seed at the rate of six pounds per 1000 square feet.
- B. Hydroseeding:
  - 1. Mechanically agitate the required materials to form a homogeneous slurry. Spray the slurry on the ground by a hydraulic seeder equipped to apply up to 200 gallons per minute at 100 pounds pressure from the nozzle with a clearance for 1/2 inch solids.
  - 2. When hydraulically sprayed on the ground, the material shall form a blotter-like cover impregnated uniformly with grass seed. The cover will allow the absorption of moisture and allow rainfall or added water to percolate to the underlying soil.
  - 3. The suggestions of the manufacturer of the individual materials shall be followed in preparing and applying this hydroseeding mixture. However, the following minimum ingredient amounts shall be used and thoroughly and consecutively mixed together.
    - Water as per manufacturer's instructions.
    - Seed as specified.
    - Biodegradable Binder as per manufacturer's directions.
    - Fiber Mulch 27.5 lbs./1000 square feet.
  - 4. Only use biodegradable binder on slopes greater than 4 horizontal on 1 vertical.
  - 5. All containers and tanks used for holding and mixing the ingredients and the final

homogeneous hydroseeding mixture shall have been thoroughly cleaned of all material incompatible with seed germination and which is not readily biodegradable.

C. Broadcast Seeding:

1. Uniformly broadcast seed on prepared seed bed and immediately rake into top one half inch of topsoil. Do not displace seed during raking.
2. Immediately following seeding and raking, roll seed bed with a 200 pound roller and thoroughly water with a fine spray.
3. Immediately following rolling and watering, apply straw mulch uniformly to seed bed at rate of three tons per acre.
4. Uniformly apply binder to all mulch (slopes steeper than 4 horizontal on 1 vertical) at the following rates:
  - a. Chemical Binder: At manufacturer's recommended rate, or
  - b. Asphalt Emulsion: 300 gallons per acre.

D. Mechanical Seeding:

1. Uniformly apply seed to prepared seed bed to a depth of one half inch by a mechanical seeder such as a Brillon or approved equivalent.
2. Immediately following seeding, roll seed bed with a 200 pound roller and thoroughly water with a fine spray.
3. Immediately following rolling and watering, apply straw mulch uniformly to seed bed at the rate of three tons per acre.
4. Uniformly apply binder to all (mulch) slopes steeper than 4 horizontal on 1 vertical.

3.4 SODDING NEW LAWNS

- A. Lay sod within 24 hours of stripping. Do not lay sod if dormant or if ground is frozen.
- B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
  1. Lay sod across angle of slopes exceeding 1:3.
  2. Anchor sod on slopes exceeding 1:6 with wood pegs spaces as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.
- C. Saturate sod with fine water spray within 2 hours of planting. During first week, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches (38 mm) below the sod.

3.5 RECONDITIONING LAWNS

- A. Recondition existing lawn areas damaged by Contractor's operations, including storage of materials or equipment and movement of vehicles. Also recondition lawn areas where settlement or washouts occur or where minor regrading is required.
- B. Remove sod and vegetation from diseased or unsatisfactory lawn areas; do not bury into soil. Remove topsoil containing foreign materials resulting from Contractor's

operations, including oil drippings, fuel spills, stone, gravel, and other construction materials, and replace with new topsoil.

- C. Where substantial lawn remains, mow, detach, core aerate, and rake. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.
- D. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of it off the Owner's property.
- E. Till stripped, bare, and compacted areas thoroughly to a depth of 6 inches.
- F. Apply required soil amendments and initial fertilizers and mix thoroughly into top 4 inches of soil. Provide new planting soil as required to fill low spots and meet new finish grades.
- G. Apply seed and protect with straw mulch as required for new lawns.
- H. Apply sod as required for new lawns.
- I. Water newly planted areas and keep moist until new grass is established.

### 3.6 PROTECTION

- A. Immediately after seeding, protect seeded areas from all traffic until lawn is established.
- B. The Contractor shall be responsible for correction of all damage done by unauthorized traffic at no additional cost.

### 3.7 LAWN ESTABLISHMENT

- A. Watering:
  - 1. Keep seed bed moist until germination of seed by application of fine spray.
  - 2. Continue fine spraying after germination at four to seven day intervals as required to supplement natural rainfall so that all lawn areas received sufficient water for normal plant growth.
  - 3. Furnish all equipment necessary for artificial watering and be responsible for securing an adequate supply of water.
  - 4. The Contractor is completely responsible for all watering requirements until the lawn has been deemed satisfactory.
- B. Mowing:
  - 1. Mow lawn to a height of 2 inches when the overall height reaches 3 to 4 inches.
  - 2. Remove clippings when height of lawn is 6 inches or higher before mowing.
  - 3. Complete a minimum of three mowings in one growing season.
- C. Fertilize:
  - 1. After the second mowing, uniformly spread fertilizer at the rate of 5 pounds per thousand square feet.
  - 2. Thoroughly water lawn after applying fertilizer to facilitate penetration of fertilizer particles to the soil.
  - 3. The Contractor shall also be responsible for providing and applying fertilizer for the



duration of one (1) complete growing season. Required application shall be as follows:

| <u>Construction Time</u> | <u>Fertilization Required</u>   |
|--------------------------|---|
| Spring                   | Starter fertilizer<br>Spring turf builder with weed control<br>Fall turf builder<br>Winterizer application  |
| Summer                   | Starter fertilizer<br>Turf builder with Summerguard protection<br>Fall turf builder<br>Winterizer application<br>Following Spring turf builder and weed control |
| Fall                     | Starter fertilizer<br>Fall turf builder<br>Winterizer application<br>Following Spring turf builder and weed control   |

All fertilizers must be approved by the Landscape Architect prior to application.

