

PROJECT SPECIFICATIONS / MANUAL

Volume 4

Rye City School District

Milton Elementary School

10 Hewlett St
Rye, NY 10580

SED Number: #66-18-00-01-0-002-015

Issued for Bid: 2021-01-19

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Rye City Schools**Milton Elementary School****10 Hewlett Street, Rye, NY 10580**

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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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CIVIL

C2-100 EXISTING SURVEY

CONSTRUCTION IMPLEMENTATION

CIP-01 CONSTRUCTION IMPLEMENTATION PLAN – GENERAL NOTES & MILESTONE SCHEDULES

CIP-02 CONSTRUCTION IMPLEMENTATION PLAN – SITE BASE & STAGING

CIP-03 CONSTRUCTION IMPLEMENTATION PLAN – GROUND FLOOR PLAN AND PARTIAL FIRST FLOOR PLAN

CIP-04 CONSTRUCTION IMPLEMENTATION PLAN – FIRST FLOOR PLAN

CIP-05 CONSTRUCTION IMPLEMENTATION PLAN – SECOND FLOOR PLAN AND ROOF PLAN

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X2-101 GROUND FLOOR CODE COMPLIANCE PLAN

X2-102 FIRST FLOOR CODE COMPLIANCE PLAN

X2-120 LIBRARY LIFE SAFETY PLAN

MIL-ASB-101 GROUND FLOOR ASBESTOS ABATEMENT

MIL-ASB-102 ROOF FLOOR ASBESTOS ABATEMENT

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D2-120 LIBRARY DEMOLITION PLAN

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A2-502	SECURE ENTRY AND LOBBY ELEVATIONS
A2-601	DOOR & WINDOW TYPES & SCHEDULES
A2-602	CURTAIN WALL AND ENTRANCE DETAILS
A2-700	FINISH SCHEDULE AND LEGEND
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HEATING VENTILATION AND AIR CONDITIONING

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END OF SECTION 000115

SECTION 020800 – ASBESTOS ABATEMENT

AT: RYE CITY SCHOOL DISTRICT
MILTON ELEMENTARY SCHOOL
SED# 6618-0001-0002-015

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*** ☐ ***Milton Elementary 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. In the case of floor covering removal(s), the substrate(s) shall be washed with a neutralizing agent subsequent to final air clearances 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/NYSDOL 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
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

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 (DOSHS-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 20899
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 (cummingtonite-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 Respiratory Protection</u>	<u>Maximum Use Concentration</u>
Half-Mask Air Purifying with HEPA Filters	10x PEL
Full-Facepiece Air Purifying HEPA Filters and Quantitative Fit Test	10x PEL
Powered Air Purifying (PAPR), Loose fitting Helmet or Hood, HEPA Filter	25x PEL
Powered Air Purifying (PAPR), Full Facepiece, HEPA Filter	50x PEL
Supplied Air, Continuous Flow Loose fitting Helmet or Hood	25x PEL
Supplied Air, Continuous Flow Full Facepiece, HEPA Filter	50x PEL
Full Facepiece-Supplied Air Pressure Demand, HEPA Filter	100x PEL
Full Facepiece-Supplied Air Pressure Demand, with Aux. SCBA,	>100x PEL

Pressure Demand or Continuous Flow

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 CRF 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) MILTON ELEMENTARY SCHOOL – INTERIOR ABATEMENTS

- The mechanical room contains two (2) boilers with PACM interior materials. Prior to any removals or disturbance, the Mechanical Contactor is responsible for opening both units to allow for bulk sampling by the Owner’s consultant. Boiler room and boiler access shall be coordinated with the Owner and the Owner’s Consultant.
 - If ACM is present, the Abatement Contractor is responsible for complete & total removal and disposal of two (2) boilers located in the mechanical room. Each boiler contains approximately 200 SF of friable presumed asbestos-containing (PACM) gaskets, insulation, cementitious plates, etc. 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 drawing for locations. Refer to drawing H2-204 “Boiler Room Plans and Detail” for removal details and locations.
 - If ACM is not present, abatement is not required.

2) MILTON ELEMENTARY SCHOOL – EXTERIOR ABATEMENTS

- Abatement Contractor is responsible for complete & total removal and disposal of term bars (approximately 150 LF), bricks (approximately 300 SF) and associated sealants (approximately 150 LF), flashing tars, and asphalt cement (approximately 300 SF) on the southeast and southwest crickets of the Library Roof (Roof Areas L & M). Refer to attached ACM location drawings for removal locations. Refer to drawing A2-112 for removal details. All material removals shall be coordinated with the Owner and roofer. All masonry removals shall be coordinated with the mason. Mechanical removal of bricks containing ACM tars/coatings/sealants in which the ACM is disturbed by the mechanical methods requires the use of a NYSDOL-approved variance submitted by the Owner’s Consultant.

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 – Milton Elementary 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 – Milton Elementary 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.

*** 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.

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* ☐ *Milton Elementary School*
- *MIL ASB-101* ☐ *Milton Elementary School* ☐ *Ground Floor Asbestos Abatement*
- *MIL ASB-102* ☐ *Milton Elementary School* ☐ *Roof & Exterior Asbestos Abatement*

**END OF SPECIFICATION
SECTION 020800**

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. Predemolition 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
MILTON ELEMENTARY SCHOOL
SED# 6618-0001-0002-015

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.:

MILTON ELEMENTARY SCHOOL - INTERIORS

- First Floor, Library Hallway Entrance from Stairs – White Wood Door Casing

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 concentrations in paint for the purposes 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.

MILTON ELEMENTARY 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 concentrations in paint for the purposes 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 I** 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 an 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 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/m³ - 500 ug/m³)

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.
 - b. The Owner's Consultant shall perform Dust and/or Soil Sampling 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/m³ - 500 ug/m³)

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 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 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-oz 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 Par 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** projects, as detailed within Section 1.2 of this specification.

EPA Lead Risk Assessor, Louis N. Johnson III, of **QuES&T**, performed visual assessment(s) and representative sampling in February of 2019. Existing documentation and/or information attained within inspection(s) and/or sampling activities conducted prior to the inspection date 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 in order 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/cm²

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:

MILTON ELEMENTARY SCHOOL - INTERIORS

- First Floor, Library Hallway Entrance from Stairs – White Wood Door Casing

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 concentrations in paint for the purposes 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.

MILTON ELEMENTARY 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 concentrations in paint for the purposes 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 033000

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 masonry where new cap flashings are being installed.

- B. Related Requirements

- | | |
|---------------------------------------|--------------------|
| 1. Carpentry | - Section 06 10 00 |
| 2. Asphalt Shingles | - Section 07 31 13 |
| 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 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. Bricks: four samples of solid colors, twelve samples of blended colors.
 - b. Mortar: four 6 inch long 1/2 inch wide strips set in metal or plastic channels.
 - c. Anchors: four pieces 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 brick rebuilding - provide 4 foot long mockups.
- 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 guaranties 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. Face Brick: Severe weather (SW) grade face brick and accessories, including special bricks for corners, and other special conditions, to match the color, surface texture, shape and size of existing bricks.

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, graduation 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. 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 BRICK REMOVAL AND REPLACEMENT

- A. Simultaneously remove only limited sections of existing brick masonry; support and protect masonry remaining next to and above the removal areas.
- B. Carefully remove bricks on a piece-by-piece basis. Cut out full units from joint to joint and to permit replacement with full size units. Clean the edges of the remaining bricks, 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 bricks. Install the flashings so a full wythe of new brick will fit flush with the existing wall surface.
- D. Wet bricks which have initial rates of absorption (suction) greater than 30 grams per 30 square inches per minute, (in accordance with ASTM C 67), to ensure the bricks are nearly saturated with water, but surface dry when laid.
- E. Install new brick to replace removed brick. Fit replacement bricks to match the original bond and course pattern. Use a motor driven diamond blade wet saw to cut bricks with clean, sharp unchipped edges.
- F. Lay replacement brick with completely filled bed, head and collar joints. Butter the ends with sufficient mortar to fill the head joints and shove the bricks into place.
- G. Install new bricks with mortar joints to match the width of the adjoining brick joints. Tool the new joints to match existing joints in surrounding brickwork.
- H. Do not cut off the backs of the new bricks if a full wythe of brick doesn't fit. Notify the Architect and obtain his direction before proceeding further.

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 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 04 01 00

SECTION 042000
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 051200

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. Provide metal fabrications and miscellaneous metals as indicated on the Drawings and as specified herein, including, but not limited to the following:
 - 1. Supports, miscellaneous hangers and accessories
 - 2. Lintels (Exterior)

1.3 DESIGN REQUIREMENTS

- A. Structural Performance: Fabricate, and install metal fabrications to withstand not less than structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections as per the Building Code.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, installation instructions, use limitations and recommendations for each material used.
- B. Shop Drawings, for each item specified.
 - 1. Show all locations, markings, quantities, materials, sizes and shapes.
 - 2. Indicate all methods of connecting, anchoring, fastening, bracing and attaching to work of other trades.
- C. Calculations
 - 1. Where metal fabrications are required to comply with certain design loadings, submit calculations, materials properties, and other information needed signed and sealed by the NYS licensed Professional Engineer.

1.5 QUALITY ASSURANCE

- A. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code – Steel".
- B. Hot-Dip Galvanizer: The company or individual responsible for application of

hot dip galvanizing with a powder coat finish shall be certified by American Galvanizers Association as a Master Galvanizer

1.6 PROJECT CONDITIONS

- A. Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit, by accurate field measurements before fabrication. Coordinate fabrication schedule with construction progress and work of other trades to avoid delay of work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Metals
 - 1. Metal Surfaces, General: For metal fabrications exposed to view, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, or variations in flatness exceeding those permitted by reference standards for stretcher-leveled sheet.
 - 2. Ferrous Metals
 - a. Steel Plates, Shapes, and Bars: ASTM A36
 - b. Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.
 - c. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for the metal alloy to be welded.
- B. Grout and Anchoring Cement
 - 1. Nonshrink Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, non-gaseous grout complying with Federal Specification CE CRD-C 621. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this section.
 - “Euco N-S Grout”, Euclid Chemical Co.
 - “Crystex”, L & M Construction Chemicals, Inc.
 - “Masterflow 713”, Master Builders
 - “Sonogrout”, Sonneborn Div., Rexnord Chemical Products, Inc.
 - “Five Star Grout”, U.S. Grout Corp.
- C. Fasteners
 - 1. General: Provide galvanized or type 304/316 SS fasteners for exterior use or where built into exterior walls. Select fasteners for the type, grade, and class required.
 - 2. Bolts and Nuts: Regular hexagon head type, ASTM A307, Grade A
 - 3. Lag Bolts: Square head type, ANSI B18.2.1

4. Machine Screws: Cadmium plated steel, FS FF-S-92C
5. Drilled-In Expansion Anchors: Anchors installed in concrete shall have current ICC-ES listing for performance in cracked concrete as per Section BC 1912.
6. Toggle Bolts: Tumble-wing type, type, class, and style as required.
7. Lock Washers: Helical spring type carbon steel, FS FF-W-84A
8. Vandal resistant fasteners: Torx with pin, or as otherwise indicated. Corrosion resistant.

D. Paint

1. Shop Primer, interior Work: Acrylic rust-inhibitive type containing no lead equal to Tnemec 115 Unibond or Carboline Carbocrylic 3358. Paint must meet SCAQMD standards for VOC emissions.

E. Galvanizing

1. Galvanize structural shapes in accordance with ASTM 123.
2. Galvanize hardware in accordance with ASTM A153.
3. Galvanizing repair paint for regalvanizing welds and damaged areas shall conform to ASTM A780 and comply with Military Specification MIL-P-21035B, such as ZRC Cold Galvanizing Compound.
4. Galvanizing repair paint for regalvanizing welds and damaged areas shall conform to ASTM A780 and comply with Military Specification MIL-P-21035B, such as ZRC Cold Galvanizing Compound.

2.2 FABRICATIONS

A. General

1. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.
2. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
3. Allow for thermal movement resulting from the following maximum change (range) in ambient temperature to prevent buckling, opening up of joints, and overstressing of welds and fasteners.

Temperature Change (Range): 180°F

4. Shear and punch metals cleanly and accurately. Remove burrs.
5. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
6. Weld corners and seams continuously to comply with AWS recommendations.
7. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type

indicated or, if not indicated, Phillips flathead (countersunk) screws or bolts. Locate joints where least conspicuous.

8. Provide for anchorage of type required; coordinate with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.

C. Supports, Miscellaneous Hangers and Accessories

1. Provide bolts, stud bolts, for all proprietary bolts and fasteners for the support of apparatus and other items as indicated on the Drawings. Secure to steel beams or concrete floor slabs above. Where exposed to view in interior, provide finish paint in addition to shop paint.

D. Lintels (Exterior)

1. Furnish to mason at the proper time for setting all steel lintels in exterior walls.
2. All lintels in exterior walls shall be galvanized. Bolts connecting lintels to the galvanized wedge inserts shall be galvanized in accordance with ASTM A153. Lintels exposed to view shall also be finish painted with powder coating or epoxy coating system.

E. Miscellaneous

1. Provide all other miscellaneous metal work. All Work to be embedded in concrete or masonry work or in connection with bolts, anchors, and inserts shall be furnished at the proper time for setting. Those items exposed to the elements or located in exterior walls or roof shall be galvanized. Where exposed to view, also provide finish paint as specified herein with powder coating or epoxy coating system. Interior items shall be shop and finish painted.

2.4 PAINTING

- A. All miscellaneous ferrous metal work, except those members to be galvanized, shall be given one shop coat of paint before leaving the shop. For those items to be zinc metallized or hot dip galvanized and finish painted, apply coatings in the shop as specified herein.

B. Cleaning and Surface Preparation

1. Clean all steel first in accordance with SSPC-SP1.
2. Clean steelwork not to be painted (except steel work to be galvanized) in accordance with SSPC-SP2.
3. Clean steelwork to be painted within the same day as it will be applied and in accordance with the following methods, determined by location and exposure:
 - a. Interior steel not exposed to view: SSPC-SP2.
 - b. Interior steel exposed to view: SSPC-SP3.
 - c. Cavity wall and exterior steel exposed to weather: SSPC-SP6.

C. Shop Coat

1. Apply steel primer paint (general application) at a rate to provide dry film thickness of 2.0 to 3.5 mils. Apply primer paint (cavity wall and exterior application) at a rate to provide dry film thickness of 4.0 to 6.0 mils. Provide full coverage of joints, corners, edges, and exposed surfaces.
2. Apply to dry surfaces only, when surface temperatures are above dew-point, by brush, spray, or roller, thoroughly and evenly, in strict accord with manufacturer's instructions for every detail of handling.
3. Apply second coat of the approved primer, in a darker shade, to surfaces inaccessible to painting after assembly or erection.
4. Protect machined surfaces with an approved rust-inhibiting coating that is readily removable prior to erection.

2.5 GALVANIZING AND FINISH COATING

A. General: Galvanize the following Work

1. All angles and other steel items located in exterior wall or roof construction
2. All angles supporting exterior masonry or exposed to the weather.
3. All steel members and fabrications exposed to the exterior.
4. All other steel members and fabrications indicated as galvanized on the Drawings and Specifications.

B. Zinc Metallizing-Finish Coating Applicators:

1. Atlantic Coast Metallizing & Coatings Corp., Melville, NY
2. Avant Guards Manufacturing, Brooklyn, NY
3. East Coast Metallizing & Coating Systems Inc., Westbury, NY
4. Island Wide Sandblasting Inc., Wyandanch, NY
5. Reneuxit LLC, West Chester, PA

C. Hot Dip Galvanizing with Powder Coating Finish

1. Duncan Galvanizing Corp, Everett, MA

D. Powder Coating Materials

1. Tiger Drylac, Series 38 Super Durable Powder Coating.
2. PPG Industries, Corafon Ultradurable Powder Coating.
3. Sherwin-Williams; Powdura Super Durable Powder Coatings Series.

E. Shop Coat - Hot-dip Galvanizing –as required for galvanized items not indicated to receive finish paint coat.

1. Galvanize hardware in accordance with ASTM A153.
2. Galvanize steel shapes in accordance with ASTM A123. Apply zinc coating as per Thickness Grade specified in ASTM A123.

F. Shop Coat – Galvanizing by the Zinc Metallizing Process – Provide for all galvanized items indicated to receive finish paint, which includes all galvanized items exposed to public view, including lintels, and other items shown on

Drawings or specified herein. Finish paint shall be the epoxy coat system or the powder coat system; producing a smooth, uniform surface, free of bubbles, runs, or sags. Hot Dip Galvanizing with powder coat finish is also permitted.

1. Thermally spray metallizing material at a rate of 4.0 to 6.0 mils DFT. Sprayed coating shall be free of lumps, blisters, and loosely adhering particles. Coating shall be capable of passing the inspection requirements of Mil Std 2138A(SH) of 5/13/92, but with adhesion 750 psi minimum per ASTM D4541, Test Method E.
2. Epoxy Coating System: After the metallizing material has cured, apply a first coat of paint at a rate of 4.0 to 6.0 mils DFT, Polyamide Epoxy Paint such as Tnemec Series 27 FC Typoxy. Top coat shall be Acrylic Aliphatic Polyurethane such as Tnemec Series 73 Endura-Shield, applied at a rate of 2.0 to 3.0 Mils DFT.
3. Powder Coating System: After the metallizing material has cured, properly prepare the item and apply Tiger Drylac Series 38 Super Durable Powder Coating; or PPG Industries Corafon Ultradurable Powder Coating; or Sherwin-Williams Powdura Super Durable Powder Coatings Series system.
 - a. Oven bake item for 20 minutes at 450°F, and remove all oil and grease. Cool surface to 72°F, clean with an organic solvent. Apply paint within 3 hours of final cleaning.
 - b. Apply an out-gas-forgiving primer at the rate of 2-3 mils DFT. Oven cure material at 400°F for 10 minutes.
 - c. In order to avoid oxidation, final topcoat must be applied within 12 hours.
 - d. Apply a lead-free TGIC polyester powder topcoat finish at a rate of 4.0 to 5.0 mils DFT.
 - e. Oven cure as recommended by coating manufacturer.

PART 3 - EXECUTION

3.1 ERECTION/INSTALLATION

- A. Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction; including, threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required.
 1. Provide inserts, setting plates, and other items of concealed work required for attachment of metal fabrications in a timely manner to facilitate on-going construction.
- B. Perform cutting, drilling, and fitting required for installation of metal fabrications. Set work accurately in location, alignment, and elevation, plumb, level, true, and free of rack, measured from established lines and levels. Do not weld, cut, or abrade surfaces of metal fabrications that have been coated or finished after fabrication and are intended for field connection by mechanical means without

further cutting or fitting.

- C. Fit exposed connections accurately together to form tight, hairline or, where indicated, with uniform reveals and spaces for sealants and joint fillers.
- D. Adjust metal fabrications prior to anchoring to ensure matching alignment at abutting joints.
- E. Install items as detailed in the drawings; for manufactured items, install as recommended by the Manufacturer, unless indicated otherwise.
- F. Coordinate with other trades involved.
- G. Field Touch-Up
 - 1. Painted Members: After erection, clean all damaged areas in shop coat, exposed surfaces of bolts, bolt heads, nuts and washers, abrasions, and all field welds and unpainted areas adjacent to field welds to the same standards as the shop coat and paint with primer paint to same thickness as the shop coat.
 - 2. Galvanized Members: After erection, clean and paint all damaged areas to the galvanizing, welds, and areas adjacent to welds with the galvanizing repair paint complying to ASTM A780. For galvanized members to be painted, finish painting shall be the final two coats of the epoxy coating system. For powder coating system follow instructions of the powder coat manufacturer, to match surrounding undamaged areas.

3.2 PROTECTION

- A. Protect finishes of metal work from damage during construction period. Restore finishes damaged during installation and construction period so that no evidence remains of correction work.