D. Erosion Repair:

1. Repair all erosion damage by filling with topsoil, compacting, fertilizing, liming, seeding, and mulching according to original Contract requirements. This shall be required until such a time that the lawn has established itself and has been approved by the Landscape Architect.

E. Mulch Removal:

1. Remove and/or replace mulch that has been displaced.
2. Keep all paved surfaces and storm sewers free of mulch material.

F. Reseeding:

1. Reseed all areas which are sparse and/or spotty and where surface soils are highly visible not having a uniform stand of grass after the first mowing.
2. If a dense lawn is not established after three mowings in the first germination period, return in the following planting season to scarify, re-fertilize, topdress, re-seed, and re-mulch to establish a uniform stand of grass after three mowings in that following season. Dense lawn can be defined as areas where surface soils cannot be seen through the grass.

### 3.8 CLEANUP

- A. Remove trash and excess materials from project site.
- B. Maintain paved areas in a clean condition.
- C. Remove barriers and signs from project site at termination of establishment period.

### 3.9 PERFORMANCE

- A. Lawn will not be considered for payment and acceptance until a satisfactory stand of grass, as judged by the Landscape Architect, and is evident after three consecutive mowings and refertilization.
- B. The Landscape Architect will inspect the established lawn upon written request to the Owner by the Contractor.
- C. The Contractor shall provide to the School a Schedule of Procedure including, but not limited to, fertilizing, irrigation and aeration, for the care and maintenance of the lawns in the future, prior to acceptance of the work.
- D. Upon acceptance of the Work specified in this Section, the Contractor shall be relieved of further responsibility for care and maintenance of lawn.

END OF SECTION 329200

## **SECTION 329300**

### **TREES, SHRUBS, GROUNDCOVERS, AND LANDSCAPING**

#### **PART 1 - GENERAL**

##### **1.1 WORK INCLUDED:**

- A. This Section includes furnishing all labor, materials, equipment, plants, and incidental materials necessary to perform all operations related to the planting of all trees, shrubs, vines, herbaceous plants, ground covers, and for all appurtenant work, complete in

place, maintained, and accepted, in accordance with the Contract Drawings and Specifications.

- B. The Contractor shall bear the responsibility and cost of furnishing and applying water or any other substances, as necessary to ensure the sustainability of plant materials, as part of the work of this contract.

## 1.2 RELATED WORK:

- A. Section 32 91 13, SOIL PREPARATION AND SOILS MIXES
- B. Section 32 92 19, SEEDING

## 1.3 SUBMITTALS:

In accordance with requirements of Section 01 33 23 SUBMITTALS, the Contractor shall submit the following:

- A. Prior to planting, State nursery inspection certificates for all plant materials.
- B. Samples of the manufacturer's product data, as applicable, for the following materials:
  - 1. Limestone.
  - 2. Fertilizer.
  - 3. Sphagnum Peat Moss.
  - 4. Humus.
  - 5. Organic Compost.
  - 6. Manure.
  - 7. Mulch.
  - 8. Guying and Staking Apparatus.
  - 9. Crepe Wrapping for tree trunks.
  - 10. Anti-transpirant/Anti-desiccant.
  - 11. Insecticides.
  - 12. Herbicides.
  - 13. Fungicides.

## PART 2 - PRODUCTS

## 2.1 PLANT MATERIALS:

- A. The Contractor shall furnish and plant all plant materials as shown on the plans and in the quantities and sizes listed thereon. No substitutions shall be permitted without the written approval of the Engineer.
- B. Plants larger than those specified in the Plant List may be used if approved by the Engineer. However, use of such oversized plants shall not be considered grounds for any increase in the contract price. If the use of larger plants is approved, the required spread of roots or ball of earth shall be increased in proportion to the size of the plant and plant pits shall be increased as necessary.
- C. All plants shall be certified to have passed all required Federal and State inspection laws requiring ensuring freedom from plant diseases and insect infestations. The Contractor shall obtain clearance from applicable governing agencies, as required by law, before planting any plants delivered from outside the state in which they are to be planted.
- D. All plants shall be nursery-grown under climatic conditions and environmental stresses similar to those in the locality of the project. All plants shall originate from nurseries that are no more than one Hardiness Zone higher (as established by the Arnold Arboretum, Jamaica Plain, MA) than where the plant is to be installed. Plants also shall conform to the botanical names and standards of size, culture, and quality for the highest grades and standards as adopted by the American Association of Nurserymen, Inc. in the American Standard for Nursery Stock, ANSI-Z60.1, latest edition. All plants shall be legibly tagged with their proper botanical name.
- E. No heeled-in plants or plants from cold storage shall be used. All plants shall be typical of their species or variety and shall have a normal habit of growth. Plants shall be sound, healthy, and vigorous, well branched and densely foliated when in leaf; shall be free of disease, insects, eggs or larvae; and shall have healthy, well-developed root systems. All parts of the plant shall be moist and shall show active green cambium when cut.
- F. All nursery plants shall be balled and burlapped or container-grown and shall have been acclimatized for at least one growing season. Container-grown stock shall have been grown in a container long enough for the root system to have developed sufficiently to hold its soil together, firm and whole, after removal from the container. No plants shall be loose in the container. Container-grown plants shall have no girdling roots and shall not be in a root-bound condition. Plants shall remain in their container until planted.
- G. Care shall be exercised in digging and preparing field-grown plants for shipment and planting. Balled and burlapped materials shall have solid unbroken balls of earth of sufficient size to encompass all fibrous feeding roots necessary to ensure successful recovery and development of the plants. Balls shall be firmly wrapped in untreated biodegradable burlap and tied securely with wire cages and/or jute twine. Roots or balls of plants shall be adequately protected at all times from sun and drying winds. No plant shall be accepted when the ball of earth surrounding its roots has been badly cracked or broken preparatory to or during planting, or after the burlap, staves, wire cage, rope, or

platform in connection with its transplanting have been removed. Soil characteristics (i.e., composition, texture, pH, etc.) of all field-grown plants shall closely match those of the soil where plant materials are to be planted.

- H. The height of the trees, measured from the crown of the roots to the top of the top branch, shall not be less than the minimum size designated in the Plant List in the Drawings. The branching height for deciduous trees installed adjacent to or within walks shall be 7 feet minimum, having been pruned to this height at least 1 year prior to transplanting. Except when a clump is designated, the trunk of each tree shall be a single trunk growing from a single, unmulated crown of roots. No part of the trunk shall be conspicuously crooked as compared with normal trees of the same variety. The trunk shall be free from sunscald, frost cracks, or wounds resulting from abrasions, fire, or other causes. All pruning cuts shall comply with acceptable horticultural practices. No pruning wounds having a diameter of more than 1½-inches shall be present. Any such wounds must show vigorous bark growth on all edges. Evergreen trees shall be branched to within 1 foot of the ground. No tree that has had its leader cut or die shall be accepted.
- I. Caliper measurements for tree trunks shall be taken 6-inches above ground for trees up to and including 4-inch caliper size and at 12-inches above ground for larger sizes.
- J. Shrubs shall meet the requirements for spread and/or height stated in the Plant List on the Drawings. The measures for height are to be taken from the crown or root flare to the average height of the top of the shrub mass (not the longest branch). The fullness of each shrub shall correspond to the trade classification "No. 1". Single stemmed or thin plants will not be accepted. The side branches must be generous, well-twigged and the plant as a whole must be well-bushed to the ground. The plants must be in a moist, vigorous condition, free from dead wood, bruises or other root or branch injuries.
- K. Herbaceous plants, vines and groundcovers shall be of the size, age and/or condition designated in the Plant List on the Drawings.
- L. Plants shall be delivered only after preparations for planting have been completed. Plants shall be handled and packed in a horticulturally approved manner and all necessary precautions shall be taken to ensure that plants arrive on-site in a healthy vigorous condition. Trucks used for transporting plants shall be equipped with covers to protect plants from windburn, desiccation, and overheating during transport. Plants that have not been thoroughly watered shall not be accepted at the planting site. Any plants delivered to the site in a dry or wilted condition shall be rejected and replaced at no expense to the Owner. All plant materials shall be protected, watered and otherwise maintained prior to, during, and upon delivery to the site.
- M. Plants shall be subject to inspection and approval by the Engineer at the place of growth, or upon delivery, for conformity to specification requirements as to quality, size, variety, and condition. Inspection and selection of plants before digging shall be at the option of the Engineer. The Contractor, or his representative, shall be present, if requested by the Engineer, for inspection of plants at the Nursery. Such approval shall not impair the right of inspection and rejection upon delivery at the site or during the progress of work, for size and condition of balls and roots, disease, insects and latent defects or injuries.

Rejected plants shall be removed immediately from the site. Certificates of inspection of plant materials shall be furnished as may be required by Federal, State and other authorities to accompany shipments.

## 2.2 SOIL PREPARATION AND SOIL MIXES:

Soil Preparation and Soil Mixes shall be as specified in Section 31 91 13, SOIL PREPARATION AND SOIL MIXES.

## 2.3 SOIL ADDITIVES AND AMENDMENTS:

### A. LIMESTONE:

Lime shall be an approved agricultural limestone containing at least 50 percent total oxides (calcium oxide and magnesium oxide). The material will be ground such that 50 percent of the material will pass through a No. 100 mesh sieve and 98 percent will pass a No. 2 mesh sieve. Lime shall be uniform in composition, dry and free-flowing and shall be delivered to the site in the original sealed containers, each bearing the manufacturer's guaranteed analysis.

### B. FERTILIZER:

1. Fertilizer shall be a complete, standard commercial fertilizer, homogeneous and uniform in composition, dry and free-flowing, and shall be delivered to the site in the manufacturer's original sealed containers, each bearing the manufacturer's guaranteed analysis and marketed in compliance with State and Federal Laws. All fertilizer shall be used in accordance with the manufacturer's recommendations.
2. Fertilizer for tree, shrub and groundcover plantings shall contain all major plant nutrients and minor trace elements essential to sustain plant growth and shall have the following analysis:

|              |                 |               |
|--------------|-----------------|---------------|
| Nitrogen (N) | Phosphorous (P) | Potassium (K) |
| 10%          | 10%             | 10%           |

3. As approved by the Engineer, a slow release root contact fertilizer installed at the time of planting, may be used in place of the above, at the discretion of the Contractor.

- C. Organic Compost shall be a standard commercial product comprised of fully decomposed, 100 percent plant-derived, natural organic matter. Its composition shall furnish ample water holding capacity and cation exchange capacity for the retention of plant nutrients. Compost shall be free of sticks, stones, weed seeds, roots, mineral or other foreign matter and delivered air dry. It shall be free from excessive soluble salts,

heavy metals, phytotoxic compounds, and/or substances harmful to plant growth and viability. Organic compost shall have an acidity range of 4.5 to 7.0 pH.

- D. Sphagnum Peat Moss shall be a standard commercial product. Its composition shall furnish ample water holding capacity and cation exchange capacity for the retention of plant nutrients. Peat moss shall be free of sticks, stones, weeds or weed seeds, roots, mineral or other foreign matter. It shall be free from toxic substances and/or compounds harmful to plant growth and viability. It shall be delivered air dry in standard bales and shall have an acidity range of 3.5 to 5.5 pH.
- E. Humus shall be natural humus, reed peat, or sedge peat. Its composition shall furnish ample water holding capacity and cation exchange capacity for the retention of plant nutrients. Humus shall be free of sticks, stones, weeds, roots, mineral or other foreign matter and/or toxic substances harmful to plant growth and viability. It shall be low in wood content, free from hard lumps and excessive amounts of zinc and delivered air dry in a shredded or granular form. The acidity range for humus shall be 5.5 to 7.5 pH, and the organic matter content shall be not less than 85 percent, as determined by loss on ignition. The minimum water holding capacity shall be 200 percent by weight on an oven-dry basis.
- F. Manure shall be well-rotted, leached, cow manure not less than 8 months or more than 2 years old. It shall be free of sawdust, shavings, or refuse of any kind and shall not contain more than 25 percent straw. It shall contain no substances harmful to plant growth. The Contractor shall furnish information regarding chemical disinfectants, if any, that may have been used in storage of the manure.