END OF SECTION

SECTION 06 10 01

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. 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. Asphalt Shingles - Section 07 31 13
 - 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 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.

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 metal decks with #12 screws.
- H. Fasten wood blocking assemblies to 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 01

SECTION 06 10 53

MISCELLANEOUS ROUGH CARPENTRY

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions 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. Wood blocking, grounds and nailers.
 - 2. Backing panels at utility closets.
 - 3. Framing at kiva.
 - 4. Utility shelving

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
 - 2. Section 06 40 23, Interior Architectural Woodwork

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: Submit manufacturer's product data, installation instructions, use limitations and recommendations for each material used. Provide certifications stating that materials comply with requirements.
- B. Treatment Data: For each type of treatment required provide manufacturer's certification stating chemicals and process used, quantities of chemicals retained, conformance with applicable standards, and certification that moisture content after treatment was reduced to maximum specified.

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 and joist hangers.

1.5 STORAGE AND HANDLING

- A. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from moisture and damage. 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.
- B. Sequence deliveries to avoid delays, but to minimize on-site storage.

1.6 PROJECT CONDITIONS

- A. Coordinate work of this section with work of other sections to ensure proper location and attachment of other work. Scribe and trim work to provide accurate fit.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS - GENERAL

- A. 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.
- B. Provide construction grade blocking, furring, sleepers and similar items of any species complying with PS 20. Provide above ground lumber not at building interior and in contact with roofing, flashing, sheet metal, masonry, concrete, dampproofing and waterproofing that is pressure treated with waterborne preservatives complying with AWPB LP-2 and AWWA C2. Dry lumber to maximum moisture content of 15% after treatment.

1. All concealed wood and lumber within the building shall be fire-retardant treated. Provide treatment that yields a flame spread rating of not more than 25 when tested according to ASTM E84. Kiln dry after treatment to maximum moisture content of 19%. Do not use fire-retardant treatments containing ammonium phosphates or salts.
2. Provide factory markings on each piece of lumber.

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.

2.3 LUMBER

- A. Dimension Lumber Items: Construction or No. 2
 1. Mixed southern pine or southern pine; SPIB.
- B. 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.
- C. 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.

- D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- E. Joists, ledgers and other framing lumber:
 - 1. Species and grade with a modulus of elasticity of at least 1,300,000 psi (8970 MPa) and an extreme fiber stress in bending of at least 850 psi (5.86 MPa) for 2-inch nominal (38-mm actual) thickness and 12-inch nominal (286-mm actual) width for single-member use.

2.4 PLYWOOD

- A. For backing panels at utility closets, provide APA trademarked, UL labeled, fire-retardant treated, C-D Plugged Exposure 2 panels 3/4" thick unless noted otherwise, and complying with PS 1. Provide treatment that yields a flame spread rating of not more than 25 when tested according to ASTM E84. Kiln dry after treatment to maximum moisture content of 19%. Do not use fire-retardant treatments containing ammonium phosphates or salts.
- B. For subfloor-underlayment panels: DOC PS 1, Exposure 1, Structural I, Underlayment single-floor panels.
 - 1. Span Rating: Not less than 24 o.c.
 - 2. Nominal Thickness: Not less than 7/8 inch.
 - 3. Edge Detail: Square.
 - 4. Edge Detail: Tongue and groove.
 - 5. Surface Finish: Fully sanded face.

2.5 MISCELLANEOUS MATERIALS

- A. Inserts, Anchors, and Fasteners: Provide inserts, anchors, anchor bolts, lag bolts, screws, washers, nuts, nails, and other rough hardware. Assist other trades as necessary in the placement of inserts and anchor bolts in concrete and masonry. Furnish full instructions regarding locations, sizes, and other requirements to ensure proper preparation. Provide rough hardware which complies with requirements of the governing laws and codes.
 - 1. All fasteners (i.e. bolts, anchor rods, lag bolts, nails, screws, etc.) in direct contact with Chromated Copper Arsenate (CCA-C), Sodium Borate (SBX), Alkaline Copper Quat (ACQ-C & ACQ-D), Copper Azole (CBA-A & CA-B) OR SBX w/ NaSiO₂ preservative treated lumber shall have Hot Dipped Galvanized (G135 HDG per ASTM A653) finish or approved equal. All Fasteners in contact with any other type of preservative treatment shall be fabricated from Type 306 or Type 316 stainless steel.
- B. Rough Hardware: Provide hot-dip galvanized steel finish or stainless steel finish for rough hardware items for use at exterior. Hot dip galvanizing shall be in accordance with ASTM A 153. Provide other concealed items cadmium plated

or zinc chromate plated.

- C. Provide non-impact drilled anchors and fasteners for securing wood framing, blocking or plywood into masonry of sufficient length to penetrate the receiving member a minimum of 1-1/2 in.
- D. Nails, Brads, and Staples: ASTM F1667.
- E. Screws for Fastening to Metal Framing: ASTM C954, length as recommended by screw manufacturer for material being fastened.
- F. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- G. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to Architect and authorities having jurisdiction, based on ICC-ES AC01, ICCES 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.
- C. Joist Hangers: U-shaped joist hangers with 2-inch- (50-mm-) long seat and 1-1/4-inch- (32-mm-) wide nailing flanges at least 85 percent of joist depth.
 - 1. Thickness: 0.050 inch (1.3 mm).

PART 3 - EXECUTION

3.1 INSPECTION

- A. The Installer/Erector 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 - GENERAL

- A. Strictly comply with referenced standards, except where more restrictive requirements are specified in this section. Choose pieces carefully to eliminate split, warped and twisted members.
- B. Securely anchor work to substrates and structure. Ensure that blocking is capable of supporting applied work and loadings. Countersink bolts and other fasteners flush with face of wood.
- C. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- D. 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.
- E. 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.
- F. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- G. Do not splice structural members between supports unless otherwise indicated.
- H. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.
- I. 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.
- J. 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.
- K. 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.

3.3 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

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[®] 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 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 13

ASPHALT SHINGLES

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. Inspect the underside of the roof deck before starting work, and periodically 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 removal 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 all existing asphalt shingles, underlayments and flashings.
 - 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 asphalt shingle roofing system, including a vented nailbase insulation, ice & water shield, underlayment, asphalt cement, fasteners, sealants and flashings.
 - 4. Coordinate the application of asphalt shingle roofing with the installation of all related components to provide a watertight installation.

5. Provide miscellaneous mechanical, electrical, hoisting and other work needed, and remove, adjust, modify, reset and reconnect all roof-mounted and roof-penetrating equipment.

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

A. Install roofing and insulation 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 E108 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
5. Underwriters Laboratories Inc. 110 mph Wind Rating for Roof Covering Materials.

1.4 QUALITY ASSURANCE

A. General: Do not apply any products when the substrate is wet.

B. 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.
- 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. Pre-Work 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 old roofing is removed and the work progresses.
 - 2. How the installation of asphalt shingles will be coordinated with the installation of the vented nailbase insulation, ice & water shield, underlayment, flashings and other items to provide a watertight installation.
 - 3. Generally accepted industry practice, the Manufacturer's instructions for handling and installing his products, and specified work requirements.
 - 4. The condition of the substrate (deck), 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.

1.6 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 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 of the Manufacturer's Warranty and Contractor's Guarantee forms.
- 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 DELIVERY, STORAGE AND HANDLING

- A. Deliver material to the site in the Manufacturer's original and unopened packaging, bearing labels which identify the type and names of the products and Manufacturers, with Underwriters Laboratories, Inc. labels intact and legible.
- B. Store material on raised platforms and cover it immediately upon delivery. Keep material dry until installed.
- C. Do not stack bundles of shingles more than 4 feet high.

- D. Store rolled goods on end.
- 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.

1.8 GUARANTEE

- A. Provide the standard Manufacturer's Lifetime limited warranty against manufacturing defects.
- B. Provide a written Contractor's Guarantee which guaranties 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.
- C. Provide one Guarantee that covers "all work performed" when a single contractor is awarded work specified in multiple Sections.
- D. The Guarantee shall take effect no more than 30 days before the satisfactory 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.

PART 2 - PRODUCTS

2.1 ASPHALT SHINGLES

- A. Shingles shall be 5 layer laminated fiberglass architectural textured shingles as manufactured by CertainTeed under the trade name Grand Manor Shingle, to comply with the following standards and characteristics:
 - 1. ASTM Specification D-3462.
 - 2. U.L. Class A Fire Rating.
 - 3. U.L. Wind Resistant Rating.

4. Approximate Size: 36 inches long x 18 inches wide, 8 inch exposure.
5. Approximate weight: 425 pounds per square.
6. Color as selected.

B. Utilize the Manufacturer's special starter, hip and ridge shingles.

2.2 ACCESSORY MATERIALS

A. Ice and Water Shield:

1. Standard - 40 mil thick slip resistant, rubberized asphalt adhesive sheet, backed with a layer of cross laminated polyethylene, with a release paper for peel and stick application directly to the prepared roof deck: W.R. Grace Ice & Water Shield.
2. High Temperature - 30 mil thick slip resistant, rubberized asphalt adhesive sheet, backed with a layer of cross laminated polyethylene, with a release paper for peel and stick application directly to a prepared substrate: Grace Ultra Ice & Water Shield.
3. Use high temperature ice & water shield where it is in contract with EPDM PVC roofing and sheet metal flashings.

B. Underlayment: 12 mil thick spun-bonded polypropylene coated with UV stabilized polyolefin: WR Grace Tri-Flex 30.

C. Vented Nailbase Insulation:

1. 3-1/2 inch thick, vented, composite board with 5/8 inch thick APA rated CDX plywood, 1 inch air space meeting ASTM C1289-05, Type V, Grade 2, 20 psi isocyanurate foam - Hunter Panels Cool Vent, with an R Value of 12.1

D. Asphalt Cement: Type 1, asbestos-free grade bituminous plastic cement complying with Federal Specification of SS-C-153B.

E. Fasteners:

1. Felt - galvanized or aluminum cap nails with low profile heads.
2. Shingles - Hot dipped, 12 gauge barbed shank, galvanized roofing nails, long enough to penetrate through the underside of the sheathing about 1/4 inch.

2.3 Ridge Vent: High density rigid corrugated black polyethylene sections with integral factory installed snow screens that provide 20 square inches of net free ventilation area per lineal foot, Cor-A-Vent Model V-600E.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Remove all existing sloped roofing materials, including underlayment, protruding nails, bituminous mastic, caulking, and other materials from the surface of the decks and from within the flutes of metal decks.
- B. Repair and refasten the roof decks, to assure that all surfaces are restored to a condition which will properly support the new asphalt shingle roofing system.
- C. Replace deteriorated portions of roof decking in accordance with the Unit Price Bids.
- D. Maintain the buildings watertight in the interim, but do not install new asphalt shingle roof system components until deck defects are corrected.
- E. Do not apply any new material over wet surfaces.

3.2 VENTED NAILBASE INSULATION

- A. Install nailbase insulation with joints offset between rows a minimum of 12 inches. Cut the nailbase insulation to fit neatly at penetrations and joints. Fill any gap which is greater than 1/4 inch.
- B. Fasten nailbase insulation with screws to penetrate through the existing nailbase insulation and into the metal deck a minimum of 1 inch.
 - 1. **Carefully choose the length of the screws to ensure the screws do not protrude through the underside of the deck where visible inside the School.**
 - 2. Install 24 fasteners per 4 by 8 foot nailbase insulation board.

3.3 ICE AND WATER SHIELD

- A. Install ice & water shield, fully adhered to the deck surface and metal drip edge to shed water at all roof eaves, extending from the eave up the slope 6 feet.
- B. Install ice & water shield over the entire surface of the screen roof, around penetrations, and on each side of metal valleys. Turn the ice shield up 6 inches at intersecting vertical walls, chimneys, and parapets.
- C. Overlap ice & water shield plies 3 inches and end laps 6 inches, minimum.
- D. Store ice & water shield between 60°F and 80°F when the outside temperature is 40°F or below; install the ice & water shield immediately after removing it from storage to assure it adheres to the substrate, and quickly install fasteners for the shingles and flashings through the ice and water shield - to assure self-sealing nail performance.

3.4 UNDERLAYMENT

- A. Install underlayment over the entire roof surface.
- B. Lap underlayment plies 3 inches toward the eaves and form 6 inch end laps.
- C. Fasten the underlayment with cap nails spaced 12 inches on center along the ply lines, at the end laps, and in all directions through-out the sheet.
- D. Lap underlayment at least 12 inches to form double thickness at ridges, and hips.

3.5 ASPHALT SHINGLES

- A. Install asphalt shingles strictly in accordance with the requirements and recommendations of the Manufacturer, except as modified herein.
- B. Utilize chalk lines and install the shingles with straight courses and uniform exposure. Do not exceed the Manufacturer's recommended course exposure.
- C. Nail each strip of asphalt shingles with a minimum of 7 nails. Leave no exposed nails in the completed installation.
- D. Fit shingles neatly around pipes, ventilators and other projections in roof. Do not cover the bottom flange of apron flashings. Position the shingles about 3/4 inch from cricket corners to create a drainage gap.
- E. Utilize the manufacturer's special starter, hip and ridge shingles.
- F. Form open valleys, which taper, increasing in size from the top to bottom.
- G. Do not puncture the sheet metal flashings with nails, as the shingles are installed.

3.6 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 31 13

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 074213.23

METAL COMPOSITE MATERIAL WALL PANELS

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 MCM wall panels.

1.3 DEFINITIONS

- A. MCM: Metal composite material; cladding material formed by joining two thin metal skins to polyethylene or fire-retardant core and bonded under precise temperature, pressure, and tension.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, MCM panel Fabricator and Installer, MCM sheet manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects MCM panels, including installers of doors, windows, and louvers.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review methods and procedures related to MCM panel installation, including manufacturer's written instructions.
 - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 - 5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect MCM panels.
 - 6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
 - 7. Review temporary protection requirements for MCM panel assembly during and after installation.
 - 8. Review procedures for repair of panels damaged after installation.

9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.5 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 each type of panel and accessory.
- B. Shop Drawings:
 1. Include fabrication and installation layouts of MCM panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, and accessories; and special details.
 2. Accessories: Include details of the flashing, trim and anchorage, at a scale of not less than 1-1/2 inches per 12 inches (1:10).
- C. Samples for Initial Selection: For each type of MCM panel indicated with factory-applied color finishes.
 1. Include similar Samples of trim and accessories involving color selection.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 1. MCM Panels: 12 inches (305 mm) long by actual panel width. Include fasteners, closures, and other MCM panel accessories. Submit custom color samples in paint manufacturer's standard size.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each product, tests performed by a qualified testing agency.
 1. MCM Manufacturer's Material Test Reports: Certified test reports showing compliance with specific performance or third-party listing documenting compliance to comparable code sections IBC 1407.14 and IBC 1703.5.
- C. Field quality-control reports.
- D. Sample Warranties:

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For MCM panels to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by MCM Fabricator.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for MCM fabrication and installation.
 - 1. Build mockup of typical MCM panel assembly as shown on Drawings including supports, attachments, and accessories.
 - 2. Water-Spray Test: Conduct water-spray test of mockup of MCM panel assembly, testing for water penetration in accordance with AAMA 501.2.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, MCM panels, and other manufactured items so as not to be damaged or deformed. Package MCM panels for protection during transportation and handling.
- B. Unload, store, and erect MCM panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack MCM panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store MCM panels to ensure dryness, with positive slope for drainage of water. Do not store MCM panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on MCM panels during installation.

1.10 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of MCM panels to be performed in accordance with manufacturers' written instructions and warranty requirements.

1.11 COORDINATION

- A. Coordinate MCM panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.12 WARRANTY

- A. Warranty on Panel Material: Manufacturer's standard form in which manufacturer agrees to replace MCM that fails within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace MCM panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide MCM panel systems capable of withstanding the effects of the following loads, based on testing in accordance with ASTM E330:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Drawings
 - 3. Deflection Limits: As indicated on Drawings.
- B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) of wall area when tested in accordance with ASTM E283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).
- C. Water Penetration under Static Pressure: No water penetration to room side of assembly when tested for 15 minutes in accordance with ASTM E331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).
- D. Thermal Movements: Include expansion and contraction points as needed to allow for free and noiseless thermal movements from surface temperature changes.
 - 1. Temperature Change (Range): minus 20 deg F to 175 deg F (minus 29 to 79.4 deg C), material surfaces.
- E. Fire Propagation Characteristics: MCM wall assembly passes NFPA 285 testing.

2.2 MCM WALL PANELS

- A. MCM Wall Panel Systems: Provide factory-formed and -assembled, MCM wall panels fabricated from two metal facings that are bonded to a solid, extruded thermoplastic

core; formed into profile for installation method indicated. Include attachment assembly components, panel stiffeners, and accessories required for weathertight system.

1. Basis-of-Design Product: Subject to compliance with requirements, provide 3A Composites USA Inc.; ALUCOBOND PLUS or comparable product by one of the following:
 - a. Arconic Architectural Products (USA).
 - b. Mitsubishi Chemical Composites.
- B. Aluminum-Faced Composite Wall Panels Formed with 0.020-inch- (0.50-mm-) thick, aluminum sheet facings.
 1. Panel Thickness: 0.157 inch (4 mm).
 2. Core: Fire retardant.
 3. Exterior Finish: PVDF fluoropolymer with coats and thicknesses that comply with MCM panel manufacturer's performance and warranty requirements.
 - a. Color: As indicated on drawing schedule..
 4. Peel Strength: 22.5 in-lb/in. (100 N x mm/mm) when tested for bond integrity in accordance with ASTM D1781.
 5. Fire Performance: Flame spread less than 25 and smoke developed less than 450, in accordance with ASTM E84.
- C. Attachment Assembly Components: Formed from extruded aluminum.

2.3 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet ASTM A653/A653M, G90 (Z275) hot-dip galvanized coating designation or ASTM A792/A792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide Fabricator's standard sections as required for support and alignment of MCM panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of MCM panels unless otherwise indicated.
- C. Flashing and Trim: Provide flashing and trim formed from same material as MCM panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent MCM panels.
- D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of MCM panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

- E. Panel Sealants: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in MCM panels and remain weathertight; and as recommended in writing by MCM panel manufacturer.

2.4 FABRICATION

- A. General: Fabricate and finish MCM panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Fabricate MCM panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations or recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 4. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 - 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Aluminum Panels and Accessories:

1. PVDF Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, MCM panel supports, and other conditions affecting performance of the Work.
- B. Examine roughing-in for components and assemblies penetrating MCM panels to verify actual locations of penetrations relative to seam locations of MCM panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages in accordance with ASTM C754 and MCM panel manufacturer's written recommendations.

3.3 MCM PANEL INSTALLATION

- A. General: Install MCM panels in accordance with Fabricator's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor MCM panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 1. Shim or otherwise plumb substrates receiving MCM panels.
 2. Flash and seal MCM panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by MCM panels are installed.
 3. Install screw fasteners in predrilled holes.
 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 5. Install flashing and trim as MCM panel work proceeds.
 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 7. Align bottoms of MCM panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

- B. Fasteners:
 - 1. Aluminum Panels: Use aluminum or stainless steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by MCM panel manufacturer.
- D. Attachment Assembly, General: Install attachment assembly required to support MCM wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.
 - 1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
- E. Panel Installation: Attach MCM wall panels to supports at locations, spacings, and with fasteners recommended by Fabricator to achieve performance requirements specified.
 - 1. Wet Seal Systems: Seal horizontal and vertical joints between adjacent MCM wall panels with sealant backing and sealant. Install sealant backing and sealant in accordance with requirements specified in Section 079200 "Joint Sealants."
 - a. Clip Installation: Attach panel clips to supports at locations, spacings, and with fasteners recommended in writing by Fabricator. Attach routed-and-turned flanges of wall panels to panel clips with Fabricator's standard fasteners.
 - b. Panel Installation:
 - 1) Seal horizontal and vertical joints between adjacent panels with sealant backing and sealant. Install sealant backing and sealant in accordance with requirements specified in Section 079200 "Joint Sealants."
 - 2) Seal horizontal and vertical joints between adjacent MCM wall panels with Fabricator's standard gaskets.
 - c. Joint Sealing: Seal all joints in accordance with AAMA 501.
- F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
 - 1. Install components required for a complete MCM panel assembly including trim, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by MCM panel Fabricator; or, if not indicated, provide types recommended in writing by MCM system Fabricator.
- G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, or SMACNA's "Architectural Sheet Metal Manual." Provide

concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof performance.

3.4 ERECTION TOLERANCES

A. Site Verifications of Conditions:

1. Verify conditions of substrate previously installed under other Sections are acceptable for the MCM system installation. Provide documentation indicating detrimental conditions to the MCM system performance.
2. Once conditions are verified, MCM system installation tolerances are as follows:

3.5 FIELD QUALITY CONTROL

- A. Water-Spray Test: After installation, test area of assembly as directed by Architect for water penetration in accordance with AAMA 501.2.
- B. MCM wall panels will be considered defective if they do not pass test and inspections.
- C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- D. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as MCM panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of MCM panel installation, clean finished surfaces as recommended by MCM panel manufacturer. Maintain in a clean condition during construction.
- B. After MCM panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace MCM panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213.23

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

- 1. Install new EPDM flashings at new equipment curbs on existing EPDM roofs. Refer to the Mechanical Drawings for the locations, types and quantities of equipment.
 - 2. 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. Asphalt Shingles - Section 07 31 13
 - 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 the 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 new equipment is installed and new flashings are installed.

2. Generally accepted industry practice and the Manufacturer's instructions for handling and installing his products.
3. Incomplete submittals; note that progress payments will be not processed until all submittals are received and approved.
4. The construction schedule, weather forecast, availability of materials, personnel, equipment and facilities needed to proceed and complete the work on schedule.
5. 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 Contractor's Guarantee which guaranties 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.
- B. Provide one Contractor's Guarantee that covers "all work performed" when a single contractor is awarded work specified in multiple Sections.
 - C. The Contractors Guarantee 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 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. Guarantee 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 shall be products supplied by the existing roof material manufacturer.
- B. Primary products required for this project include:
 1. Roof insulation
 2. EPDM roofing
 3. Primers and adhesives
 4. Sealants
 5. EPDM flashing
 6. Fasteners

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. 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". Thickness to match existing insulation.

- C. 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.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install the new flashings in a watertight, workmanlike manner, meeting the requirements of the existing roofing manufacturer, except as enhanced by the drawings and specifications.
- B. Clean substrate surfaces of all laitance, dirt, oil, grease or other foreign matter.
- C. 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.
- D. Install flashing 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.
- E. 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.
- 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.

3.2 INSULATION

- A. Install new insulation neatly cut at all miters and transitions.
- B. Fasten the insulation only to the top flute of steel decks, and to wood 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 1 fasteners per 2 square feet.

3.3 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.

3.4 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.

3.5 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.

3.6 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.

3.7 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.

3.8 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 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.

3.9 ROOF INSPECTIONS BY MANUFACTURER

- A. Arrange for the existing 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 the existing warranty remains in effect.
- B. Provide 48 hours advance written notice to the Architect, so he may have a representative attend the inspection.

C. Submit the inspection report within one week following the inspection.

1. Payment requisitions will not be reviewed nor approved until the inspection reports are received.

END OF SECTION 07 53 23

SECTION 07 62 00

SHEET METAL FLASHINGS & SPECIALTIES

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 cap flashings, hook strips, fascia, drip edges, gutters, leaders, valleys, and miscellaneous flashings.

- B. Related Requirements

- 1. Masonry Maintenance - Section 04 01 00
 - 2. Carpentry - Section 06 10 00
 - 3. Asphalt Shingles - Section 07 31 13
 - 4. EPDM Roofing - Section 07 53 23
 - 5. 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 underlayments, asphalt shingles, 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.
- 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, drip edges, fascia, gutters, leaders, valleys, step and apron flashings, 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 fascias, hook strips, drip edges 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. Fasteners: fabricated of stainless steel, or material that matches the sheet metal being fastened.

- F. Glass Cloth: open mesh glass fabric coated on each side with plasticized asphalt as manufactured by Karnak Corporation or equal.
- G. Asphalt cement: Federal Specification SS-C-153B, Type 1, asbestos free grade.
- H. Exterior mounted gutters: 7 inch wide, .050 inch thick aluminum seamless, factory finished with Kynar 500 finish, color as selected by the Architect, from the full range of custom and standard colors, box style gutters supported with concealed aluminum fascia brackets spaced 12 inches on center fastened with 1-1/2 inch long stainless steel screws.
 - 1. Gutters manufactured by Garrety Manufacturing 800 / 628-5849 are the basis of design to establish the quality standard required.
- I. Exterior mounted leaders and straps: .040 inch thick rectangular aluminum leaders factory finished with Kynar 500 finish. Fasten each leader with 1/16 inch thick by 1 inch wide straps spaced 7 feet on center. Install stainless steel wire baskets at all leader outlet tubes.
- J. 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.
- K. Ice and Water Shield: high temperature 30 mil thick slip resistant butyl based adhesive coated sheet, with a plastic release layer for peel and stick application directly to a prepared roof deck: Grace Ultra.

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 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. 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 DRIP EDGES

- A. Fabricate drip edges to extend 1-1/2 inches past the roof edge, and turn down to ensure water cannot track back and run down the fascia. Secure the drip edge with roofing nails along the top edge, spaced 4 inches apart along the raw metal edge. Form joints in the drip edge with 6 inch wide concealed under plates which duplicate the profile of the drip edge. Set the underplates in a full bed of sealant.

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 FASCIA

- A. Fabricate new fascia to engage the hook strip 3/4 inch minimum and extend to the top of the wood fascia blocking. Secure the fascia with a continuous hook strip along the bottom edge and roofing nails along the top edge spaced 8 inches apart, positioned to be covered by the roof edge trim. Form joints in the fascia with 6 inch wide concealed under plates which duplicate the profile of the fascia. Set the underplates in a full bed of sealant.

3.8 MISCELLANEOUS FLASHINGS

- A. Fabricate and install copper flashings at sloped roof areas including: valleys; step and built-in cap flashings; vent pipe flashings; step flashings; etc.
- B. Install an 18 inch wide piece of ice shield to strip over the up-hill side of metal flashings, crickets, and over both sides of valley flashings.
- C. Fabricate step flashings 1 inch longer than the unexposed length of a shingle, and to extend 4 inches up the wall and 4 inches onto the roof.
- D. Fabricate apron flashings with 6 inch wide exposed faces which finish with 1/2 inch hems and rounded corners. Fasten the exposed face with stainless steel screws and washers with neoprene inserts spaced uniformly about 12 inches apart along the bottom edge.

3.9 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. Pre-fabricated curbs and equipment supports.
 - b. Factory fabricate pipe curb portals
 - c. Roof walkway pads and concrete pavers.
 - d. Snow guard assemblies.
- B. Related Requirements
 - 1. Masonry Maintenance - Section 04 01 00
 - 2. Carpentry - Section 06 10 00
 - 3. Asphalt Shingles - Section 07 31 13
 - 4. EPDM Roofing - Section 07 53 23
 - 5. 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 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 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.

2.3 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.

2.4 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.

2.5 SNOW GUARD ASSEMBLIES

- A. Asphalt shingle roof: 3 pipe snow guard assembly consisting of 1 inch outside diameter aluminum pipes, a 1/8 inch thick Type 302 stainless steel base plate, and milled 6061-T6 aluminum snow guard block as manufactured by Alpine Snow Guards, Model #125.

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 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.

3.3 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 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.

3.4 ROOF WALKWAY PADS AND CONCRETE PAVERS

- A. Install concrete pavers paced 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.**

3.5 SNOW GUARD ASSEMBLIES

- A. Install new snow guard assemblies. Position the brackets uniformly spaced and no more than 5 feet on center, with the plates covered by the next shingle course.
 - 1. Fasten the bracket plates with six #14 flat head stainless steel screws through the nailbase insulation into the metal deck.
 - 2. Cover the bracket plate and screws with ice and water shield.
 - 3. Secure each snow guard pipe, with End Collars provide by the manufacturer.
 - 4. Install end caps at the ends of all snow guard pipes.
 - 5. Join sections of pipe with couplings.

3.6 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.

3.7 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 72 00

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 manufacturer's 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 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; 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 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/FT² for single door or 1.00 CFM/FT² 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_f): A minimum of 58.
 - c. Thermal Transmittance U-Value: 0.52 BTU/HR/FT²/°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_f): A minimum of 58.
 - c. Thermal Transmittance U-Value: 0.52 BTU/HR/FT²/°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.

*Rye City School District
Milton Elementary School*

ALUMINUM FRAMED ENTRANCES & STOREFRONTS

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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

*Rye City School District
Milton Elementary School*

- 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

SECTION 084413.2
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/FT² (1.10 m³/h·m²) 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).
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 up to 13'-6" (4.1m): L/175 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 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.
8. Thermal Performance tested in accordance with AAMA 1503:
 - a. Condensation Resistance Factor (CRF_f): A minimum of 75.
 - b. Thermal Transmittance U Value: 0.41 BTU/HR/FT²/°F

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 752 OGP Aluminum Curtain Wall System.
- B. Curtain Wall Framing System:
1. Description: Framing shall be thermally improved. 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.

2.02 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.
- C. 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.

2.03 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: System sealants selected by installer are to be permanently elastic, non-shrinking, non-migrating type recommended by sealant manufacturer for joint size, movement, and compatibility.

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 manufacturer, 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 product carton instructions. The latest Installation Manual can be found at 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. System Perimeter Seals: Refer to Division 7 joint treatment section for sealant requirements.

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 084413.2

SECTION 085667

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.
- 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.

F.

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.

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.
- A. 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 EVI: 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/BHMAA156.28, 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

- B. 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.
- C. 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

- D. 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:
- E. 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.
- F. 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.
- G. The Owner's representative, prior to acceptance, shall witness all testing.
- H. 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	630	IVE
1	EA	ELECTRICAL CYLINDRICAL LOCKSET	CB250N70CSB3	CS	SAL
1	EA	CYLINDRICAL LATCH	LC1KC70IM		SAL
1	EA	LATCH ALIGNMENT 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	630	IVE
1	EA	WALL STOP	WS406/407CCV	US26D	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	630	IVE
2	EA	FIRE EXIT HARDWARE	9927-EO-F-LBR-499F	626	VON
2	EA	ELECTRONIC EXIT DEVICE TRIM	XS4 HALF ESCHUTCHEON TO USE WITH PANIC BAR - AB650A00IMH8W	IM	SAL
1	EA	PANIC BAR ADAPTER KIT	KPB04IMW	IM	SAL
2	EA	SURFACE CLOSER	4050 CUSH	689	LCN
2	EA	KICK PLATE	8400 16" X 1" LDW B-CS	630	IVE
2	EA	FIRE/LIFE WALL MAG	SEM7850 AS REQ (12/24/120V AC/DC TRI-VOLT)	689	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	630	IVE
1	EA	ELECTRICAL CYLINDRICAL PRIVACY LOCKSET	AB656N00IM38W	IM	SAL
1	EA	CYLINDRICAL LATCH	LC1KC70IM		SAL
1	EA	LATCH ALIGNMENT SPRING KIT	01848		SAL
1	EA	DOOR CONTACT SENSOR	RFDTCTW30W01		SAL
1	EA	SURFACE CLOSER	4050 REG OR PA AS REQ MWMS	689	LCN
2	EA	KICK PLATE	8400 16" X 1" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	US26D	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	630	IVE
1	EA	ELECTRICAL CYLINDRICAL LOCKSET	CB250N70CSB3	CS	SAL
1	EA	CYLINDRICAL LATCH	LC1KC70IM		SAL
1	EA	LATCH ALIGNMENT SPRING KIT	01848		SAL
1	EA	DOOR CONTACT SENSOR	RFDTCTW30W01		SAL
1	EA	SURFACE CLOSER	4050A RW/PA	689	LCN
2	EA	KICK PLATE	8400 16" X 1" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	US26D	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	630	IVE
2	EA	MANUAL FLUSH BOLT	FB458	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	ELECTRICAL CYLINDRICAL LOCKSET	CB250N70CSB3	CS	SAL
1	EA	CYLINDRICAL LATCH	LC1KC70IM		SAL
1	EA	LATCH ALIGNMENT SPRING KIT	01848		SAL
1	EA	DOOR CONTACT SENSOR	RFDTCTW30W01		SAL
2	EA	SURFACE CLOSER	4050 CUSH	689	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	630	IVE
2	EA	MANUAL FLUSH BOLT	FB458	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	ELECTRICAL CYLINDRICAL LOCKSET	CB250N70CSB3	CS	SAL
1	EA	CYLINDRICAL LATCH	LC1KC70IM		SAL
1	EA	LATCH ALIGNMENT SPRING KIT	01848		SAL
1	EA	DOOR CONTACT SENSOR	RFDTCTW30W01		SAL
2	EA	SURFACE CLOSER	4050A RW/PA	689	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	630	IVE
1	EA	FIRE EXIT HARDWARE	99-EO-F	626	VON
1	EA	ELECTRONIC EXIT DEVICE TRIM	XS4 HALF ESCHUTCHEON TO USE WITH PANIC BAR - AB650A00IMH8W	IM	SAL
1	EA	PANIC BAR ADAPTER KIT	KPB04IMW	IM	SAL
1	EA	SURFACE CLOSER	4050 REG OR PA AS REQ MWMS	689	LCN
1	EA	WALL STOP	WS406/407CCV	US26D	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	630	IVE
1	SET	AUTO FLUSH BOLT	FB31P	US32D	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	FIRE EXIT HARDWARE	9975-EO-F-576A	626	VON
1	EA	ELECTRONIC EXIT DEVICE TRIM	XS4 HALF ESCHUTCHEON TO USE WITH PANIC BAR - AB650A00IMH8W	IM	SAL
1	EA	PANIC BAR ADAPTER KIT	KPB04IMW	IM	SAL
2	EA	SURFACE CLOSER	4050A EDA	689	LCN
2	EA	KICK PLATE	8400 16" X 1" LDW B-CS	630	IVE
2	EA	WALL STOP	WS406/407CCV	US26D	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	630	IVE
1	EA	ELECTRICAL CYLINDRICAL LOCKSET	CB250N70CSB3	CS	SAL
1	EA	CYLINDRICAL LATCH	LC1KC70IM		SAL
1	EA	LATCH ALIGNMENT 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	630	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	630	IVE
1	EA	FIRE EXIT HARDWARE	99-EO-F	626	VON
1	EA	ELECTRONIC EXIT DEVICE TRIM	XS4 HALF ESCHUTCHEON TO USE WITH PANIC BAR - AB650A00IMH8W	IM	SAL
1	EA	PANIC BAR ADAPTER KIT	KPB04IMW	IM	SAL
1	EA	SURFACE CLOSER	4050 REG OR PA AS REQ MWMS	689	LCN
1	EA	WALL STOP	WS406/407CCV	US26D	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	630	IVE
1	EA	ELECTRICAL CYLINDRICAL LOCKSET	CB250N70CSB3	CS	SAL
1	EA	CYLINDRICAL LATCH	LC1KC70IM		SAL
1	EA	LATCH ALIGNMENT SPRING KIT	01848		SAL
1	EA	DOOR CONTACT SENSOR	RFDTCTW30W01		SAL
1	EA	SURFACE CLOSER	4050A EDA	689	LCN
1	EA	KICK PLATE	8400 16" X 1" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	US26D	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	630	IVE
1	EA	ELECTRICAL CYLINDRICAL LOCKSET	CB250N70CSB3	CS	SAL
1	EA	CYLINDRICAL LATCH	LC1KC70IM		SAL
1	EA	LATCH ALIGNMENT SPRING KIT	01848		SAL
1	EA	DOOR CONTACT SENSOR	RFDTCTW30W01		SAL
1	EA	SURFACE CLOSER	4050A RW/PA	689	LCN
1	EA	KICK PLATE	8400 16" X 1" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	US26D	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	628	IVE
1	EA	REMOVABLE MULLION	4954	689	VON
2	EA	PANIC HARDWARE	33A-EO	626	VON
1	EA	ELECTRONIC EXIT DEVICE TRIM	XS4 HALF ESCHUTCHEON TO USE WITH PANIC BAR - AB650A00IMH8W	IM	SAL
1	EA	PANIC BAR ADAPTER KIT	KPB04IMW	IM	SAL
2	EA	SURFACE CLOSER	4050 HCUSH	689	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	628	IVE
1	EA	REMOVABLE MULLION	4954	689	VON
2	EA	PANIC HARDWARE	33A-EO	626	VON
2	EA	SURFACE CLOSER	4050 HCUSH	689	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	628	IVE
1	EA	REMOVABLE MULLION	4954	689	VON
2	EA	PANIC HARDWARE	33A-EO	626	VON
1	EA	ELECTRONIC EXIT DEVICE TRIM	XS4 HALF ESCHUTCHEON TO USE WITH PANIC BAR - AB650A00IMH8W	IM	SAL
1	EA	PANIC BAR ADAPTER KIT	KPB04IMW	IM	SAL
2	EA	SURFACE CLOSER	4050 HCUSH	689	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	628	IVE
1	EA	PANIC HARDWARE	33A-EO	626	VON
1	EA	ELECTRONIC EXIT DEVICE TRIM	XS4 HALF ESCHUTCHEON TO USE WITH PANIC BAR - AB650A00IMH8W	IM	SAL
1	EA	PANIC BAR ADAPTER KIT	KPB04IMW	IM	SAL
1	EA	SURFACE CLOSER	4050 HCUSH	689	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	628	IVE
1	EA	PANIC HARDWARE	33A-EO	626	VON
1	EA	ELECTRONIC EXIT DEVICE TRIM	XS4 HALF ESCHUTCHEON TO USE WITH PANIC BAR - AB650A00IMH8W	IM	SAL
1	EA	PANIC BAR ADAPTER KIT	KPB04IMW	IM	SAL
1	EA	SURFACE CLOSER	4050 HCUSH	689	LCN
1	EA	PERIMETER GASKETING	BY DOOR MANUFACTURER		
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	628	IVE
1	EA	PANIC HARDWARE	33A-EO	626	VON
1	EA	ELECTRONIC EXIT DEVICE TRIM	XS4 HALF ESCHUTCHEON TO USE WITH PANIC BAR - AB650A00IMH8W	IM	SAL
1	EA	PANIC BAR ADAPTER KIT	KPB04IMW	IM	SAL
1	EA	SURFACE CLOSER	4050 HCUSH	689	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	630	IVE
2	EA	FIRE EXIT HARDWARE	9827-EO-F-LBR-499F	626	VON
1	EA	ELECTRONIC EXIT DEVICE TRIM	XS4 HALF ESCHUTCHEON TO USE WITH PANIC BAR - AB650A00IMH8W	IM	SAL
1	EA	PANIC BAR ADAPTER KIT	KPB04IMW	IM	SAL
2	EA	SURFACE CLOSER	4050A EDA	689	LCN
2	EA	KICK PLATE	8400 16" X 1" LDW B-CS	630	IVE
2	EA	WALL STOP	WS406/407CCV	US26D	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. This section includes miscellaneous interior glass and glazing materials and installation components and accessories where scheduled, as shown on the drawings and specified in this section that is not included in security glazing, storefront or curtain wall sections.