#### 2.4 PLANTING MIXTURE:

Planting mix shall consist of 7 parts loam borrow and 1 part organic compost, humus, sphagnum peat moss, or manure, thoroughly blended.

#### 2.5 WATER:

Water shall be furnished by the Contractor, unless otherwise specified, and shall be suitable for irrigation and free from ingredients harmful to plant growth and viability. The delivery and distribution equipment required for the application of water shall be furnished by the Contractor, at no additional cost to the Owner.

#### 2.6 MULCH:

Mulch shall be fibrous pliable shredded softbark mulch, not exceeding ½-inch in width. It shall be 98 percent organic matter with a pH range between 3.5 and 4.5 and a moisture content not to exceed 35 percent. It shall be free of weeds, weed seeds, debris, and



other materials harmful to plant growth and viability. Organic mulch shall be aged no longer than 2 years.

## 2.7 MATERIALS FOR STAKING, GUYING, AND WRAPPING:

- A. Tree stakes shall be sound, untreated 2 x 3 (nominal) x 8-foot length Douglas Fir reasonably free of knots. No paint or stain shall be used in conjunction with tree stakes. Tying material shall be flexible braided nylon webbing, ¾-inch wide and have a tensile strength of 900 pounds. Webbing shall be 'ArborTie', or approved equal.
- B. Drive anchors and guy wire assemblies shall be suitable for protecting trees and shall be sized in accordance with the manufacturer's recommendations. No materials shall be used for guying that will girdle, chafe, or otherwise injure trees.
- C. Tree wrap shall be duplex, waterproof kraft paper crinkled to 33-1/3 percent stretch, 4 to 6-inch wide strips. Tying materials shall be jute twine, 2-ply for shrubs and trees less than 3-inch caliper; 3-ply for larger plants.

## 2.8 TREE PAINT:

Tree paint shall not be used.

## 2.9 ANTI-TRANSPIRANT/ANTI-DESICCANT:

Anti-transpirant or anti-desiccant shall be 'Wilt-Pruf', as manufactured by Nursery Specialty Products, Inc., Groton Falls, NY, or approved equal. It shall be delivered in original sealed manufacturer's containers and used in accordance with the manufacturer's instructions.

## 2.10 INSECTICIDES:

- A. No insecticides shall be used on-site without the Contractor notifying and obtaining the prior approval of the Engineer.
- B. Insecticides shall be EPA registered and approved for use in public open spaces. All insecticides shall be handled by State licensed applicators only, delivered in the original

sealed manufacturer's containers, and used in accordance with the manufacturer's instructions.

- C. Insecticide use shall be limited and selective, only to control specific insect infestations, as identified by the Contractor or the Owner's Representative that may result in the disfigurement, decline, or death of plant materials.

#### 2.11 HERBICIDES:

- A. No herbicides shall be used on-site without the Contractor notifying and obtaining prior approval of the Engineer.
- B. Herbicides shall be EPA registered and approved for use in public open spaces. All herbicide shall be handled by State licensed applicators only, delivered in the original sealed manufacturer's containers, and used in accordance with the manufacturer's instructions.
- C. Herbicide for post-emergent application shall be glyphosate contact, 'Roundup', as manufactured by Monsanto, Inc., or approved equal.
- D. Herbicide use shall be limited and selective, only to control specific weed infestations that have been identified by the Contractor or the Owner's Representative.

#### 2.12 FUNGICIDES:

- A. No fungicides shall be used on-site without the Contractor notifying and obtaining prior approval of the Engineer.
- B. Fungicides shall be EPA registered and approved for use in public open spaces. All fungicides shall be handled by State licensed applicators only, delivered in the original sealed manufacturer's containers, and used in accordance with the manufacturer's instructions.
- C. Fungicide use shall be limited and selective, only to control specific fungal pathogenic disease infestations, as identified by the Contractor or the Owner's Representative, that may result in the disfigurement, decline, or death of plant materials.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION:

- A. All plants shall be subject to inspection and approval by the Engineer upon delivery to the site. No materials shall be planted until approval is received.
- B. All work shall be performed by skilled workers with a minimum of 2 years planting experience, in accordance with accepted horticultural/nursery practices, under the full-time supervision of a Certified Nurseryman or Arborist.
- C. All balled and burlapped plants that cannot be planted immediately upon delivery shall be set on the ground and the root balls shall be well protected with soil, wet moss, or

other acceptable material. All foliage shall be protected and covered with perforated shade materials.