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. Shooter/Attack Glass: Where indicated provide certified Shooter/Attack Glass with UL verified testing following National Safety Security Protection Association protocols.
- E. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.
- F. 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".
- G. 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. It is intended that each type of glazing system be selected by the fabricator for the individual systems for doors.
- B. Framing system for interior borrow lites: Factory fabricated assemblies consisting of double-glazed rectilinear aluminum framing with screw spline or clip joinery. Basis of Design: C.R. Laurence Co., Inc; CRL 487-AR Series.
 - 1. Configuration: As indicated on drawings.
 - 2. Profile Width: 1-1/2 inch .
 - 3. Profile Depth: 5-11/16 inch overall.
 - 4. Profile Face Trim: 1-1/2 inch wide by 3/8 inch deep, snap in place.
 - 5. Throat size to match wall construction width.
 - 6. Frame Finish: Class I natural anodized.
 - 7. Exposed Fasteners: Aluminum.
 - 8. Perimeter Anchors: Steel, properly separated from aluminum framing.
 - 9. Acoustical Performance: Assembly tested by a qualified testing agency for sound transmission loss performance according to ASTM E90, calculated according to ASTM E413, and rated for not less than the STC value indicated.

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 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 is required to meet the performance criteria, 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 as 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 01

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

1" IGU - 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 – 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. 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; Web: 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: ¼" 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; Web: 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; Web: 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 088853.3

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. Fiberglass ceiling tiles with plant-based binder in suspension grid.
 - 3. 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 CEILINGS

- A. Fiberglass Ceiling Tile - 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. Fiberglass Ceiling 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.
9. Provide Microlock 90 edge at Storage Room.

- C. Plant Based Fiberglass Ceiling Tile - Basis of Design: Armstrong Lyra PB Square Lay-In 1" plant based binder fiberglass ceiling tiles, sizes and colors as indicated on Finish Schedule on Drawings. Equivalent products by the following may also be considered subject to approval of the Architect:

1. Certainteed
2. USG

- D. Plant Based Fiberglass Ceiling 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: 0.88 for white finish, varies by color
4. Humidity and sag resistant.
5. Washable surface.
6. Mold/mildew resistant.
7. Formaldehyde free.
8. Greenguard Gold Certified for emissions.

2.3 METAL CEILINGS

- A. Basis of Design: Armstrong MetalWorks Acoustic Blades, Color to be selected from manufacturer's full range. Equivalent products by the following may also be considered subject to approval of the Architect:
 1. Cetainteed
 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 FIBERGLASS CEILING BLADES/BAFFLES

- A. Basis of Design: Armstrong Soundscapes Blades, 2" thick fiberglass panels with finished scrim facing on faces and edges. Color, size and shape as indicated on Finish Schedule. Equivalent products by the following may also be considered subject to approval of the Architect:
 1. Cetainteed
 2. USG
- B. Tile properties
 1. Fire performance: Class A. ASTM E1264.
 2. Sound absorption: 1.38 sabins/square foot
 3. Light reflectance: varies by color
 4. Washable surface.
 5. Mold/mildew resistant.
 6. Formaldehyde free.

2.5 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

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. Rubber tile flooring
3. Resilient sheet flooring
4. Resilient wall base.
5. Resilient reducer strips and trim pieces.
6. Subfloor preparation.
7. Acoustic underlayment

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 RUBBER TILE FLOORING

- A. Refer to the Finish Schedule on Drawings for type, colors, patterns and locations.
- B. Heavy Commercial Rubber Floor Tile, ASTM F1344.
 1. Flammability: NFPA 253 Class 1
 2. Smoke Density: NFPA 258 <450
 3. Slip Resistance: ASTM D 2047 >0.5
 4. Total thickness: 0.125 " (3.18 mm)
 5. Installation method: Glue-Down
 6. Pattern: Solid

- C. 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.
- D. Polyurethane based adhesive as recommended by manufacturer.

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 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. Altro Wood Comfort 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

2.5 RESILIENT SPORT FLOORING

- A. Refer to the Finish Schedule on Drawings for type, colors, patterns and locations.
- B. Multi-Use Sport Flooring: Foam-backed sheet vinyl flooring designed for fully adhered athletic flooring applications. Gerflor Taraflex Multi-USE 6.2 or approved equal.

1. Flammability: ASTM E 648 Class 1
2. Shock Absorption: ASTM F 2772, Class 2
3. Slip Resistance: ASTM D 2047 >0.6
4. Total thickness: 0.24" (6.2 mm)
5. Installation method: Glue-Down

2.6 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 72 13

VINYL 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, vinyl 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 vinyl fabric wallcovering by one of the following meeting the requirements of this section and as indicated in Finish Schedule:

- 1. MDC Studio Design Solutions

2.2 MATERIALS

- A. Vinyl Fabric Wall Covering:

- 1. Fabric: Woven Poly-Cotton Osnaburg.
 - 2. Product Weight: 20 oz. per lineal yd. (13oz. per sq. yd.) at 54" width
 - 3. Vinyl Weight: 17 oz. per lineal yd.
 - 4. Fabric Weight: 3 oz. per lineal yd.
 - 5. Thickness: 0.017 to 0.027 depending on texture.

- B. 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 SPECIFICATIONS / TESTING / CERTIFICATION

- A. Federal Specification: CCC-408D, TYPE II
- B. NSF/ANSI342 Sustainability Standard - exceeds
- C. Fire testing:
 - ASTM-E84 Tunnel Test: Class A
 - NFPA 286 Corner Burn Test Class A
 - NFPA 265 Corner Burn Test Class A
 - *Meets or exceeds requirements for flame spread, smoke developed and flash over.

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 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 Erasemagnetic 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. 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 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: 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 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 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.
 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 and piping and removal of existing as indicated.
 4. Provide all new plumbing fixtures where indicated, complete including traps, stops, drains, strainers, tailpieces, faucets, escutcheons, etc.
 5. Provide complete new piping and final connections to equipment furnished under other Divisions.
 6. 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.
 7. Provide all required temporary connections to maintain all plumbing services without interruption.
 8. Pipe insulation.
 9. Tests and adjustments.
 10. This Contractor shall obtain all permits, bonds, approvals, etc. at no additional cost to the Owner.
 11. This Contractor shall provide all required sprinkler hydraulic calculations and corresponding drawings per all authorities having jurisdiction. Provide calculations and drawings stamped and signed by a New York State Licensed Engineer.
 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 220160

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 AND FITTING 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.

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 had 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 220160

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, kitchen, laboratories tabletop gas outlets 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. Single Bowl Stainless Steel Sink - Type A (Handicapped)
Kohler Undermount model K-8689-5U with enamel cast iron finish (color by Architect) Faucet equal to Chicago faucet model 50-E2805-5ABCP and all required trip.
 - 2. Self-Contained Eye Wash - Type B
Encon "Aquarion" model no. AQ100. Provide 11" x 17" sign.
 - 3. Floor Drains:
Josam series 30000A or Zurn Z415 type "B" coated cast iron, two piece body with double drainage flange, flashing collar, weepholes, bottom outlet and adjustable strainer.
 - 4. Crawl Space Pump:
Equal Bell & Gossett model MWP18X30 package with 2VW051A pump, 10 gpm @ 35 ft. of head, 5 gallon capacity, basin, 1/2 hp, 1 rpm, 120/1/60, built in switch, stainless steel shaft, bronze bearing and no clog impeller, basin check valve and Electrical cord.

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 220370

SPRINKLER 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. The work covered by this section consists of furnishing all labor, equipment, appliances, materials and performing all operations necessary for the installation of an automatic sprinkler systems all in strict conformance with NFPA, insurance regulatory agency and requirements of all authorities having jurisdiction. Provide approved hydraulically designed Drawings and calculations as required by insurance regulatory agency.

1.2 REFERENCES

- A. NFPA 13 - National Fire Protection Association Standard for the Installation of Sprinkler Systems.

1.3 SYSTEM DESCRIPTION

- A. Type of System: Wet System - Hydraulic.
- B. Occupancy Classification: Ordinary Hazard Occupancy.

1.4 SUBMITTALS

- A. Shop Drawings
 - 1. Complete sprinkler system layout indicating the locations of sprinkler heads, devices, and accessories. Include separate details of special or not easily visualized piping arrangements and inspectors test valves and connections.
 - 2. Hydraulic calculations shall be complete and cross referenced to the appropriate Drawing sheets per all Authorities having jurisdiction. Provide hydraulic calculations and sprinkler shop drawings stamped and signed by a Licensed NYS Professional Engineer.
 - 3. Submit four (4) copies of Drawings to Owner's Risk Management Group for approval.
- B. Product Data: Catalog sheets, specifications, and installation instructions. Indicate UL or FM approval for each product. Include the following additional information:
 - 1. Electrical Devices: Complete description of intended use, wiring diagrams, data plate information and, in the case of switching devices, whether normally on, or normally off. Include motor test data.

2. Mechanical Devices: Complete description of intended use, including normal operating capacities and working pressures.
3. Enclosures: Dimensions, materials, gauges of metals; type of door hinges and locks, and methods of securing the enclosure members to the building construction.
4. Hose Threads: Verify that hose threads on fire department connections match threads on equipment used by the local or servicing fire department.

C. Quality Control Submittals

1. Design Data: The portions of the sprinkler system not sized on the Contract Drawings shall be sized in accordance with NFPA requirements for Hydraulically Designed Systems. Submit Drawings and hydraulic calculations for approval.
2. Certificates: As required under Quality Assurance Article.
3. Installers Qualification Data
 - a. Name of each person who will be performing the Work.
 - b. Upon request, furnish names and addresses of the required number of similar projects that each person has worked on which meet the experience criteria.

D. Contract Closeout Submittals

1. Operation and Maintenance Data. Deliver 2 copies to the Owner's Representative
 - a. Instruction manual describing the operation and maintenance of the system.
 - b. Parts list for each mechanical and electrical device.
 - c. Publication NFPA 13A, Inspection, Testing, and Maintenance of Sprinkler Systems.

1.5 QUALITY ASSURANCE

- A. Qualifications: The persons employed to perform the work of this section and their supervisor shall be personally experienced in sprinkler work and shall have been regularly performing such work for a minimum of 5 years while in the employ of a company or companies engaged in the installation of sprinkler systems. Upon request, furnish to the Owner the names and addresses of five similar projects, which the foregoing people, have worked on during the past 3 years.
- B. Regulatory Requirements: Materials for the work of this section shall be Underwriter's Laboratories listed, and/or Factory Mutual approved.
- C. Certification: NFPA Contractor's Material and Test Certificate.

1.6 MAINTENANCE

- A. Spare Parts: Furnish the following items and deliver to the Owner's Representative for storage in spare sprinkler head cabinets:

1. Spare sprinkler heads of required temperature range as follows:

<u>Quantity</u>	<u>Type</u>
5	standard upright
5	concealed ceiling
1	side wall horizontal
1	dry type

2. One sprinkler head wrench to fit each type sprinkler head listed above.

PART 2 - PRODUCTS

2.1 VALVES AND ACCESSORIES (All Tamper Proof and Monitored)

- A. Gate Valves (175 psig non-shock working pressure)

- 3/4 inch to 2 inch: Bronze body, OS & Y indicating type; double or wedge disc with threaded ends.
- 2-1/2 inch and larger: IBBM, OS & Y indicating type; double or wedge disc with end connections as required to suit the piping system.

- B. Valve Locking Devices

- Chain: 3/16 inch galvanized steel, welded link.
- Padlock: Series 800 by Yale, Eaton Corp., Charlotte, NC: Key all locks alike. Furnish 2 keys for each lock.
- Key Tags: 1-1/2 inch diameter, brass, stamped with valve number and service.
- "S" Hooks: Brass, for securing keys to key tags.

- C. Check Valves: IBBM, single clapper swing check with metal to metal or rubber faced checks, suitable for horizontal and vertical installation; end connections as required to suit the piping system; 175 psig non-shock working pressure. Ball Drip (where shown on Drawings): Brass, automatic; threaded on both ends.

- D. Pressure Gauges: Range of 2 times system working pressure at point where installed. Equip with gauge cock and provisions for draining.

- E. Inspector's Test Connection: Cast brass, capped, sprinkler line tester fitting; Elkhart Brass Mfg. Co.'s No. 112, or Seco Mfg., Inc.'s No. 445 or 446.

2.2 SPRINKLER HEADS AND APPURTENANCES

- A. Sprinkler Heads: Brass or bronze, with standard 1/2 inch orifice, and deflector, as manufactured by Reliable Sprinkler Co., Grinnell, Fire Protection Co., or Elkhart Brass Manufacturing Co.
 - 1. Upright or Pendent Type: (Quick Response) Provide in areas with no ceiling. Deflector designed to distribute water downward in a uniform hemispherical spray pattern. Reliable model GFR.
 - 2. Concealed Type: (Quick Response) Provide in finished areas. All parts of sprinkler body including shank thread mounts above lower plane of finished ceiling, Reliable model G4QR.
 - 3. Sidewall Type: (Quick Response) Equal to Reliable model GFR.
 - 4. Markings: Stamp sprinkler type on deflector in addition to NFPA's color code requirements covering temperature classification.
 - 5. Finish: White.
- B. All sprinkler heads in skylights and boiler rooms shall be high heat type. Contractor may use swing joints to sprinkler heads where applicable.
- C. Spare Sprinkler Head Cabinet: Steel, with hinged cover, constructed of minimum 20 gauge material and fitted with 16 gauge steel racks designed to hold quantities and types of spare sprinkler heads and sprinkler head wrenches. Finish shall be bright red, baked on enamel.

2.3 WATER FLOW ALARM DEVICE

- A. Pressure Type Waterflow Switch - Equal to Reliable's model E having:
 - 1. Corrosion-resistant vane.
 - 2. Splash/dust resistant enclosure with anti-tamper switch.
 - 3. Adjustable pneumatic retard.
 - 4. Screw type wiring terminals.
 - 5. Switch rated minimum 7.0 amps at 125 V ac and 0.25 amps at 125 V dc.

2.4 VALVE SUPERVISORY SWITCHES

- A. Mechanically actuated, designed to close contacts and sound an alarm when supervised valve is closed and when switch cover removed.
 - 1. For Gate Valves: Potter Electric Signal Co.'s OSYSU-A, or Grinnell's F640.
 - 2. For Post Indicator Valves: Potter Electric Signal Co.'s PIVSU-A2, or Potter-Roemer, Inc.'s 6223.

2.5 STEEL PIPE AND FITTINGS

- A. Steel Pipe for Threading: Standard weight, Schedule 40, black or galvanized; ASTM A53 or ASTM A135.
- B. Cast Iron Fittings
 - 1. Drainage Pattern, Threaded: ASME B16.12.

2. Steam Pattern, Threaded: ASME B16.4.
 - a. Standard Weight: Class 125.
 - b. Extra Heavy Weight: Class 250.
 3. Flanged Fittings and Threaded Flanges: ASME B16.1.
 - a. Standard Weight: Class 125.
 - b. Extra Heavy: Class 250.
- C. Unions: Malleable iron, 250 lb. class, brass to iron or brass to brass seats.
- D. Couplings: Same material and pressure rating as adjoining pipe, conforming to standards for fittings in such pipe. Use taper tapped threaded type in screwed pipe systems operating in excess of 15 psig.
- A. Nipples: Same material and strength as adjoining pipe, except nipples having a length of less than one inch between threads shall be extra heavy.
- 2.6 DUCTILE IRON PIPE AND FITTINGS
- A. Water Pipe: Bitumen coated and cement-mortar lined; AWWA C151.
1. 3 and 4 Inch Sizes: Class 51.
 2. 6 inch Size and Over: Class 50.
- B. Fittings: Bitumen coated and cement-mortar lined; AWWA C110.
- 2.7 BOLTED MECHANICAL BRANCH CONNECTION
- A. Victaulic Co.'s "Firelock" rigid coupling.
- 2.8 JOINING AND SEALANT MATERIALS
- A. Thread Sealant
1. LA-CO Industries' Slic-Tite.
 2. Loctite Corp.'s pipe sealant with Teflon.
- B. Joint Packing
1. Oakum: FS A-A-1186.
- C. Gaskets For Use With Ductile Iron Water Pipe: Synthetic rubber rings (molded or tubular): Clow Corp.'s Belltite, Tyler Pipe Industries Inc.'s Ty-Seal, or U.S. Pipe and Foundry Co.'s Tyton.
- D. Flange Gasket Material
1. For Use With Cold Water: 1/16 inch thick rubber.
- F. Gaskets For Use With Grooved End Pipe and Fittings: Type and materials as recommended and furnished by the fitting manufacturer, for the service of piping system in which installed.
- F. Anti-Seize Lubricant: Bostik Inc.'s Never Seez or Dow Corning Corp.'s Molykote 1000.

2.9 PACKING MATERIALS FOR BUILDING CONSTRUCTION PENETRATIONS

- A. Oakum: FS A-A-1186.
- B. Mechanical Modular Seals: Thunderline Corp.'s Link Seal wall and floor seals designed for the service of piping system in which installed.

2.10 PIPE SLEEVES

- A. Type A: Schedule 40 steel pipe.
- B. Type B: No. 16 gauge galvanized sheet steel.
- C. Type C: Schedule 40 steel piping with 1/4 inch steel collar continuously welded to pipe sleeve. Size steel collars as required to span a minimum of one cell or corrugation, on all sides of the rough opening through the metal deck.
- D. Type D: No. 16 gauge galvanized sheet steel with 16 gauge sheet steel metal collar rigidly secured to sleeve. Size metal collars as required to span a minimum of one cell or corrugation, on all sides of the rough opening through the metal deck.

2.11 FLOOR, WALL AND CEILING PLATES

- A. Cast Brass: Polished chrome plated finish, with set screw.
 - 1. Solid Type: Models 5 and 5T by Pegasus Mfg. Inc., Cheshire, CT; and Models 951 - 960 (inclusive) by Bridgeport Plumbing Products, Moutrie, GA.
- B. Cast Iron: Solid type, unplated, with set screw; Model 395 by Grinnell Corp., Cranston, RI.

2.12 SUPPORTS, HANGERS AND ANCHORS

- A. Pipe hangers, supports anchors, etc. shall be designed and fabricated to comply with NFPA Code No. 13.
- B. Hangers for piping below the roof shall be supported from the roof or the building structural steel. Where hangers cannot be supported directly from the building roof or structural members, any additional steel required to support the hangers shall be furnished and erected. No drilling of or welding to, structural members shall be permitted. All structural attachments shall be beam clamps. Inserts and sleeves for supports shall be provided in concrete where necessary.

2.13 SIGNS

- A. Steel with vitreous enamel finish, lettering on contrasting background to identify and indicate the function of:
 - 1. Control valves.
 - 2. Drain and test valves.
 - 3. Hydraulic Design Nameplate Data: Size approx. 9 x 12 inches, inscribed with the following:

- a. SPRINKLER SYSTEM HYDRAULICALLY DESIGNED (in block letters).
- b. Location and area of hydraulically designed section.
- c. Discharge density over designed area in gallons per minute.
- d. Residual pressure at base of riser supplying water to designed section.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Unless otherwise shown or specified, install the Work of this section in accordance with NFPA 13, and the item manufacturer's installation instructions.
- B. Before beginning work, Contractor shall obtain all bonds, permits, fees, etc. from all authorities having jurisdiction.
- C. Locking Valves
 - 1. Lock gate valves in open position with chain looped through handwheel and around adjacent sprinkler pipe. Secure with padlock.
 - 2. Lock test outlet valve in closed position with padlock.
- D. Spare Sprinkler Head Cabinet: Secure to building wall or other permanent structure in vicinity of main valve controlling sprinkler system, unless otherwise directed.
- E. Signs: Install signs identifying the following:
 - 1. Valves: One for each size, type and function.
 - 2. Water Motor Alarm.
 - 3. Hydraulically Designed System.
- F. Workmanship
 - 1. All work shall be performed in a practical and workmanlike manner by mechanics skilled in the work they are to do using the best practices of their trade.
 - 2. No work shall be covered or hidden from view until it has been inspected and approved by the Engineer.
 - 3. Any workmanship or materials not meeting with the requirements of the Contract Documents and/or the satisfaction of the Engineer shall be rejected. The Contractor shall immediately replace defective work and materials as required by the Engineer, at no additional cost to the Owner.
- G. Cutting and Patching: Unless otherwise specified, the Contractor shall do all cutting and patching necessary for the installation of work in accordance with Division 1 of Specifications. This cutting and patching shall be done only after having obtained the Engineer's approval as to the location and extent of the cutting.
- H. Drain Connections: Contractor is cautioned to arrange his permanent installation of piping in such a manner to that all or any part of the work may be completely drained. All piping shall be pitched so as to drain to the main drain.