- D. The planting season for evergreen trees and shrubs shall extend from the time the soil becomes workable in the spring until new growth appears, and from September 15 until November 30 in the fall. Deciduous trees and shrubs shall be planted only when dormant, either prior to bud break and/or before leaves appear in the spring, or subsequent to their leaf drop in the fall. Ground covers shall be planted only after the last frost in the spring through mid-May. Planting season periods may be extended if weather and soil conditions permit only with the written approval of the Engineer. Extended or out-of-season planting requirements shall include application of antitranspirant and extra water as needed. Plant guarantee periods shall remain as stated below. Planting shall not be permitted in frozen ground.
- E. All plant locations and outlines for planting beds shall be staked out for review and potential adjustment by the Engineer before any excavation is begun. In the event that rock, underground construction work or obstructions are encountered in any proposed planting pit or bed, the Engineer may select alternate locations. Where locations cannot be changed, the obstruction shall be removed, subject to the Engineer's approval, to a depth of not less than 3 feet below grade and not less than 6-inches below the bottom of the root ball when plant is properly set at the required grade. Removal of boulders or obstructions greater than 1 cubic yard in size shall be subject to approval and will be paid for by the Owner. No ledge will be removed to create planting pits or beds
- F. All planting pits shall be excavated with sloped walls, wider at the top than at the bottom, and scarified to eliminate glazing. Tree pits shall be at least 2 feet greater in diameter than the root ball of earth or root system. Shrub pits shall be at least 1 foot greater than the diameter of the root ball. Planting pits shall not be deeper than the height of the root ball.
- G. When excavation occurs in areas of heavily compacted earth, stones, concrete chunks or other foreign matter, pits shall be dug at least 3 times the width of the rootball. Excavated material from plant pits shall be disposed of as required.
- H. Container plants shall be removed from their growing container before planting. If roots are densely matted, the outer root mass shall be scored, sliced vertically, with a sharp knife to separate roots. All herbaceous plants and groundcovers shall be evenly spaced to produce a uniform effect and staggered in rows at intervals designated on the contract drawings.
- I. Shrubs and trees shall be set in the center of planting pits, plumb and straight, and at such a level that after settlement the crown of the roots will be 1-inch above the surrounding finished grade. Root ball masses shall not be loosened, broken or damaged. When balled and burlapped plants are set, planting mixture shall be compacted around bases of balls to fill all voids. All tying materials, twine and rope shall be cut and removed. Biodegradable burlap shall be laid back or cut away from the top half of the ball. If a wire basket is present, the upper 2/3 of the basket shall be cut away and removed. Do not remove the entire basket. Roots or bare root plants shall be

properly spread out and planting mixture carefully worked in among them. Broken or frayed roots shall be cleanly cut.

- J. Backfill plant pits with planting mixture in layers of not more than 9-inches and firmly tamp each layer and water to sufficiently settle the backfilled soil before the next layer is put in place. When the planting pit is 2/3 backfilled, the hole shall be flooded and watered thoroughly so that the water level reaches the top of the planting pit. Allow water to soak in, then complete the backfilling operation. Immediately after planting pit is backfilled, a shallow basin 3-inches deep and slightly larger than the pit shall be formed with a ridge of soil for water retention. Form a common basin for plant materials throughout mass planting beds. After planting, lightly till the soil in planting beds between planting pits and rake smooth to eliminate compaction of soils.
- K. All planting hole basins shall be flooded with water twice within the first 24 hours of planting, and watered not less than twice per week until final acceptance of the work.
- L. All thin barked deciduous trees shall be wrapped after they are planted and before they are staked. Prior to wrapping, inspect trees for injury to trunks or improper pruning. Take corrective measures as necessary. Wrap trunks of all trees spirally from bottom to top with tree wrap and secure top and bottom at 2-foot intervals with jute twine. The wrapping shall overlap and entirely cover the trunk from the ground to the height of the second branches and shall be neat and snug. Overlap shall be approximately 2-inches.
- M. Stake trees immediately after planting as detailed. All staking apparatus shall be adequate to hold the tree in a vertical position under severe weather conditions. All staking apparatus and tree trunk wrapping shall be removed and disposed of off-site by the Contractor at the end of one growing season.
- N. Immediately after planting and staking operations are complete, all plant pit basins and plant beds shall be covered with approved mulch to the depths designated on the plans. Mulch shall not contact tree bark, cover tree root flares, or shrub crowns. No mulch shall be applied prior to the first watering.
- O. The pruning of trees and shrubs shall only be permitted to remove dead or dying branch limbs and tips, sucker growth, water sprouts, crossing or rubbing branches, broken or damaged branches, diseased or insect infested limbs, and to preserve the natural character of the plant. Plant materials shall be pruned in accordance with American Nurserymen Association Standards and as required by the Engineer. Questionable weak limbs and branch removals that may disfigure the plant shall be left to the discretion of the Engineer. The tree leader shall never be permitted to be cut. Pruning shall be done with clean, sharp tools. All large pruning cuts that are 1/2-inch in diameter or larger shall be made along the bark branch ridge. Pruning cuts shall not breach or otherwise interfere with the branch collar. All pruning cuts less than 1/4-inch diameter shall be made with hand pruners as close to the main stem as possible without damaging the cambium or bud. Tree paint shall not be used to cover pruning cuts.
- P. As the work proceeds, the Contractor shall remove all debris from the site, including but not limited to branches, rock, paper, and rubbish. All areas shall be kept clean, neat and

in an orderly condition at all times. Prior to final acceptance, the Contractor shall cleanup the entire area to the satisfaction of the Engineer.

### 3.2 MAINTENANCE:

- A. Maintenance shall begin immediately after each plant is planted and shall continue until completion of the guarantee period and final acceptance of the project. Plants shall be watered, pruned, sprayed, fertilized, cultivated and otherwise maintained and protected. Tree guys and stakes shall be tightened and repaired. Defective work shall be corrected as soon as possible after it becomes apparent and weather and season permit.
- B. Settled plants shall be reset to proper grade and position, planting pits and common basins restored, and dead materials removed and replaced. Planting beds and individual basins shall be neat in appearance, maintained to their original layout lines and kept free of weeds. Mulch shall be replaced as required to maintain proper depths.
- C. Contractor shall make arrangements to provide sufficient water to maintain all trees, shrubs and plant materials until final acceptance. Plants shall be sprayed with anti-transpirant or anti-desiccant if required by seasonal conditions or as required by the Engineer.
- D. Planting areas shall be protected against trespass and damage of any kind during the maintenance period. This shall include the furnishing and installation of approved temporary fencing if necessary. If any plants become damaged during the maintenance period, they shall be treated or replaced as required by the Engineer at no additional cost to the Owner.

### 3.3 INSPECTION AND PRELIMINARY ACCEPTANCE:

- A. Contractor shall provide written notice to the Engineer not less than 10 days before the anticipated date of inspection for preliminary acceptance. The Engineer shall recommend preliminary acceptance of the work of this Section only after completion and re-inspection of all necessary repairs, renewals or replacements.
- B. Inspection and acceptance of plantings may be requested and granted in part, provided the areas for which acceptance is requested are relatively substantial in size, and with

clearly definable boundaries. Acceptance and use of these areas by the Owner shall not waive any other provisions of this Contract.

#### 3.4 GUARANTEE:

- A. All plant materials shall be guaranteed for a period of one year after the date of completion of the specified maintenance period and preliminary acceptance of the project by the Owner.
- B. When the work is accepted in part, the guarantee period shall extend from each partial acceptance to the terminal date of the last guarantee period. All guarantee periods terminate at one time.
- C. Plants shall be healthy, free of pests and disease. Plants shall exhibit vigorous growth, shall bear foliage of normal density, size and color and shall have no less than seventy-five percent (75%) of their branches alive at the end of the guarantee period. If the leader of any single-leader species is dead, the entire plant shall be considered dead.
- D. Any plant required under this Contract that is dead or unsatisfactory, as determined by the Engineer, shall be removed from the site. These shall be replaced as soon as weather permits during the specified planting season, at no additional cost to the Owner, until the plants live through one year.
- E. All replacements shall be plants of the same kind and size as specified on the Plant List. They shall be furnished and planted as specified above.
- F. The guarantee of all replacement plants shall extend for an additional one-year period from the date of their acceptance as replacement.
- G. Guarantee shall not apply to the replacement of unacceptable plants resulting from the removal, loss, or damage due to occupancy of the project in any part; vandalism or acts

of neglect on the part of others; physical damage by animals, vehicles, etc.; and Acts of God, including but not limited to, catastrophic fire, hurricanes, riots, war, etc.

- H. In the instance of curtailment of water by local water authorities (when supply was to be furnished by the Owner), the Contractor shall furnish all necessary water by water tanker, the cost of which will be approved and paid for by the Owner.

3.5 FINAL INSPECTION AND FINAL ACCEPTANCE:

- A. At the end of the guarantee period, the Contractor shall provide written notice to the Engineer not less than 10 days before the anticipated date of final inspection for final acceptance.
- B. The Engineer shall recommend final acceptance of the work of this Section only after completion and re-inspection of all necessary repairs, renewals or replacements.

END OF SECTION 329300





## **SECTION 334000**

### **STORM SEWER SYSTEMS**

#### **PART 1 – GENERAL**

- 1.1 Applicable provisions of the Contract, General Clauses and General Specifications govern work under this section.
- 1.2 **WORK INCLUDED:** Construction of new catch basins, drywells, inline drains, drain basins, storm sewer piping, and appurtenances. Provide temporary means of conveyance for all existing disrupted systems until new systems are operational.
- 1.3 The Contractor shall submit drawings for the Engineer's review of each precast catch basin, drywell, and pipe which he proposes to furnish.
- 1.4 **RELATED SECTIONS**
  - Section 31 23 00: Earthwork.
  - Section 31 23 16: Trenching, Backfilling and Compaction.
  - Section 32 10 00: Roadway and Miscellaneous Surface Subbase.

#### **PART 2 - PRODUCTS**

- 2.1 **CATCH BASINS:** Shall be precast concrete having a 28-day compressive strength of 4,000 psi, minimum 5% air entrainment, and reinforcing steel meeting ASTM A615-A497. They shall be designed for AASHTO H-20 loading, as manufactured by Fort Miller Company, or an approved equivalent. Pipe connections shall be accomplished with masonry cement (knockouts are not acceptable). (Sizes as indicated on Plans.)
- 2.2 **PLASTIC CATCH BASINS/DRAINAGE BASINS:** Inline drain/drain basin designed for AASHTO H20 loading, with cast iron grate, as manufactured by Nyloplast America, Inc. or equivalent. Grates shall be lockable. Basin sizes per Plans.
- 2.3 **STEPS:** Where depth of catch basin is greater than 2 feet, MA Industries PS-2-PF Polypropylene or Alcoa #16027B or equivalent aluminum steps shall be provided 12 inches on center.
- 2.4 **CATCH BASIN INSIDE DIMENSIONS:** As shown on Plans.
- 2.5 **CONCRETE BRICK:** Shall meet New York State Department of Transportation Specification 704.02, Concrete Brick.
- 2.6 **MORTAR:** Shall meet New York State Department of Transportation Specification 705.21, Mortar for Concrete Masonry.
- 2.7 **BACKFILL MATERIALS:** See Section 31 23 16 - Trenching, Backfilling and Compaction, and the Contract Drawings.
- 2.8 **GRADE ADJUSTMENT:** Solid concrete brick or concrete grade rings.

2.9 FRAME AND GRATES: As shown on plans.

2.10 SMOOTH INTERIOR CORRUGATED POLYETHYLENE STORM SEWER PIPE: This specification applies to high density polyethylene (HDPE) corrugated pipe with an integrally formed smooth interior. Pipe products must be NYSDOT approved and be included on their list of approved manufacturers. Eight and 10-inch diameter pipes shall conform to the strength requirements of AASHTO M252 with the addition that the pipe have a smooth interior liner. Twelve to thirty-six-inch diameter pipe shall conform to AASHTO M294 Type S. Pipe shall be perforated in specific locations where indicated on the plans.

Pipe shall be Type HI-Q as manufactured by Hancor, Inc., Type N-12 as manufactured by Advanced Drainage Systems, Inc., or approved equivalent.