- I. As-Built Drawings: This Contractor shall keep an accurate dimensional record of all mechanical work on marked prints. The Contractor shall furnish one (1) set of As-Built, at the completion of the project and before final payment shall be made.

3.2 FIELD QUALITY CONTROL

- A. Tests: Unless otherwise shown or specified, perform tests in accordance with NFPA 13.
 1. Flushing: In addition to the requirements of the Standard, flush new piping before making final connection to existing systems and before performing hydrostatic test. Flush at rates of flow prescribed in the Contractor's Material and Test Certificate.
 2. After making final connections, flush entire system and assure that debris is removed from piping and there are no stoppages or obstructions in the system.
 3. System Tests:
 - a. Test all New Work.
 - b. Notify the Owner's Representative when the work of this section is ready for testing.
 - c. Perform the tests when directed, and in the Owner's Representatives presence.
 4. Furnish Certificate of Approval for completed system to the Owner.

END OF SECTION 220370

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. Submit shop drawings for checking and approval.

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. Hot water heating boilers.
 2. Exhaust, supply fans and related appurtenances.
 3. HVAC units and related appurtenances.
 4. Condensing units and related appurtenances.
 5. Air handling units and related appurtenances.
 6. All required piping, valves and related specialties.
 7. Base mounted and inline centrifugal pumps and related appurtenances.
 8. Variable frequency drives.
 9. Fin-tube radiation, convectors and cabinet heaters.
 10. Sheetmetal ductwork and related accessories.
 11. Duct and pipe insulation.
 12. Registers, diffusers, and dampers.
 13. Rigging of equipment.
 14. 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.

15. Air and Water Balancing.
 16. Automatic temperature controls with complete wiring (regardless of voltage).
 17. Testing, adjusting and start-up of equipment.
 18. Painting and identification of all equipment and piping.
 19. Firestopping per NFPA requirements (UL approved systems).
 20. Operating and maintenance instructions.
 21. As-Built Drawings - Refer to Division 1.
 22. Cutting and Patching – See Front End Specifications for Trade Responsibilities.
 23. Excavation and Backfill – See Front End Specifications for Trade Responsibilities.
- 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 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. Soot Removal: In connection with the dismantling of boilers, Contractor shall gather together with a vacuum-cleaning machine all accumulations of soot. He shall remove all soot from the base of the chimney.
 - D. 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.

1.1 OIL TANK DECOMMISSIONING WITH CODE

A. WCSC Article XXV 873.2502.6

1. Permanent closure and changes in service.

- a. At least 30 days before beginning permanent closure or a change in service, the contractor must notify the department of its intent to permanently close or make the change in service, unless such action is in response to corrective action. The required assessment of the excavation zone under subsection (c) of this section must be performed after notifying the department but before completion of the permanent closure or a change in service. The resultant report must be submitted to the department within 90 days after permanent closure. Within 30 days after permanent closure or a change in service, the contractor must submit a registration application to the department, in accordance with section 873.2501.9(f) of the Westchester Sanitary Code Article XXV, indicating that the UST system has been permanently closed or that a change in service has occurred.
- b. To permanently close a UST system:
 - i. The contractor must empty and clean it by removing all liquids and accumulated sludge. Every tank that is part of a UST system that is permanently closed must also be either removed from the ground or filled with an inert solid material (such as sand or concrete slurry). If an inert solid material is used, all voids within the UST must be filled. All connecting and fill lines must be disconnected and removed or securely capped or plugged. Manways must be securely fastened in place.
 - ii. The facility must ensure that all scheduled deliveries to the UST system are terminated. Notify owner in writing.
- c. Use of a UST system to store a substance other than petroleum is considered a change in service. Before a change in service, the facility must empty and clean the UST by removing all liquid and accumulated sludge and conduct a site assessment in accordance with subsection (c) of this section.
- d. One of the following codes of practice (refer to section 873.2501.10 of the Westchester Sanitary Code Article XXV for complete citation of references) must be adhered to in order to comply with this subsection:
 - i. API RP 1604, March 1996;
 - ii. API RP 2016, August 2001;
 - iii. API RP 1631, June 2001;
 - iv. NFPA 326, 2010 edition

- e. Assessing the site at closure or change in service.
 - i. Before permanent closure or a change in service is completed, the contractor must measure for the presence of a release where contamination is most likely to be present at the UST system location. In selecting sample types, sample locations, and measurement methods, the contractor must consider the method of closure, the petroleum stored, the type of backfill, the depth to groundwater, and other factors appropriate for identifying the presence of a release. The requirements of this subsection are satisfied if one of the external release detection methods allowed in section 873.2502.3(c)(5) and (6) of the Westchester Sanitary Code Article XXV is operating in accordance with the requirements in section 873.2502.3 of the Westchester Sanitary Code Article XXV at the time of closure, and indicates no release has occurred.
 - ii. If contaminated soils, contaminated groundwater, or petroleum as a liquid or vapor is discovered, the contractor must begin corrective action in accordance with the Environmental Conservation Law, the Navigation Law, and 6 NYCRR Subpart 613-6 as implemented by NYSDEC.
- f. For any UST system that has been out-of-service since December 27, 1986 and was not properly permanently closed pursuant to department regulations governing UST system closure, the facility owner must assess the excavation zone and permanently close the UST system in accordance with this section if the department determines there is a potential for a release of petroleum from the UST system. This does not apply to Milton Elementary School.
- g. Records for permanent closure or change in service. The contractor must submit records to the owner for them to maintain for three years records that are capable of demonstrating compliance with closure requirements under this article. In addition, the contractor must transmit a copy of the records to the Department within 30 days after permanent closure or change in service.

B. NYSFC 5704.2.13.1.4

1. Tanks abandoned in place shall be as follows:

- a. Flammable and *combustible liquids* shall be removed from the tank and connected piping.
- b. The suction, inlet, gauge, vapor return and vapor lines shall be disconnected.
- c. The tank shall be filled completely with an *approved* inert solid material.
- d. Remaining underground piping shall be capped or plugged.
- e. A record of tank size, location and date of abandonment shall be retained.
- f. All exterior above-grade fill piping shall be permanently removed when tanks are abandoned or removed.

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 the work in this section. Submit shop drawing for checking and approval.

1.1 BOILER DESCRIPTION

- A. Packaged, factory-fabricated and assembled, gas-fired, firetube duplex alloy stainless steel ultra-high efficiency condensing boilers, trim and accessories for generating hot water. Submit shop drawings for checking and approval.

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. CSA 4.9, ANSI Z21.13
- G. AHRI, BTS-2000
- H. ASHRAE 90.1

1.3 SUBMITTALS

- A. 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.
- B. Certificate of Product Rating: Submit AHRI Certificate indicating Thermal Efficiency, Combustion Efficiency, Materials of Construction, Input, and Gross Output conform to the design basis.
- C. Thermal efficiency curves: Submit thermal efficiency curves between and including minimum and maximum rated capacities, for return water temperatures ranging from 80°F to 180°F.
- D. Water side pressure drop curve.
- E. 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 or excess O₂% levels, 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 potential costs associated with reselection of the flue gas exhaust system.
- F. Source quality-control test reports.
- G. Field quality-control test reports: Start-up by a factory authorized service company.
- H. Operation and Maintenance Data: Data to be included in Installation and Operation Manual.
- I. 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 headquartered in North America and manufacture pressure vessels in an ASME-certified facility wholly owned by the manufacturer. The specifying engineer, contractor and end customer must have the option to visit the factory to witness test fire and other relevant procedures.
- B. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. 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.
- D. CSD-1 Compliance: The boiler shall comply with ASME Controls and Safety Devices for Automatically Fired Boilers (CSD-1).
- E. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."
- F. UL Compliance: Boilers must be tested for compliance with UL 795, "Standard for Commercial-Industrial Gas Heating Equipment." Boilers shall be listed and labeled by ETL.
- G. AHRI Compliance: Boilers shall be tested and rated according to the BTS-2000 test standard and verified by AHRI.
- H. 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.
- I. The equipment shall fit within the allocated space, leaving ample allowance for maintenance and inspection.

- J. The equipment shall be new and fabricated from new materials. The equipment shall be free from defects in materials and workmanship.
- K. In order 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 of this specification section.

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:
 - a. Flue gas condensate corrosion, and/or defective material or workmanship for a period of ten (10) years, non-prorated, from the date of shipment from the factory.
 - b. Thermal shock for the lifetime of the boiler.
 - 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.
1. Endura+ model EDR+2500 duplex stainless steel firetube condensing boiler.
 - a. Alternate boilers must equal or exceed all aspects of this specification in its entirety throughout. Boilers seeking an approval shall provide documentation that supports this requirement.
- 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, fresh water make up, fuel, and drain. The boiler manufacturer shall have the engineering capabilities for all aspects of the mechanical, electrical and control design of the skidded system.

2.2 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 combustion gases transfer heat to the hydronic fluid.
1. The boiler shall be a single-pass firetube design, such that all combustion chamber components are within water-backed areas. Watertube boilers will not be accepted.
 2. Furnace to tube connections shall be constructed with low weld intensity, a tube to tube minimum spacing of 2 tube diameters center to center, minimum 1 tube diameter tube to tube ligament, and shall not contain any overlapping welds.
 3. Heat transfer capability shall be maximized via the use of corrugated firetubes. The corrugation process shall not remove any material from the tubes. Finned, twisted tape, or coil type tube inserts negatively impact ease of maintenance and will not be accepted.
 4. The boiler shall compensate for heat exchanger thermal expansion using a stress relief deflection element external to the pressure vessel shell. The deflection element shall act to protect the boiler tubes and tubesheets from exposure to longitudinal thermal expansion stresses. The deflection element shall not be in contact with flue gases.
 - a. Designs using the tubes, tubesheets, or furnace components to compensate for thermal expansion require cutting, welding, tube repair, or complete heat exchanger replacement in the event of deflection element failure and are not accepted.
 - b. Designs which do not compensate for thermal expansion stresses are not accepted.

5. Tubesheet to tube weld stresses while the boiler is in operation shall never exceed 1.0 ksi.
6. Material: The heat exchanger furnace, tubesheets, and firetubes shall be constructed of duplex alloy stainless steel. Austenitic stainless steels, such as 316L or 304, and ferritic stainless steels, such as 439, are not accepted.
 - a. For long term durability, heat exchanger material of construction must have a minimum Ultimate Tensile Strength of 94 ksi, and a minimum 0.2% Yield Strength of 65 ksi. Weaker materials of construction with reduced strength are not accepted. Boilers seeking an approval must provide documentation that supports this requirement or will be rejected.
 - b. Heat exchangers constructed of cast aluminum, mild steel, cast iron or copper finned tube materials are not accepted.
- C. Exhaust manifold shall be minimum 0.5" thick stainless steel, ASME designation SA-351 CF3M, and shall be a water-backed design to enhance heat transfer. Dry-back style flue gas condensate collection pan exhaust manifolds are not accepted.
- D. 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 0.375" thick steel, SA-53B ERW.
 2. The top head shall be a minimum 0.50" thick steel, SA-790 or SA-516 Grade 70.
 3. The pressure vessel shall be a counter-flow design with internal water-baffling plates.
 4. The boiler return and supply water connections shall be 150# ANSI flanged. 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 80 gallons.
 6. The maximum water pressure drop across the boiler inlet and outlet connections shall not exceed 3.0 PSID at 235 GPM for 2,500 MBTU/hr boiler.
- E. Fuel/Air Mixture Combustion System: Air and gas pre-mix on the suction side of the fan.
 1. Closed-loop oxygen sensor feedback shall automatically adjust the fuel/air ratio. O₂ monitoring-only systems that cannot adjust for operation variability shall not be accepted.
 2. Combustion air flow shall be controlled by fan speed and a servo-motor actuated butterfly valve. Fuel flow shall be controlled by a servo-motor actuated butterfly valve. Zero governor or negative regulation systems offer less precision and are not capable of independent air and gas control, and are not accepted.
- F. Burner: Standard natural gas, forced draft, woven fiber mesh design.
 1. Turndown: Shall be no less than EDR+2500: 12.5:1.
 2. Excess Air: The burner shall operate at no greater than 8.0% excess O₂ over the entire modulation range to maximize seasonal combustion and thermal efficiencies.

3. NOx Emissions: When operating on natural gas, the burner shall maintain a level of <20 ppm over the complete combustion range at a 3% O₂ correction. The natural gas burner shall be configurable down to <9 ppm NOx when operating on 460/3/60 electrical service.
- G. Blower: Variable speed centrifugal fan to operate during each burner firing sequence and to pre-purge and post-purge the combustion chamber.
1. Motor: Totally enclosed fan-cooled premium efficiency AC motor, Class H insulation, variable speed capable with sealed bearings.
 - a. Variable speed drive: IP20 housing, 0-400Hz frequency output capability, overload capacity of 150% for 60 seconds and 200% for 3 seconds, shall fully modulate fan speed according to burner input requirements.
 2. Motor Alternate: Closed-loop 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.
- H. Main Fuel Train:
1. A factory mounted fuel train shall be supplied. The fuel train shall be fully assembled and enclosed within the boiler cabinet, complete with factory mounted and wired high and low gas pressure switches in compliance with CSD-1.
 2. Provide factory approved regulator as required and submit it with shop drawing.
- I. Ignition: Direct spark ignition with transformer. A UV scanner shall be utilized to ensure precise communication of flame status back to the flame programmer. Flame rods are not accepted.
- J. Boiler Enclosure:
1. Cabinet: Jacketed steel enclosure with left hinged full height front access door, fully removable latching access panels, mounted on a steel skid with steel plate decking.
 2. Control Enclosure: NEMA 250, Type 1.
 3. Finish: Cabinet shall be powder coated, pressure vessel assembly shall be painted.
 4. Combustion Air: Factory mounted air filter directly coupled to the blower inlet.
- K. Rigging and Placement: The boiler shall include lifting eyes and fork hole accessibility for rigging.
- L. Characteristics and Capacities:
1. Standard capacities shall be based on 100% water.
 2. Minimum Design Water Pressure Rating: 160 psig.
 3. Minimum Return Water Temperature: No minimum temperature requirements.
 4. Maximum Allowable Water Temperature (ASME): 210°F.
 5. Minimum Water Flow Rate: EDR+2500: 25 gpm.
 6. Maximum Delta-T: 100°F

7. Maximum Allowable Operating Setpoint: 200°F
 8. 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.
 - M. 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 will not be accepted.
 - N. The dimensions of the boiler from where service clearances are measured shall not be more than (Height x Width x Depth) EDR+2500: 80" x 30" x 73" .
 - O. 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 60 psig.
 - B. Pressure and Temperature Gauge: Minimum 3-1/2" diameter, combination pressure and temperature gauge.
 - C. 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.
 - D. Flue Gas Condensate Neutralization: pH neutralization shall be provided.
- 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.
 2. The control display shall serve as a user interface for programming parameters, boiler control and monitoring; and shall feature a screen saver, boiler status, configuration, history and diagnostics.
 - a. Controls Transformers: 120VAC, 24 VDC, 12 VDC.
 - b. Flame safeguard control with 9 combustion fuel/air load profile points.
 - c. All standard controls shall be factory 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 manual reset mechanical Aquastat device shall stop the 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. Blocked Exhaust: Prevent operation in the event of a blocked flue gas exhaust stack.

- C. O2 Compensation: To maximize efficiency throughout seasonality, factory mounted and wired.
1. A wide band Oxygen sensor shall be factory mounted and measure the Oxygen level present in combustion byproducts during run. The current Oxygen level shall be displayed to the user. The Oxygen sensor minimum requirements shall be:
 - a. Lambda range: $\lambda = 0.65$ to ∞
 - b. Lambda accuracy: ± 0.008 @ $\lambda = 1.00$; ± 0.01 @ $\lambda = 0.80$; ± 0.05 @ $\lambda = 1.70$
 2. The O2 Compensation system shall utilize a combination open-loop and closed-loop control system to tune the air/fuel ratio during operation, optimizing combustion reliability, flame stability, combustion efficiency, and the dewpoint temperature for formation of flue gas condensate.
 3. Boilers listed as an alternate to the Basis of Design that do not include a closed-loop O2 Compensation control system in compliance with this specification shall be required to provide and commission a Siemens LMV52 Burner Management System with the QGO20 Oxygen Sensor, PLL52.110A100 O2 Trim Module, and associated installation parts.
- D. Boiler Operating Controls and Features:
1. Inlet Water Temperature Monitoring.
 2. Combustion Air Temperature Monitoring.
 3. Flue Gas Exhaust Temperature Monitoring: Sensor probe shall be stainless steel.
 4. Proportional Integral Derivative (PID) temperature load control capability for hydronic and domestic hot water in standalone or lead/lag operation.
 5. Operating temperature sensor for automatic start and stop.
 - a. The temperature sensor shall have tolerance according to IEC 60751
 6. Time of day display.
 7. Customizable boiler name display.
 8. Two customizable boiler interlock terminals displayed.
 - a. Alarm history for a minimum 100 most recent alarms including status at time of lockout.
 9. Administrative password protection options.
 10. Indirect domestic hot water priority.
 11. Outdoor air temperature (OAT) reset controls with warm weather shutdown:
 - a. OAT reset shall automatically adjust the setpoint according to changes in
 - b. The outdoor temperature, and disable the boilers above a warm weather shutdown temperature.
 - c. The boiler manufacturer shall provide an OAT sensor.
 - d. The temperature sensor shall be field installed in an outdoor area not exposed to direct sunlight or the exhaust of other mechanical equipment, and wired the boiler controller.

- e. The control shall be field programmed with the outdoor reset schedule.
12. Motorized isolation valve control:
- a. Upon heat demand for the boiler, the control shall provide an enable/open signal.
 - b. After the burner is disabled and upon the heat exchanger delta-T dropping to a user programmable delta-T, the signal will be disabled.
 - i. Boilers which utilize only a time delay close as the only means of valve actuation are unable to optimize for residual heat, and will not be accepted.
 - c. In variable primary arrangements, the control shall hold the lead boiler isolation valve open at all times.
- E. Lead/Lag Control of Modular (Multiple) Boiler Plants: Lead/Lag capabilities shall be integral to the boiler controller for up to 10 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.
 - a. The temperature sensor shall have tolerance according to IEC 60751, field installed in the common supply water piping.
 - 2. Lead/lag operation shall not require a master boiler or external control panel. Field wired sensors or communication may be connected to any boiler in the lead/lag sequence.
 - 3. The boilers shall communicate with each other via a private Ethernet/IP addressed network.
 - a. Field wiring between boilers shall be shielded Cat5e or Cat6 Ethernet cable.
 - b. In the event a communication cable becomes damaged or interrupted, communication shall be lost with only one boiler and not the entire lead/lag operation. Daisy chain style wiring lacks this redundancy and shall not be accepted.
 - 4. Sequence of Operation:
 - a. Upon loop temperature dropping below start point, the lead boiler shall be enabled at low fire and shall modulate according to the heating demand.
 - b. As lag boiler stages are enabled according to heating demand, burners shall return to low fire. Boilers shall modulate in parallel as a cohesive unit according to heating demand.
 - c. When all boilers are active they shall be released to modulate in parallel up to full fire according to the heating demand.
 - d. As heating demand decreases, the sequence shall operate in reverse.
 - e. Rotation of the lead and subsequent lag boilers shall be automatic.

- F. 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.
 - b. Control with Factory Installed Jumper: Safety Interlock for External Device, mote Enable, Emergency Stop (E-Stop).
 - c. Remote Setpoint Signal: 4-20 mA or 0-10 VDC.
 2. Communication Protocol: A Modbus communication interface with BAS shall enable BAS operator to remotely enable and monitor the boiler plant from an operator workstation.
 - a. A BACnet MSTP or IP protocol communication gateway shall be provided. The BACnet gateway is field installed on a boiler. Additional boilers in the lead/lag system shall not require a dedicated BACnet gateway for the BAS to monitor status. 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: 208 V.
 2. Phase: Three.
 3. Frequency: 60 Hz.

2.6 VENTING

- A. The boiler shall be capable of operating with a stack effect not exceeding -0.10" W.C. and a combined air intake and exhaust venting pressure drop not exceeding EDR+2500: +1.50" W.C.
1. 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.
 2. Sealed Combustion: Schedule 40 PVC pipe or smooth-walled galvanized steel, vent termination with 1/2" x 1/2" mesh bird screen.
 3. Mechanical Space: Adequate combustion air and ventilation shall be supplied to the boiler room in accordance with boiler manufacturer requirements and local codes.
- B. 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.

- C. Common Exhaust Vents: The draft system shall be designed to prevent the backflow of exhaust gases through idle boilers. The common boiler vent shall not be combined with any other appliance.
- D. 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.

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 materials and installation requirements are specified in Division 03 of this section. Coordinate with general contractor as required. See Front End specifications.
- 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 or local equivalent approved by local code.
- 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.
- I. Connect wiring according to Division 26.

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.
 - 4. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level and water temperature.
- C. Remove and replace malfunctioning units and retest as specified above.

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 off line 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 off line.
- 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 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 BASE 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 SEPARATOR

- A. Furnish and install as shown on Drawings, an external low velocity air separator unit consisting of a steel tank with screwed piping connections and a tapping to connect the air separator directly to the compression tank with screwed piping connections and a tapping to connect the air separator directly to compression tank.
- B. The unit is to be furnished with a steel base and constructed in accordance with ASME boiler pressure vessel code and stamped 125 psi working pressure. The air separator shall be ITT Bell & Gossett "Rolairtrol" or approved equal.

2.2 EXPANSION TANKS (S)

- A. Furnish and install pre-charged bladder type expansion tank(s) of size and capacity as shown on Drawings. Tank shall have carbon steel shell and heavy-duty butyl rubber bladder.
- B. Tank to be constructed for (125 psig) working pressure and to be guaranteed leakproof by manufacturer. Tank to be stamped with "U" symbol and Form U-1 furnished denoting compliance with paragraph U-69 for Construction of Unfired Pressure Vessels Section VIII ASME.

2.3 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.

2.4 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.

2.5 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.

2.6 TRIPLE DUTY VALVES

- A. Furnish and install at each pump a nonslam check valve with a spring loaded disc and a calibrated adjustment feature permitting regulation of pump discharge flow and shut-off. Valves shall be designed to permit repacking under full line pressure.
- B. Unit shall be installed on discharge side of pump in a horizontal or vertical position with the stem up. Allow for minimum clearance of valve stem. This unit shall be cast iron body construction suitable for maximum working pressure of 175 psig and maximum operating temperature of 300 degrees F.
- C. All units shall be ITT Bell & Gossett Triple Duty Valve model, or approved equal.

2.7 SUCTION DIFFUSERS

- A. Furnish and install at each pump a suction diffuser. Units shall consist of angle type body with inlet vanes and combination Diffuser-Strainer-Orifice Cylinder with 3/16 inch diameter openings for pump protection. A permanent magnet shall be located within the flow stream and shall be removable for cleaning.
- B. The orifice cylinder shall be equipped with a disposable fine mesh strainer, which shall be removed after system startup. Orifice cylinder shall have a free area equal to five times cross section area of pump suction opening. Vane length shall be no less than 2-1/2 times the pump connection diameter. Unit shall be provided with adjustable support foot to carry weight of suction piping. Each Suction Diffuser to be ITT Bell & Gossett model, or approved equal.

2.8 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.

2.9 CHEMICAL FEEDING EQUIPMENT

A. Chemical Feed System Description

1. Provide an automatic chemical feeder for boiler where shown on Drawings. The feeder shall be equal to AXIOM model no. SF100-D-P, PACKAGED HYDRONIC SYSTEM FEEDER, as manufactured by Axiom Industries Limited, 2615 Wentz Avenue, Saskatoon, SK S7K5J1. System shall include 55 gallon storage/mixing tank with cover, alternating control panel with lead/lag operation, high/low level alarm, pump suction hose with inlet strainer, two pressure pumps with thermal cutouts, 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 tank, pressure regulating valve (adjustable 5-55 psig) complete with pressure gauge, built-in check valve, union connection, flexible connection hose with check valve, low level pump cut-out. Power supply 115 volt/60 Hz/1 Ph, 3.8 amps. Pump capacity, 1.0 gpm at 50 psig, self-priming. Unit shall be completely pre-assembled and certified by a recognized testing agency.

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 230220

INDOOR AIR HANDLING 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. Horizontal, Direct Drive, 4-pipe, room fan coil unit with painted finish cabinet for exposed installation or ducting.

1.2 QUALITY ASSURANCE

- A. Unit shall be tested in accordance with ARI Standard 440 and ETL listed to US and Canadian safety standard UL 1995 current version. Each coil shall be factory tested for leakage at 600 psig air pressure with coil submerged in water. Insulation and adhesive shall meet NFPA-90A requirements for flame spread and smoke generation. All equipment wiring shall comply with NEC requirements. Product family is certified to standard AHRI 430 Performance Rating of Central Station Air Handling Unit Supply Fans, which utilizes AMCA 210 laboratory test standard.

1.3 DELIVERY, STORAGE AND HANDLING

- A. Each unit shall be individually packaged from point of manufacture. Unit shall be handled and stored in accordance with the manufacturer's instructions.

Part 2 - PRODUCT

2.1 EQUIPMENT

A. General:

- 1. Factory-assembled, horizontal, draw-thru type fan coil for exposed or concealed installations, ducted or free discharge with plenum. Unit shall be complete with DX cooling coil, water heating coil, fan(s), motor(s), drain pan, and all required wiring, piping, controls and special features.

B. Base Unit:

- 1. Units shall be fabricated of galvanized or galvanized steel, 19 gauge, exterior panels with 19gauge interior panels. Internal insulation is 1" fiberglass with 1.5 pound density, providing effective acoustical and thermal control and fire safety. Cabinet shall include removable blower and filter access panels on both sides, return duct flange, filter rack and 4-in. pleated MERV 13 filter. Filter rack is field-adjustable for either 2-in. or 4-in. filter depth. Cabinet exterior has a baked on polyester powder-coated finish for corrosion and scratch resistance while providing

an enhanced appearance. Painted panels shall pass 500 hour salt spray test as described in ASTM B-117.

2. The drain pan shall extend the entire length and width of the coil, with primary and auxiliary connections that are ¾" FPT.
 - a. Double sloped 20ga 304 stainless steel. Drain pan shall have average 3mil thick antimicrobial coating that provides 750hr salt spray rating per ASTM B117.

C. Fans:

1. Direct-driven, double-width fan wheel with forward curved blades, statically and dynamically balanced. The housing shall be constructed of heavy gauge galvanized steel with die-formed inlet cones. Fan wheels shall be constructed of galvanized steel.

D. Coils:

1. Standard base unit shall be equipped with 4-row DX coil, for installation in a 4-pipe system.
2. Hot water heating coils in a 4 pipe system shall be 2-row, slab style perpendicular to airflow, factory installed. Coil fin spacing shall be 10 or 12 fins per inch (FPI). Tube diameter shall be 3/8" OD or ½" OD.
3. Cooling coil options include a 4-row DX coil with TXV (R-410A).
4. All coils shall have copper tubes and aluminum fins. Coil fins are mechanically bonded to tubes. The copper tubes comply with ASTM B-75. The fin thickness is 0.0045-in. All coils are tested with air under water.
5. Water coils are tested in accordance with AHRI 410.
6. DX coils are rated for use with R-410A refrigerant per UL 1995 requirements. 3/8" dia. tube coils are rated for R-410A heat pump operation; ½" dia. tube coils are rated for R-410A cooling service only.

E. Controls and Safeties:

1. Fan Controls: Unit shall be furnished with 24V fan controls to allow control by field-provided and installed 24V thermostat or BAS. Options include:
 - a. ECM-Premium motor controls: variable speed driven by customer-provided 0-10VD fan signal
2. Optional factory-wired selections:
 - a. Integral door disconnect switch
 - b. [as available] Fan current switch (dry contacts)
 - c. Condensate overflow switch
 - d. [as available] Low Limit Thermostat

F. Operating Characteristics:

1. A unit with two coils installed in a 4-pipe system shall be capable of providing heating and cooling, controlled as determined by field-provided and installed valves and controls.
2. In all arrangements, the temperature controls are field-provided and installed and can interface with the unit per section "Controls and Safeties."

G. Electrical Requirements:

1. Sizes 04 through 20 (400 through 2000 cfm): The unit power supply shall be 60 Hz, with standard construction 115V/1-phase. Other factory options are 208/240V/1-phase.
2. Sizes 30 and 40 (3000 and 4000 cfm) The unit power supply shall be 60 Hz, with standard construction 208/240V/3-phase

H. Motor(s):

1. Sizes 04 through 20 (400 through 2000 cfm): Fan motors are ECM-Premium, electrically commutated motor (ECM), up to 40% more efficient than permanent split-capacitor type induction motors, with control options that allow variable speed or on/off fan control.
2. Sizes 30 and 40 (3000 and 4000 cfm): Fan motors are ECM-Premium Symax, electrically commutated motor (ECM), up to 40% more efficient than permanent split-capacitor type induction motors, with control options that allow variable speed or on/off fan control. Size 30 motor is single-shaft, size 40 motor is dual-shaft.

I. Field Installed Accessories:

1. Mixing Box: Return air and outside air damper assemblies constructed of steel channel frames with 19 gauge galvanized steel blades, die formed stiffeners with stops, vinyl (or equivalent) blade-edge seals to minimize leakage, zinc plated hardware, quiet and non-binding brass pivot points, bronze oilite bearings and corrosion-resistant steel shafts. Mixing box shall be fully insulated with 1-in. thick, 1.5-lbs/ft³, Exact-O-Kote® IAQ insulation containing an EPA-registered immobilized antimicrobial agent tested in accordance with ASTM G21 and G22 . Optional – economizer control kit including Belimo ® Zip econ controller and damper actuator, suitable for field mounting for fully-modulating control, compliant with California Title 24 requirements.

END OF SELECTION 230220

SECTION 230260

DUCTLESS SPLIT 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 SYSTEM DESCRIPTION

- A. LG High Efficiency Wall Mount Unit system
- B. Outdoor-mounted, air-cooled condensing unit suitable 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.
- C. Indoor, in-the-ceiling-mounted, direct-expansion fan coil to be matched with the outdoor commercial heat pump unit. Unit be mounted on the wall.

1.2 QUALITY ASSURANCE

- A. Unit construction shall comply with ANSI/ASHRAE 15, latest revision, and with the NEC.
- B. Unit shall be rated (when matched with appropriate outdoor unit) per ARI Standard 210/240. Units shall be certified by UL and CSA.
- C. Units shall be constructed in accordance with UL standards.
- D. Units shall be listed in the CEC directory.
- E. Unit cabinet shall be capable of withstanding Federal Test Standard No. 141 (method 6061) 500-hour salt spray test.
- F. Air-cooled condenser coils shall be leak tested at 350 psig air pressure with the coil submerged in water.

1.3 DELIVERY, STORAGE AND HANDLING

- A. Units shall be shipped in one piece and shall be stored and handled per unit manufacturer's recommendations.

PART 2 - PRODUCTS

2.1 OUTDOOR EQUIPMENT

- A. Factory assembled, single piece, air-cooled outdoor unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, compressor, full or holding charge of R-410A refrigerant, and special features required prior to field start-up.

B. Unit Cabinet

1. Unit cabinet shall be constructed with pre-coated metal (PCM).
2. Unit access panels shall be removable with minimal screws and shall provide full access to the compressor, fan, and control components.
3. Outdoor compartment shall be isolated and have an acoustic lining to assure quiet operation.

C. Fans

1. Outdoor fans shall be direct-drive, variable speed propeller type, with maximum speed up to 950 rpm, and shall discharge air horizontally. Fans shall blow air through the outdoor coil.
2. Outdoor fan motors shall be totally enclosed, single-phase motors with class B insulation and permanently lubricated sleeve bearings. Motor shall be protected by internal thermal overload protection.
3. Shaft shall have inherent corrosion resistance.
4. Fan blades shall be corrosion resistant and shall be statically and dynamically balanced.
5. Outdoor fan openings shall be equipped with PVC coated protection grille over fan and coil.

D. Compressor

1. Compressor shall be fully hermetic digitally controlled inverter driven twin rotary compressor to modulate capacity in 1 Hz increments.
2. Compressor shall be equipped with oil system, operating oil charge, and motor. Internal overloads shall protect the compressor from overtemperature and overcurrent. Scroll compressors shall also have high discharge gas temperature protection if required.
3. Motor shall be NEMA rated class F, suitable for operation in a refrigerant atmosphere.
4. Reciprocating compressors shall be equipped with crankcase heaters to minimize liquid refrigerant accumulation in compressor during shutdown and to prevent refrigerant dilution of oil.
5. Compressor assembly shall be installed on rubber vibration isolators and shall have internal spring isolation.
6. Compressors shall be single phase or 3-phase as specified on the Contract Drawings.

- E. Outdoor Coil: Coil shall be constructed of aluminum fins mechanically bonded to internally enhanced, seamless copper tubes that are cleaned, dehydrated, and sealed.

- F. Refrigeration Components: Refrigerant circuit components shall include brass external liquid line service valve with service gage port connections, suction line service valve with service gage connection port, service gage port connections on compressor suction and discharge lines with Schrader-type fittings with brass caps, accumulator, bi-flow filter drier, pressure relief, reversing valve, electronic controlled expansion valve (EEV), and heating mode metering device.
- G. Controls and Safeties: Operating controls and safeties shall be factory selected, assembled, and tested. The minimum control functions shall include the following:
1. Controls
 - a. Time delay restart to prevent compressor reverse rotation on single-phase scroll compressors.
 - b. Automatic restart on power failure.
 - c. Safety lockout if any outdoor unit safety is open.
 - d. A time delay control sequence is also provided standard through the fan coil board, thermostat, or controller.
 - e. High-pressure and liquid line low-pressure switches.
 - f. Automatic outdoor-fan motor protection.
 - g. Start capacitor and relay (single-phase units without scroll compressors).
 2. Safeties
 - a. System diagnostics.
 - b. Compressor motor current and temperature overload protection.
 - c. High pressure relief.
 - d. Outdoor fan failure protection.
- H. Electrical Requirements
1. Unit shall operate on a 208-v or 230-v, 60 Hz power supply as specified on the equipment schedule.
 2. Unit shall operate on single-phase, 60 Hz power at 115 v or 208/230 v, as specified.
 3. Unit electrical power shall be a single point connection.
 4. Unit control voltage to the indoor-fan coil shall be 24 v.
 5. All power and control wiring must be installed per NEC and all local building codes.
 6. Unit shall have high- and low-voltage terminal block connections.

I. Special Features (Field Installed)

1. Low-Ambient Kit: Control shall regulate fan-motor cycles in response to saturated condensing pressure of the unit. The control shall be capable of maintaining a condensing temperature of 100 F $\pm$ 10 F with outdoor temperatures to -20 F. Installation of kit shall not require changing the outdoor-fan motor.
2. Liquid Solenoid Valve: This electronically operated shutoff valve shall close and open in response to compressor operation. The valve should be used with all long-lines applications (over 100 ft).
3. Crankcase Heater (units with scroll compressors only): Unit shall be shipped with a clamp-on compressor oil sump heater.

2.2 INDOOR EQUIPMENT

- A. Indoor, direct-expansion, single zone high efficiency wall mount fan coil. Unit shall come complete with cooling/heating coil, electric heater, fan, fan motor, piping connectors, electrical controls, condensate pump, and hanging brackets.
- B. Unit cabinet shall be constructed of heavy duty Acrylonitrile Butadiene Styrene (ABS). Fully insulated discharge and inlet grilles shall be attractively styled, high-impact polystyrene (HIPS). Cabinet shall have filter tracks and cleanable filters which shall be accessible from below with a 1/4 -turn fastener. Adjacent room cooling to be provided by a simple knock-out in the cabinet side panel, and cabinet shall have provisions to accommodate a limited amount of ductwork, if desired.
- C. Fan shall be a centrifugal, direct-drive blower type with air intake in center of the unit and discharge on the perimeter. Air louvers shall be adjustable for 2, 3, or 4-way discharge.
- D. Coil: Coil shall be copper tube with aluminum fins and galvanized steel tube sheets. Fins will be bonded to the tubes by mechanical expansion. A drip pan under the coil shall have a factory-installed condensate pump and drain connection for hose attachment to remove condensate.
- E. Motors: Motor shall be totally enclosed and permanently lubricated with inherent protection. Fan motor shall be variable speed.
- F. Electric Heater: Units shall be equipped with factory-mounted electric heaters. Minimum protections shall include overcurrent and high temperature protection.
- G. Controls: Controls shall be 24 v, and shall be easily operated by the user from a wall-mounted control unit. Float control shall be in the condensate sump to shut unit down in case of pump malfunction. A wall-mounted electromechanical thermostat with variable fan-speed selections and an auto/manual switch shall be supplied for field installation. Automatic changeover from cooling to heating modes and selectable start-up delay shall be included. The R-410A refrigerant shall be controlled with a piston-type refrigerant metering device, and evaporator coil freeze protection shall be provided.
- H. Filters: Unit shall have filter track with factory-supplied cleanable filters.

- I. Electrical Requirements: Unit shall operate on a 208-v or 230-v, 60 Hz power supply as specified on the equipment schedule.
- J. Operating Characteristics (See Drawing Schedule)
- K. Special Features (Field Installed)
 - 1. Power Ventilation Kit: Kit shall allow ventilation of the conditioned space with outdoor air. The kit shall include filter, booster fan, and controls.
 - 2. Electronic Programmable Thermostat: Thermostat shall be commercial grade and shall provide 7-day, 4-event scheduling. Integral sub base shall be included. Thermostat shall also provide 3-speed fan switchover capability, air sweep auto changeover, and shall not require a battery to retain memory.
 - 3. Fresh Air Intake Kit: Kit shall include filter and duct connections to provide for outdoor ventilation air.

2.3 AIR CONDITIONING CONDENSATE PUMP

(Provide In All Cases Where Condensate Cannot Drain By Gravity)

- A. Pump shall be equal to "Little Giant" model no. VCMA-15ULS-554401. Automatic, 15 ft. shut-off, 1/2 gallon tank, safety switch check valve, 6 ft. power cord power cord with plug.
- B. Provide 3/8" copper tubing discharge piping installed per manufacturer's recommendations.
- C. For roof discharge applications provide pitch pocket, rigid 3/8" copper discharge piping and gooseneck turned down 12 inches above roof. Provide splash block and remove pump check valve before installation.

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 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. Product Design

- 1. LG Multi V 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 2-5 ton single refrigerant circuit for the Multi V S system, and 6-42 single refrigerant circuit for the Multi V 5 system.
 - 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. 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)

C. 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 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. Voltage tolerance between 187V to 253V
 - b. Voltage imbalance of up to 2%
 - c. Power surge of up to SKA RMS symmetrical.