The pipe and fittings shall be free of foreign inclusions and visible defects. The ends of the pipe shall be cut squarely and cleanly so as not to adversely affect joining.

The nominal size for the pipe and fittings is based on the nominal inside diameter of the pipe. Corrugated fittings may be either molded or fabricated by the manufacturer.

Fittings produced by manufacturers other than the supplier of the pipe shall not be permitted without the approval of the Engineer.

Joints shall be made with manufacturer's integral-bell system, split couplings or sleeve type couplers, corrugated to match the pipe corrugations, and shall engage a minimum of 6 corrugations for 12" and 24" diameter and 4 corrugations for 30" and 36" diameter pipe. The coupler shall be fabricated by the pipe manufacturer to ensure compatibility.

2.11 FLARED END SECTION: Prefabricated, galvanized steel end sections complying with NYSDOT Specification 707-10, as manufactured by Lane Enterprises, Inc.

### PART 3 - EXECUTION

3.1 Precast catch basin and inline drains shall be located as indicated on contract plans and as specified. Proposed locations shall be excavated to a depth as indicated on plans. Catch basins shall then be placed on a subbase per the plans and Section 31 23 16.

3.2 A minimum of one course of concrete brick or concrete grade ring shall be placed and mortared between the frame and top of catch basin.

3.3 The frame and grate shall be properly positioned and mortared to the top of the concrete bricks/grade rings as required.

3.4 Adjust existing catch basins to the new grade as required. Replace top sections if required or install extension sections of precast concrete compatible with the existing structure.

3.5 All joints shall be as above specified and shall be installed in complete accordance with the requirements of the manufacturer. Joints shall be watertight.

3.6 If any defective or damaged pipe or jointing assembly is discovered after being installed, it shall be removed, corrected and replaced. All expense resulting from defective or

damaged pipe or jointing assemblies shall be borne by the Contractor.

- 3.7 All pipes and jointing assemblies shall be cleaned before they are laid, and shall be kept clean until they are inspected and accepted with the completed work. Open ends of pipe shall be kept properly plugged to prevent entrance of dirt, debris and water. Unless otherwise directed, pipe shall be laid uphill, without any break in the line from manhole to manhole. When not laying pipe, the end of the line shall be kept properly closed, so as to prevent entrance of all dirt and water.
- 3.8 Pipe bedding will be required for all storm sewer lines, where excavation of rock is encountered, where pieces of concrete or masonry or other debris is encountered, or where the subgrade is found to be unstable or to include ashes, cinders, refuse, organic material or other unsuitable material.
- 3.9 The Contractor will establish line and grade for the construction of all storm sewers by staking the location of each manhole and/or catch basin and/or drywell providing elevations (based upon contract datum) at each drainage structure. The Contractor shall work from such points and shall be responsible for all measurements necessary to establish such supplementary lines and grades that are required in order for him to install the storm sewers on the lines and at the grades shown on the drawings, or as modified at the request of the Engineer to meet changed conditions or as a result of modifications to the work covered by the contract.  
The Contractor shall furnish, at his own expense, such stakes and other required equipment, tools and materials, and all labor that may be required in laying out the work as described above.
- 3.10 Trenches in which various pipes are to be constructed shall be excavated in open cut from the surface, unless otherwise directed in writing, and in all cases in such manner and to such depths and widths that will give suitable room for building of the structure it is to contain and for removing from the trench or other excavation any material which the Engineer may deem not proper for foundation. For storm sewer lines, the maximum width of trench at the top of the pipe shall comply with specified limitations and details shown on the plans.
- 3.11 In all pipe trenches, suitable backfill materials, as called out on the plans, shall be filled in around the pipe as shown on the plans. This fill shall be brought up evenly on both sides of the pipe in 8 inch maximum layers. Each layer shall be tamped and thoroughly consolidated to provide proper support and bearing for the pipe, and so as not to disturb the line and grade of the pipe. The backfill of the trench above this point over the top of the pipe shall be as specified hereafter and/or as shown on the plans.
- 3.12 The length of the trench to be opened or the area of the surface to be disturbed or unrestored at any one time shall be limited with regard to expeditious construction and to the convenience and comfort of the persons residing in the neighborhood or frequenting the project area in question.  
  
New trenching will not be permitted when earlier trenches need backfilling or labor is needed to restore the surfaces of streets or sidewalks to a safe and proper condition.
- 3.13 First class bedding which will provide a load factor of 1.9 will be required for the installation of sewer pipe lines. This may be accomplished by either of the following methods:

- A. By so-called shaped bedding with tamped backfill. The bottom of the trench excavation shall be shaped to conform to a cylindrical surface with radius at least 2 inches greater than the radius of the outside diameter of the pipe and for a width sufficient to allow six-tenths of the width of the pipe barrel to be bedded in pipe bedding placed in the shaped excavation.

Carefully compacted backfill shall be placed at the sides of the pipe and to a depth above the top of the pipe as shown on the plans.

- B. Compacted bedding with tamped material placed on a flat trench bottom. Granular material shall be as called out on plans and in Section 31 23 16, with minimum bedding depth of 4 inches or one-fourth the outside pipe diameter, whichever is greater, and shall extend half way up the pipe barrel of the sides. The remainder of the side walls and a minimum depth over the top of the pipe as shown on the plans shall be backfilled with carefully compacted selected materials.

- 3.14 All excavated and other materials shall be so placed as not to endanger the work, and so that free access may be had at any time to all parts of the trench and to all structures and pipes in the vicinity, and shall be kept neatly piled, so as to inconvenience as little as possible public travel or the adjoining tenants. All fences and other structures in the vicinity of the work shall be protected and, if injured, shall be repaired or replaced. All trees in the vicinity of the work shall be protected in a satisfactory manner.