D. General Features

1. The air-conditioning system shall use R410A refrigerant.
2. 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.
2 to 20 ton units shall be a single frame only.
22 to 34 ton units shall be dual frame only.
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. 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. 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, medium pressure vapor injection, high pressure shell compressors
 - iv. Liquid refrigerant cooled inverter PCB
 - v. Oil separator(s)
 - vi. Accumulator /controlled volume receiver(s)
 - vii. 4-way reversing valve(s)
 - viii. 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. Vapor Injection Valve(s)
 - xv. High and low side Schrader valve service ports with caps
 - xvi. High/low Service valves
 - xvii. Threaded fusible plug
 - xviii. High pressure switch

9. 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. 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
11. 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.
12. Compressor Control:
 - a. Fuzzy control logic shall establish and maintain target evaporating temperature (T_e) to be constant on cooling mode and condensing temperature (T_c) constant on heating mode by Fuzzy control logic to ensure the stable system performance.
13. Initial Test Run (ITR) (Heating or Cooling) / Fault Detection Diagnosis (FDD) Code:
 - a. 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.
14. BMS Integration:
 - a. 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.

15. 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 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. Systems that require computers, hard wire only connection or other devices to collect, review or record operating conditions shall not be allowed.
16. Indoor Unit Connectivity:
 - a. 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.
17. Power and Communication Interruption:
 - a. 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.
18. Connection Ratios:
 - a. The maximum allowable system combination ratio for all VRF systems shall be 130% and the minimum combination ratio shall be 50%.
19. Comfort Cooling Mode:
 - a. 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.
20. The outdoor unit refrigerant circuit shall employ for safety a threaded fusible plug.
21. Refrigerant Flow Control
 - a. 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. 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. Brazed plate heat exchangers shall not be allowed for this function.

- c. Smart Load Control: The air source unit shall be provided with Smart Load Control (SLC) enhanced energy saving algorithm that reduces compressor lift during off peak operation. 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. 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. 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. 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.
22. Refrigerant Volume Management
- a. Active Refrigerant Charge
 - i. 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.
 - iv. 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.
 - v. 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. Manual Seasonal Refrigerant Charge Adjustments
(Applicable for VRF systems without Active Refrigerant Charge)
 - i. 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. 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. 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. This service shall be underwritten, warranted, and administered by the VRF equipment manufacturer – not the local distributor or applied representative.
 - v. 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. 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. VRF Systems with Onboard Alternate Operating Mode Selection Capability
- a. 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. 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. Provide a copy of instructions required to set the Alternate Operation Mode with the initial submittal.
 - d. 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.

E. Field Supplied Refrigerant Piping Design Parameters

- 1. The outdoor unit shall be capable of operating at an elevation difference of up to 360 feet above or below the lowest or highest indoor unit respectively without the requirement of field installed subcooler or other forms of performance enhancing booster devices for the Multi V 5 Series, and 164 feet above or 131 feet below for Multi V S Series.
- 2. The outdoor unit shall be capable of operating with up to 3280 for the Multi V 5 Series and 984 for the Multi V S Series equivalent length feet of interconnecting liquid line refrigerant pipe in the network.

3. The outdoor unit shall be capable of operating with up to 656 actual feet for the Multi V 5 Series and 592 actual feet for the Multi V S Series or 738 equivalent length feet for the Multi V 5 Series and 574 equivalent length feet for the Multi V S Series 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 131 feet for the Multi V 5 Series and 49 feet for the Multi V S Series.
7. The elevation differences for heat pump 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. The acceptable elevation difference between two series connected heat recovery units shall be 16 feet.

F. Defrost Operations

1. 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. 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. Defrost Mode Selection: The outdoor unit shall be provided with a minimum of three field selectable defrost operation modes: Normal, Fast, or Forced.

- a. 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. 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. 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. 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. 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. 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. 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. 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. Indoor Unit Fan Operation During Defrost
 - a. During partial defrost operation indoor units operating in cooling or dry mode shall continue normal operation.
 - b. 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. During full system defrost operation indoor unit fans will cycle off and remain off during the remainder of the defrost cycle.

G. Oil Management

1. 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. 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. 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. 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. 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. Timed oil return operations or systems that do not directly monitor compressor oil level shall not be permitted.
7. 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.

H. Fan and Motor Assembly

1. 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 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. 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. 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 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. The fan motor shall be variable speed with an operating speed range of 0-1150 RPM cooling mode and 0-1150 RPM heating mode. 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. The cabinet shall have option to redirect the discharge air direction from vertical to
8. 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. The fan control shall have a function setting to remove access dust and light debris from the outdoor unit and coil.

I. Cabinet

1. 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. 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. 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:
 - a. Service tool connection
 - b. DIP switches
 - c. Auto addressing
 - d. Error codes
 - e. Main microprocessor
 - f. Inverter PCB
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 and shall have a baked enamel finish.

J. Outdoor Unit Coil

1. Outdoor unit coil shall be designed, built and provided by the VRF outdoor unit manufacturer.
2. 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 a 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. 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. 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.

The outdoor unit coil, all indoor units and pipe network shall be field tested to a minimum pressure of 550 psig.

K. Compressor(s)

1. 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. Compressor shall be a hermetic, high-side shell (HSS), commercial grade, compliant scroll direct-drive design.
 - a. 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. 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. 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. 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. 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. 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. The viscosity property of the PVE oil in the compressor sump shall be maintained irrelevant or compressor operation and the surrounding ambient temperature.
 - a. 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. 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. Low side shell (LSS) type compressors that use suction vapor to cool the compressor motor shall not be acceptable.
9. The compressor motor shall be designed to operate at high temperatures.
 - a. The motor winding insulation shall be designed to operate continuously at a minimum temperature of 180°F without deterioration.
 - b. 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. Low side shell and compressors that use low pressure, low temperature refrigerant gas to cool the motor are not acceptable.
10. Inverter Compressor Controller(s)

- a. Each compressor shall be equipped with a dedicated inverter compressor drive. The control of multiple compressors using a single drive is not acceptable.
 - b. The inverter drive shall vary the speed of the compressor crankshaft between zero (0) Hz and 140 Hz.
 - c. 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. 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.
 - e. 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. Compressor(s)
- a. Each 6, 8, 10 ton frames shall be equipped with a single hermetically sealed, inverter driven, High Side Shell (HSS) scroll compressor.
 - b. 12, 14, 16, 18 and 20 ton frames shall be equipped with dual hermetically sealed, inverter driven, High Side Shell (HSS) scroll compressors.
 - c. 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. The compressor shall be designed for a separate port for oil to be directly returned to the compressor oil sump.
 - e. The compressor bearing(s) shall have Teflon™ coating and shall be an aero type design using High lubricity materials.
 - f. 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. Standard, non-inverter driven compressors shall not be permitted nor shall a compressor without vapor injection or direct sump oil return capabilities.

12. 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.

L. Operational Sound Levels

1. 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. 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.

M. Sensors

1. Each outdoor unit module shall have:
 - a. Suction temperature sensor
 - b. Discharge temperature sensor
 - c. Oil level sensor
 - d. High Pressure sensor
 - e. Low Pressure sensor
 - f. Outdoor temperature sensor
 - g. Outdoor humidity sensor
 - h. Outdoor unit heat exchanger temperature sensors

N. 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.

O. 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.

P. 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.

END OF SECTION 230265

SECTION 230270

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

Units shall be stored and handled per unit manufacturer's recommendations.

PART 2 - PRODUCTS

2.1 CEILING CASSETTE – 4 WAY

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 on the bottom of the unit.
4. 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
5. Ears shall have pre-punched holes designed to accept field supplied all thread rod hangers.
6. 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 four supply air outlets and one return air inlet.
2. The supply air outlet shall be through 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.

4. The unit shall have a guide vane algorithm designed to sequentially change the predominant discharge airflow direction in counterclockwise pattern.
5. 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. 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. The branch duct knockouts shall have the ability to duct up to 1/2 the unit airflow capacity.
12. 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. 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. 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. 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.
7. 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, Super high, Power Cool, and Auto.
9. In heating mode, the indoor fan shall have the following settings: Low, Med, High, Super high and Auto.
10. 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. 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. 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 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. The drain pump shall have a safety switch to shut off the unit if condensate rises too high in the drain pan.
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.
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: 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: 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: 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-programed fan speeds 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.
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.

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 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 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

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 230266

SECTION 230280

VARIABLE FREQUENCY DRIVES

PART 1 – GENERAL

1.1 CONTRACT REQUIREMENTS

Applicable Provisions of the Conditions of the Contract and Division 1 General Requirements govern work in this section. Submit shop drawing for checking and approval.

1.2 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. VFD's 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.

1.3 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. VFD's 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.

1.4 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 VFD's 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 VFD's 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. VFD's 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 VFD's 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. VFD's 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. VFD's 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 0-10V) 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 (ie. 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 VFD's 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 VFD's 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 VFD's 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 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 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.

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. 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 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 ensure 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 ensure 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. See drawings for 'SMRE'.

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, Price, 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 23 0405

DUCT SILENCERS

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 DUCT SILENCERS

A. General

1. Furnish and install Price Silencers, or approved equal, of the sizes, configuration, and performance as described on plans and schedules. Silencer inlet and outlet connections shall be equal to the duct sizes shown on the drawings. Duct transitions shall be provided by the contractor and are not permitted unless shown on the drawings and approved by the engineer. If discrepancies between the suggested specifications and the silencer schedule occur, the latter takes precedence.
2. Performance: Silencer performance characteristics including insertion loss, pressure drop, and generated noise shall have been attained through testing in accordance with the latest ASTM E477 test standard for acoustical duct silencers. Performance data shall be obtained from the manufacturer's NVLAP accredited laboratory. Laboratory performance verification may be requested in the manufacturer's test facility and a comparative test report made available to the engineer.

B. Construction

1. Absorptive Silencers shall consist of solid steel casings, perforated sheet metal liners, absorptive acoustic fiberglass media, and additional liners as required.
2. (Standard) Construction Class 1: 22 gauge galvanized casing / 22 gauge galvanized perforated liner.
3. Acceptable methods of fastening shall be button lock, Pittsburgh lock, and welds. In situations where these methods are not feasible, rivets can be used. Screws or other types of mechanical fasteners will not be acceptable.
4. The silencer perforated liners shall be rigidly fastened to the casing of the silencer on both ends and attached to the outer casing with a minimum of two stiffeners.

- C. Acoustic Media: Acoustic media shall be shot free inorganic glass fiber with long, resilient fibers, bonded with thermosetting resin. Glass fiber shall be packed with a minimum 10% compression to eliminate voids and settling; density shall be consistent with that used to generate catalogued test data.

- D. Film Lined Silencer Models: Film lined silencer models shall be provided with a layer of Tedlar or Mylar film securely wrapped around the internal acoustic media to prevent contamination from moisture and airborne particulate that may be present in the duct system. Acoustic standoff shall run the entire length of the internal baffles and be located between the perforated metal liner and the film liner to ensure the highest level of acoustic performance. If Tedlar or Mylar Film Bagged is required, the acoustic media will be fully encapsulated. Film lined silencers shall have attenuation performance for film lined silencers tested in accordance with latest ASTM E477 standard.
- E. Combustion Ratings: Combustion ratings for acoustic media shall be equal to or less than the combustion ratings noted below when tested in accordance with ASTM E84, UL723 and NFPA255.
Flame Spread Classification: 25
Smoke Development Rating: 50

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 230405

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.

2.3 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.

2.4 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 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 95/5 solder.
2. Solder shall be National Lead 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.

2.5 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.

2.6 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. See drawings for 'SMRE'

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 p.s.i.g. 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 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 sheetmetal 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. All supply, outside air intake and exhaust (on discharge side of fan) and return (in unconditioned spaces) ductwork shall be covered with fiberglass with aluminum foil vapor barrier. All joints shall be lapped so maximum coverage is achieved.
- B. All insulated ductwork shall be insulated with thick 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 New York State Energy Conservation Construction Code.
- D. Thermal acoustic lining of ductwork where indicated shall be 1" thickness fiberglass 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.
- E. Insulate Kitchen exhaust ductwork per NFPA requirements (minimum 2" calcium silicate insulation) and all other agencies having jurisdiction.

2.2 PIPING / EQUIPMENT (INDOOR)

- A. All new or altered heating and chilled water system supply and return 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 mitre 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 New York State Energy Conservation Construction 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.
5. Neatly bevel insulation around handholes, cleanouts, ASME stamp, manufacturer's nametag and catalog number.

M. Insulated Covers for Pumps

1. Do not extend pump insulation beyond or interfere with stuffing boxes or interfere with adjustment and servicing of parts regular maintenance or operating attention.

2.3 PIPING (OUTDOOR)

- A. Refrigerant piping shall be insulated with 1/2" Imcosheild un-split polyolefin insulation.

OR

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.
- B. See front office on Floor Plans.

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 wiremold 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. Comply with FCC rules, Part 15 regarding Class A radiation for computing devices and low power communication equipment operating in commercial environments.
- D. 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
- B. Network Management functions for all Lon Works based devices
- C. 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.

- D. 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.
- E. The NAC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 16 simultaneous users.
- F. 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.
- G. Control equipment and network failures shall be treated as alarms and annunciated.
- H. 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
- I. 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.

- J. Alarm actions may be initiated by user defined programmable objects created for that purpose.
- K. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.
- L. 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.
- M. Provide a “query” feature to allow review of specific alarms by user-defined parameters.
- N. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.
- O. 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

2.8 Change or activity: i.e., Change setpoint, add or delete objects, commands, etc.

2.9 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.

2.10 INTEROPERABLE DIGITAL CONTROLLER (IDC)

- A. Controls shall be microprocessor based Interoperable Lon Markä or Lon Works Controllers (IDC). Where possible, all Interoperable Digital Controllers shall bear the applicable Lon Markä interoperability logo on each product delivered.
- B. HVAC control shall be accomplished using Lon Markä 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.

2.11 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.
- D. 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. 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.

2.12 BROWSER USER INTERFACE SOFTWARE

- 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.

2.13 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.

2.14 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.

2.15 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.

2.16 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. 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.
- E. 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.
- F. 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.
- G. 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.

2.17 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 0-2 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, humidities, 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.

2.18 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.

2.19 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.

2.20 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.

2.21 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.

2.22 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.

2.23 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.

2.24 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.

2.25 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.

2.26 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 CO2 and Space Temperature Sensors: CO2 and space sensors are comprised of two sensors housed in one unit designed to measure both CO2 in the air and the building air temperature. Combination sensor shall have the following features:
 - a. Self-Calibration CO2 sensor with 5 year calibration interval.
 - b. Push button over ride.
 - c. CO2 sensitivity +/- 20 ppm.
 - d. CO2 accuracy +/- 100 ppm.
 - e. Space sensor: 5 or 10K thermistor.

2.27 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.

2.28 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.
- 3.3 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.
- 3.4 WIRING, CONDUIT, TUBING AND CABLE

- A. All wire will be copper and meet the minimum wire size and insulation class listed below:

Wire Class	Wire Size	Isolation Class
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.

3.5 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.

3.6 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

3.7 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.

3.8 SEQUENCES OF OPERATION

A. Cabinet Heaters

1. Point List
 - a. Space Temperature
 - b. Valve Modulation
 - c. Occupied/Unoccupied
2. Sequence of Operation
 - a. Cabinet heaters shall be equipped with manual unit mounted factory controls, to adjust fan speed. Control valve shall modulate to maintain set point.

B. New Ductless Heat Pump Units

1. Point List
 - a. Space Temperature
 - b. Valve Modulation
 - c. Occupied/Unoccupied
2. Sequence of Operation
 - a. Ductless heat pumps shall be equipped with unit mounted, factory controls to satisfy heating and cooling requirements.
 - b. Owner must be able to monitor space temperature and schedule units in Occupied/Unoccupied

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. 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 Pump HWP-1 Start/Stop
- f. HW Pump HWP-2 Start/Stop
- g. HW Flow Status (2)
- h. Boiler Start/Stop
- i. Boiler Auto Signal
- j. Boiler Trouble Signal
- k. Boiler Flame Modulation

2. Sequence of Operation

- a. 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 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 hardwire interlocked with hot water circulating pump operation.

E. 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.

F. HVAC Split System Units with Return Fans

1. Point List

- a. Space Temperature (2)
- b. Discharge Temperature
- c. Freezestat Status
- d. Fan Start/Stop (2)
- e. OA/RA/EA Modulation
- f. Hot Water Valve Modulation
- g. Radiation Valve Modulation
- h. DX Cooling Start/Stop

2. Sequence of Operation

- a. Unoccupied Mode: The outside air damper shall be closed, the return damper and unit coil valve shall be open. 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 and return fan shall run continuously. During morning warm-up mode (room temperature more than 2 degrees below daytime setpoint), outside air damper shall be closed. As room temperature rises, OA/RA and EA dampers shall modulate to minimum position. Should room temperature continue to rise past setpoint, radiation valve and unit coil valves shall modulate closed and then dampers shall modulate further to provide free cooling (based on differential enthalpy). Upon further room temperature rise past setpoint the dampers shall return to minimum OA position and DX cooling shall be energized. As room temperature decreases the reverse shall occur. A manual freezestat shall stop fan, close outside air damper and open unit coil valve.

G. 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.

H. Fin-Tube Radiation

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.

I. 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.

J. 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.

3.9 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.

3.10 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.

3.11 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.

3.12 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 p.s.i.g. 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. Submit shop drawings for checking and approval.

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 ± 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.
- 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.

.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. 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 EXCAVATING AND BACKFILLING
- A. All excavation and backfilling for the work of this Division shall be performed by Division 2.
- 1.17 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.
- 1.18 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.
- 1.20 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.
- 1.21 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.
- 1.22 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.
- 1.23 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.

1.24 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.

1.25 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.

1.26 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. Conduit, conduit fittings, junction and pull boxes and all appurtenances necessary for the raceway systems including necessary supports and fasteners.
 6. Electrical conductors, connectors, fittings and connection lugs.
 7. Branch circuit devices, outlet boxes, pull boxes, motor disconnect switches, etc.
 8. Power wiring to HVAC and Plumbing equipment including disconnect switches as shown and/or required by NEC.
 9. Empty conduit for computer and telephone.
 10. Lighting fixtures and lamps including site lighting and occupancy sensor.
 11. Public address speakers.
 12. Core drilled holes for conduit passing through walls, ceilings and floors.
 13. All necessary cutting, patching and core drilling incidental to the electrical work.

14. Temporary light and power.
15. Licenses, permits, inspection and approvals.
16. Grounding as required as per NEC.
17. Sleeves for conduit and watertight caulking between conduit and sleeve.
18. Testing.
19. Cutting, patching and drilling.
20. Excavation and backfill by others. Sand bedding by Electrical Contractor.

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.

1.1 APPROVED MANUFACTURERS

A. The following list of manufacturers constitutes an approved list:

- | | |
|-----------------------------|---|
| 1. Disconnect Switches | Siemens, Square D, GE |
| 2. Conduit (steel) | Wheatland, Allied, Republic Conduit |
| 3. Conduit Fittings (steel) | Appleton, Crouse-Hind, O-Z, T&B, M&W |
| 4. Wire and Cable | General, South Wire, Rome, Cerro |
| 5. Splicing Connectors | 3M, O-Z, Thomas & Betts |
| 6. Outlet Boxes | Appleton, National, Steel City, Racor |
| 7. Wiring Devices | Arrow-Hart, Hubbell, P & S |
| 8. Fuses | Bussman, Ferraz-Shawmut, Littelfuse |
| 9. Lamp | GE, Sylvania, Philips |
| 10. Motion Sensors | Watt Stopper, Sensorswitch |
| 11. Fire Alarm System | Edwards System Technologies or approved Equal |
| 12. Public Address system | Rauland-Borg, 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. Trenching: Excavation and backfill for conduit and utility on site.
- C. 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 260300

MATERIALS AND METHODS

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 CONDUIT AND CABLE INSTALLATION

- A. Conduit and cable installation shall generally conform to the following procedure unless specifically indicated on the Contract Drawing or specified.
- B. Except where specifically shown otherwise on Drawings, all conduits shall be installed concealed in new and altered areas. In existing areas which are not being altered, wiremold and conduit shall be run exposed for non run ceiling areas.
- C. In vertical risers, electric wiring shall be installed in electro-metallic tubing (EMT) or wiremold as directed in the field.
- D. For final connections to motors - flexible metallic conduit with ground shall be used, not to exceed 6'-0" in length.
- E. In accessible hung ceiling areas branch circuit wiring shall be Metal Clad/MC with ground, copper conductors installed above hung ceiling or in new dry wall construction. All cables shall be supported with approved hangers, where required provide protector plate. All connectors shall be insulated type. MC shall not be installed exposed.