- 3.15 The Contractor shall provide and maintain at his expense ample means and equipment such as pumps, well point systems, drains, and sumps for dewatering and properly disposing of water entering the trenches and other parts of the work. The excavation shall be maintained in a dry condition and no foundation materials, pipe or concrete shall be placed in the water. Dewatering shall be done in an approved manner such that the subgrade can be trimmed, foundation materials, pipe or concrete placed in the dry, without disturbing bearing materials, and water from the excavation shall be disposed of in such manner that it will cause no injury to property or inconvenience to the public.

Whenever high water tables are encountered and where subgrade consists of soils such as fine silty sands, which are easily disturbed by flowing water, uplift pressures shall be relieved by well points extending as far below the base of the trench as necessary. For subgrades of non-plastic silt or silty fine sand, the groundwater shall be drawn down to a level at least two feet below the final invert grade of the pipe by well points or other approved means.

Care should be taken to shut down dewatering equipment slowly to avoid uplift and softening of the materials supporting the pipe and appurtenances.

- 3.16 Care must be taken not to move any sewers, drains, culverts, water, gas or other pipes or poles or other structures, and in crossing such pipes or structures, or in running parallel with or near them; they shall be securely hung, braced and supported in place until the work is completed. Whenever it is necessary to interfere with said structures, the Contractor, at his own expense, shall maintain their respective services, and if necessary for that purpose, shall lay temporary water, gas or other pipes, or other structures. The Contractor shall repair all damage done to any of said structures through his acts or neglect, and shall keep them in repair until one year after the completion of the work. He shall leave them in as good condition as they were previous to the commencement of the work.

- 3.17 In case of a gas, water or other pipe becoming broken in the prosecution of the work, the Contractor shall give immediate notice to the proper authorities, and shall be responsible for any damage to persons or property caused by such breaks, and failure to give prompt notice to the authorities shall make the Contractor responsible for any needless loss of water or gas.
- 3.18 The trench and other excavations above pipe grade shall be carefully refilled as soon as possible after construction of the pipe line or related structure. No portion of a trench or other excavation shall be backfilled until the structure contained in it has been examined and approved. When, for any reason the work is left unfinished, all trenches and other excavations shall be filled, and the roadways and sidewalks left unobstructed, with their surface in a safe and satisfactory condition. In unpaved areas, the backfill above the pipe shall be carefully consolidated, in order to prevent settlement. The trench shall be tamped sufficiently to prevent any settlement of or damage to adjacent structures.
- 3.19 No rock or frozen earth over 10 inches in diameter shall be put in the trench until the refilling has reached at least 2 feet above the top of the pipe lines, and then not unless specifically permitted. All spaces between suitable pieces of rock shall be thoroughly filled with earth by backfilling with alternate layers of rock and earth.
- 3.20 PIPE-TO-CATCH BASIN CONNECTION: Pipe connections to catch basin shall be mortared into the catch basin with masonry cement. Care shall be taken with a method satisfactory to the Engineer when making holes in existing catch basins to maintain the integrity of the catch basin. The end of all inlet and outlet pipes in concrete storm structures within NYSDOT right-of-ways shall be flush with the inside wall. Outside of NYSDOT right-of-way, inlet pipes may project inside basins as shown on plans. Discharge pipe ends shall be flush with inside wall. All connections shall be watertight. Knockouts are not acceptable.
- 3.21 Installation shall be in accordance with ASTM Recommended Practice D-2321. When within New York State right-of-way, installation shall conform to NYSDOT Specifications 206 and 18603.9801XX and the NYSDOT standard sheets.
- 3.22 Do not enter or disturb on-site wetlands while performing work under this section and contract, unless otherwise ordered.
- 3.23 FIELD QUALITY CONTROL
- A. Clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed.
1. In large, accessible piping, brushes and brooms may be used for cleaning.
  2. Place plug in end of incomplete piping at end of day and when work stops.
  3. Flush piping between manholes and other structures to remove collected debris, if required by authorities having jurisdiction.
- B. The Contractor shall at all times provide the means necessary to prevent damage to structures, piping, etc., during all phases of construction. Any damage caused during construction shall be replaced, to the satisfaction of the Engineer, at no cost to the Owner.

END OF SECTION 334000



## **SECTION 334626**

### **GEOTEXTILE FABRICS**

#### **PART 1 – GENERAL**

##### **1.1 RELATED WORK**

Section 02 10 00: Tree Protection and Trimming.  
Section 31 22 13: Rough Grading.  
Section 31 23 00: Earthwork.  
Section 31 25 00: Sediment and Erosion Control.

##### **1.2 SUBMITTALS**

- A. Product Data: Manufacturer's catalog sheets, specifications, and installation instructions for each item specified.
- B. Samples: 12 inch x 12 inch sample of prefabricated drainage panel.

#### **PART 2 - PRODUCTS**

##### **2.1 MATERIALS**

- A. Prefabricated Drainage Panel; Any of the Following:
  - 1. MIRADRAIN 6000 by Nicolon/Mirafi Group
  - 2. J-Drain 300 Composite Drainage System by JDR Enterprises, Inc.
  - 3. Hydraway 300 by Monsanto
  - 4. Or approved equivalent
- B. Geotextile Woven Polypropylene Reinforcement Fabric:
  - 1. Amoco 2006 by Amoco Fabrics and Fibers Co.
  - 2. Mirafi 500x by Nicolon/Mirafi Group
  - 3. Or approved equivalent
- C. Geotextile Filter Fabric:
  - 1. Amoco 4545 by Amoco Fabrics and Fibers Co.
  - 2. Or approved equivalent

#### **PART 3 - EXECUTION**

##### **3.1 PROTECTION**

- A. Protect prefabricated drainage panel from sunlight during transportation and storage.

### 3.2 INSTALLATION

- A. Install the Work of this Section in accordance with the manufacturer's printed instructions.

END OF SECTION 334626