2.2 RIGID GALVANIZED STEEL CONDUITS

- A. All rigid conduit used outdoors, and below grade, shall be hot dipped galvanized. Electrogalvanized shall be use in dry locations. Conduit shall have minimum cover of 24". No running threads shall be used in the assembly of the conduit system; therefore, when a standard couplings cannot be used, approved type unions shall be installed.
- B. The ends of all conduits entering a box, except threaded cast box, shall be securely fastened with two galvanized locknuts and a bushing.
- C. The ends of all conduits shall be reamed out, free from burrs and sharp edges. All conduits piercing outside walls shall be properly sleeved and sealed.
- D. Bushings for terminating threaded conduits shall be insulated screw terminal grounding type. Upper edge shall have nylon ring or a bakelite ring which is bolted into the bushing. Connect ground lug to lug in boxes and/or cabinets using bare tinned copper wire. Bushings shall be as manufactured by OZ Electrical Manufacturing Company or approved equal.

- E. Galvanized steel conduits installed in soil shall be given an external coating of asphalt paint. Where installed in paved areas provide concrete encasement.
- F. Coupling threads of all threaded joints shall be given a coat of conductive anti-seize compound similar and equal to "Kopershield" by Thomas & Betts.
- G. Conduit installed in concrete slab shall be in one layer minimum 2" below the top slab. Maximum 1" diameter. Minimum clearance between parallel conduits 2". If this criteria cannot be met conduit shall be under slabs or installed below the metal deck. All conduit shall be Triangle, Steel Duct, General Electric Company, Pittsburgh or approved equal.

2.3 ELECTRIC METALLIC TUBING (EMT)

- A. EMT shall be used on exposed applications inside the building and all stage wiring. Provide approved feeder racks and/or supports.

2.4 SURFACE METAL RACEWAY

- A. Surface metal raceway: Sheet metal channel with fitted cover, suitable for use as surface metal raceway; as manufactured by wiremold #V200.
 - 1. Size: As shown on Drawing.
 - 2. Finish: Per Architect.
 - 3. Fittings: Couplings, elbows and connectors designed for use with raceway system.
 - 4. Boxes and extension rings: Designed for use with raceway systems.

PART 3 - EXECUTION

3.1 CONDUIT RACEWAY INSTALLATION

- A. In all new/renovated finished areas, conduits shall be run concealed in wall, partitions and above ceilings. Only vertical runs of conduit will be permitted in walls or partitions. In unfinished spaces such as mechanical areas, boiler room, production area, electric closets and existing spaces with inaccessible ceilings/walls, conduit shall be run exposed.
- B. Exposed conduit on ceiling shall be run 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.
- C. Provide all conduits passing through any masonry wall with conduit sleeves, the inside diameter of which shall be at least 1/2" greater than the outside diameter of the conduit passing through it.
- D. The ends of all conduits shall be carefully reamed out free from burrs before installation and after threading. The end of each conduit, 1" and smaller, shall be provided where it enters a junction box, outlet box, cabinet, etc., with a locknut and bushing.

- E. For conduit 1-1/4" and larger, insulated bushings shall be used. If insulated bushings are not of the fully insulated type, and additional locknut shall be used inside the junction box or cabinet before installing the bushings.
- F. The routing of the feeder conduit, as shown on the Drawings, is general. The exact routing shall be determined in the field after verifying all conditions and coordination with other trades. In determining conduit clearances, the Contractor shall note that in no place shall conduit be run within 6" of any heated pipe. Each conduit in a bank of conduit shall be separately clamped. Conduits shall not be supported by wire or other conduits.
- G. Conduit in hung ceiling shall be run on and be secured to slab or primary structural members of ceiling, not to lathing channels of other elements which are direct supports of the ceilings system. Secure conduit firmly to steel by clips and fittings designed for that purpose.
- H. Concealed conduit in slab shall be run in as direct a line and with as long bends as possible. Under no circumstances may conduit with outside diameter dimension greater than 1" be installed in poured concrete floor slabs. In addition, no two conduits shall cross each other in the floor slab. In all such cases, conduit shall be rerouted through other areas, or be run in fill below floor slab and stubbed through the slab at the required locations.
- I. 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 compression fittings for all EMT. Set screw fittings are not acceptable.
- J. No more than three right angle bends shall be permitted in conduit between any two terminations of pull boxes.
- K. During installation of conduit, all unfinished runs and terminations in pull boxes, cabinets, etc., shall be capped and shall be left in place until conduit is ready for installation of conductors. Use plastic caps; paper or wood plugs shall not be used for this purpose.
- L. The use of flexible conduit and armored cable is specifically excluded except as follows:
- M. Final connections to motors shall be made with 18" of liquid tight flexible conduit.
- N. Final connections to recessed lighting fixtures shall be made with not more than 48" of flexible conduit. This requirement shall be strictly adhered to.
- O. Provide all empty conduits for systems as indicated on the Drawings, in which the wiring will not be furnished and installed under this Contract.
- P. Provide #12 gauge galvanized iron fish wire or suitable nylon cord in all empty conduit.

3.2 INSTALLATION - SURFACE METAL RACEWAY

- A. Use a flat-head screw to fasten channel to surfaces, mount plumb and level.
- B. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.
- C. Maintain ground continuity between raceway components to provide a continuous grounding path.
- D. Fastener option: Use clips and straps suitable for the purpose.

3.3 CLEANING AND TESTING CONDUIT

- A. After conduits and accessories have been installed and all concreting operations completed, all conduits runs shall be satisfactorily cleared of all obstructions and foreign matter. Any defects, including those which might damage cable upon installation, shall be corrected.
- B. Conduits installed under this Contract shall be tested by pulling through each conduit a flexible cylindrical mandrel, one-quarter inch less than the inside diameter of the conduit. Any defects of stoppages occurring in portions of the conduit runs installed by the Contractor shall be corrected at the Contractor's own expense.

3.4 WIRE AND CABLES

- A. After conduit work has been completed, each conduit shall have a cloth swab drawn through until moisture is removed; the wire may then be drawn in by means of a steel snake or fish wire which shall be inserted only after the conduit is in place. Wire pulling lubricant shall be Burndy or equal approved. The Contractor shall receive permission from the Owner's representative before pulling of any wire or cable.
- B. The Contractor shall receive permission from the Owner's representative before pulling of any wire or cable.
- C. Provide and install all feeder circuit and signal wiring complete as shown on Drawings and as hereinafter specified. All branch wiring for lighting shall be #12. Branch circuit wiring shall be increased in size if so demanded by wattage/load. All home runs of lighting circuits with runs up to 100 feet shall be #12, runs up to 150 ft. shall be #10.
- D. All wire shall bear the label of the Underwriters Laboratories for type "THWN" - 600 volt general building use and shall have been manufactured not more than eight months prior to installation. Wire shall be properly marked along its entire length for identification and shall have a flame retarding coating. All wire shall be the product of one manufacturer, Anaconda, Simplex, Circle or approved equal. All wiring shall be color coded. Neutral wire shall be white throughout and each phase wire shall be readily identified any place in the system by its color code. All conductors in panel boxes and junction boxes shall be properly tagged with red non-flammable tags properly attached. THHN shall be used as indicated.

- E. Wiring shall be color coded as follows:

120/208 volt system

A Phase	Black
B Phase	Red
C Phase	Blue

- F. Equipment drawn into conduits passing through outside walls to exterior outlets, in underground runs and in all conduits placed in or under the slab which is on unexcavated earth or filled earth shall be "THWN".
- G. Conductors shall be of soft drawn copper and shall have a conductivity of not less than 98%. Wires #8 AWG gauge and larger shall be stranded with double braid; smaller wires may be solid with single braid. Splices shall be made only in outlet, junction, pull or panel boxes and shall not be drawn into conduit. Wire connectors shall be Minnesota Mining "3M" Scotch type, or approved equal.
- H. The use of MC 3C armored cable with ground conductor will be permitted for all branch circuit work above hung ceiling and dry wall construction as noted hereinbefore. All MC work shall be in accordance with the National Electric Code and all other codes having jurisdiction. All cables shall be supported with approved insulators at approximately three foot intervals. MC shall not be installed exposed. Drain wire will not be acceptable as ground.
- I. In addition to the basic color coding described hereinbefore, the following additional identification and tagging shall apply:
- J. The switch legs for local wall switches and in switch panel shall have a distinctive color such as stripped blue, black, or red. In instances where color coding is not practicable, such as short runs of heavy feeder cables taping the ends of the cable with coded colors as indicated above or tagging will be permitted.
- K. Cables shall be tagged in all pull and/or junction boxes, wireways and wiring gutters of panels.
- L. Where two or more circuits run to or through a control device, outlet box or junction box, each circuit shall be tagged as a guide in making connections.
- M. Tags shall identify wire or cable by number and/or piece of equipment served as shown on the Drawings.

3.5 OUTLET BOXES

- A. Outlet boxes shall be not less than #14 gauge pressed steel galvanized and shall be generally 4" square or octagon and not less than 1 1/2" deep. They shall, in all cases, be of size and shape especially adapted to the particular use to which they are put. Switch covers for wall outlets shall be 3/4" deep and shall be tile type in exposed block walls.

- B. Outlet boxes installed in the roughing shall be provided with plastic covers to bring them flush with the finished ceiling. Outlet boxes installed in furred or hung ceilings shall be of the Knight double bar type, securely tied to the furring channels.
- C. Conduit shall be secured to the outlet box by means of a locknut on the outside and a bushing on the inside of the box. Only those openings which are to be used shall be knocked out. Outlet boxes which are to carry fixtures shall be equipped with 3/8" fixture studs.
- D. Locknuts and bushings shall be of steel galvanized with sharp threads and shall be manufactured by Thomas & Betts or approved equal.
- E. Bushings larger than 1 inch diameter shall be of the malleable insulated type as manufactured by OZ Electric Company, type B. Outlet boxes shall be manufactured by Steel City, Appleton, Rayco, National or approved equal. Exposed outlet boxes shall be FS type with cast hubs.
- F. All exposed outlet boxes shall be fastened with expansion screws or lead shields. Wood or fiber plugs will be accepted. Outlet boxes exposed to the weather shall be brass or aluminum.

3.6 SLEEVES

- A. The Electrical Contractor shall set all sleeves for all work which is to be installed under the heading of Electrical Work.
- B. Sleeves shall be standard weight black iron pipe of length to suit floor, wall of partition thickness and size to suit condition. All openings and sleeves shall be installed in wall and slabs, and shall be bored with core type drilling equipment.
- C. Sleeves shall be of such diameter which will provide a 1/2" clearance or caulking space between conduit and sleeves. Conduit shall be installed to center accurately on sleeves.
- D. Sleeves through outside walls and sleeves through interior walls and ceilings shall be caulked air and watertight. The Contractor shall tightly caulk the sleeves with oakum or jute, leaving not less than a 2" space on each exposed end, which shall be completely filled with Thiokol caulking compound.

3.7 CONNECTORS FOR WIRE AND CABLE

- A. Wire and cable connectors shall be solderless, mechanical, solid copper or copper alloy types. Connectors for conductors larger than #8 AWG shall be mechanical bolted type, insulated with clamp on molded covers.
- B. Electrical insulating tape shall be vinyl plastic type with pressure adhesive. All connections having irregular surfaces shall be properly padded with "Scotchfill" putty prior to application of tape.
- C. Terminal tags shall be hard gray fire and waterproof fiber type, approximately 3/64" thick and size suited to the tag legend. Legends shall be legibly lettered on tags with waterproof black indelible ink.
- D. Cable ties shall be nylon straps as manufactured by T & B.

3.8 MISCELLANEOUS MATERIALS

- A. Pipe straps for exposed conduit shall be heavy-duty cadmium or zinc coated one screw malleable rigid conduit clamps, complete with backstraps.
- B. Conduit hangers for single run of conduit shall be one piece electrogalvanized strap steel.
- C. Hanger rods shall be galvanized or cadmium plated threaded steel rods of adequate size to support the load which they carry. Minimum diameter shall be 1/2".
- D. Inserts in existing concrete work shall be expansion anchors with tapped steel or brass core nuts set in drilled holes. Pierce, Phillips Red Head, Star or Ackerman-Johnson expansion nuts will be acceptable.
- E. Special fasteners shall comprise miscellaneous types of conduit and box fasteners of malleable iron or steel with a corrosion resistant coating of cadmium or zinc; these shall be provided as required or necessary to complete the installation of electrical work. The type selected shall be of adequate strength for the load to which it is subjected and of a design suited to installation conditions.
- F. Fastening hardware shall be cadmium or zincplated steel, sheet metal or machine screws, bolt, nuts, washers, shims and similar fastening accessory hardware.

3.9 LOCATIONS OF OUTLETS

- A. The locations of all outlets shown on the Drawings is schematic only. To insure that all outlets are properly located, the Contractors shall thoroughly familiarize himself with the details of the Project and set the outlets in accordance with or as directed by Architect/Engineer. Allowance shall be made for window, door trim or other finishes. Door swings shall be carefully checked before installing switch outlets and such boxes shall be set on the strike side of the door in every case, regardless of the location indicated on the Drawings, unless otherwise approved or directed.
- B. Should an outlet be installed out of its proper relation to architectural details, such location shall be corrected by the Contractor at his own expense to the exact height as determined by the Architect.
- C. The following is to be used only as a guide for centering:

Switches	4□ 0"
Base Receptacles	1□ 6" unless otherwise noted
Fire Alarm Stations	4□
Fire Alarm Horns/Strobe	80□from floor or 6" from ceiling which ever is lower as per ADA rules.
Speakers	as detailed

3.10 ALTERATIONS

- A. The attention of the Contractor is specifically directed to the fact that the work of this project includes an alteration to the existing building. Work shall be carried on at such times and in such a manner as to complete the work in the allotted time.
- B. The Contractor shall remove, relocate, reroute, blank or otherwise take care of existing outlets and conduits which may occur in the areas of alteration or which will interfere with the trades.
- C. Existing outlet/equipment being retained downstream of removed outlet and alteration shall remain active providing all necessary nipping of conduits to new outlets, removing existing wiring, providing new wiring and connections.
- D. All removed fixtures shall be turned over to the Owners warehouse and receipt received of disposed of as directed.
- E. All removed materials shall be removed from the premises as directed.
- F. All circuits both new, altered shall be tagged at each end in approved manner.

END OF SECTION 260300

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> (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. Emergency Lighting Control (if applicable)

B. Related Sections

1. Section 26 04 00 Wiring Devices: Receptacles
2. Section 26 05 75 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

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. 508– Industrial Controls
 2. 916 – Energy Management Equipment.
 3. 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. 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.
 7. Digital Lighting Management (DLM) local network – Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.
 8. 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
 9. 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. 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 daylight 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.
3. 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. Units shall not have any dip switches or potentiometers for field settings.
- D. 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.
- E. 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
- F. 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.
- G. 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. Units shall not have any dip switches or potentiometers for field settings.
- D. 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.
- E. 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. Two RJ-45 ports for connection to DLM local network.
- C. 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.
- D. 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 dependent; each button may be bound to multiple loads.

- E. 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 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. One RJ-45 port for connection to DLM local network.
 - 14. 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.

15. Any load or group of loads in the room can be assigned to a daylighting zone
16. Each load within a daylighting zone can be individually enabled or disabled for discrete control (load independence).
17. 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

2.7 DIGITAL ROOM CONTROLLERS

- A. Digital controllers for lighting bind the room lighting loads to the connected devices in the space without commissioning or the use of any tools. 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. Device Status LEDs to indicate:
 - a. Data transmission
 - b. Device has power
 - c. Status for each load
 - d. Configuration status
 4. Quick installation features including:
 - a. Standard junction box mounting
 - b. Quick low voltage connections using standard RJ-45 patch cable
 5. 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
 6. 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)
 7. The polarity of each load output shall be reversible, via digital configuration, so that on is off and off is on.
 8. UL 2043 plenum rated
 9. Manual override and LED indication for each load

10. 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.
 11. Zero cross circuitry for each load
 12. All digital parameter data programmed into an individual room 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

2.8 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.

2.9 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

2.10 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

- 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 factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system.

3.4 OPTIONAL COMMISSIONING SUPPORT SERVICES

- A. On this project, a commissioning agent will be hired to verify the installation and programming of all building systems, which includes the lighting control system. Manufacturer should include an extra day of technician's time to review the functionality and settings of the lighting control hardware with the commissioning agent, including reviewing submittal drawings and ensuring that instructions on how to configure each device are readily available. Manufacturer is NOT responsible for helping the commissioning agent inspect the individual devices. It will be the commissioning agent's responsibility to create and complete any forms required for the commissioning process, although the manufacturer or contractor may offer spreadsheets and/or printouts to assist the agent with this task.
- B. The commissioning agent shall work with the Electrical Contractor during installation of the lighting control hardware to become familiar with the specific products. The agent may also accompany the manufacturer's technicians during their start-up work to better understand the process of testing, calibration and configuration of the products. However, the contractor and manufacturer shall ensure that interfacing with the agent does not prevent them from completing the requirements outlined in the contract documents.

3.5 OPTIONAL ACCEPTANCE TESTING SUPPORT SERVICES

- A. On all California projects, a certified lighting controls acceptance test technician (CLCATT) must verify the installation of the lighting control system. Manufacturer should include an extra day of factory technician's time to assist the CLCATT review the functionality and settings of the lighting control hardware per the requirements in the California State forms. It will be the CLCATT's responsibility to create and complete any forms required for the commissioning process, although the manufacturer or contractor may offer spreadsheets and/or printouts to assist the CLCATT with this task.

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 260450

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. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit.
- B. Do not use powder-actuated anchors.
- C. 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.
- D. In wet locations install free-standing electrical equipment on concrete pads.

- E. Install surface mounted cabinets and panelboards with minimum of four anchors. Provide steel channel supports to stand cabinet one inch off wall.
- F. 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

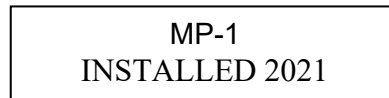
- A. De-grease and clean surfaces to receive nameplates and tape labels.
- B. Install nameplates and tape labels parallel to equipment lines.
- C. Secure nameplates to equipment fronts using screws, rivets, or adhesive. Secure nameplate to inside face of recessed panelboard doors in finished locations.
- 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 SERVICE ENTRANCE/SWITCH

- A. Coordinate all bonding and grounding requirements of the service entrance with the utility company.
- B. Provide ground lug in each switchboard, minimum 25% of phase bus, along entire length of switchboard.

- C. Separately connect each ground to existing grounding electrode. Test existing grounding electrode for proper resistance values and provide all necessary modifications required.

3.2 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.

3.3 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

3.4 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.

3.5 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.

3.6 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.

3.7 TESTING

- A. Upon completion of the installation, confirm the grounding continuity of all raceways, conductors and equipment. Maximum allowable resistance is 25 ohms.

3.8 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 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. Speaker Baffles (room)
 - 1. The room flush mount 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. Speakers shall be a Rauland USO 188 Speaker/Transformer with 8", 25/70 volt 7 watt transformer and 6 oz. magnet.

END OF SECTION 260825

SECTION 260890

ELECTRICAL 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 SUMMARY

- A. Section includes commissioning process requirements for electrical systems, assemblies, and equipment.
- B. Related Sections:
 - 1. Section 01 9100 - General Commissioning Requirements.

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.
- C. Integrated Systems: When referenced this encompasses all control, equipment and systems utilized in support of the facility.
- D. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.3 CONTRACTOR'S RESPONSIBILITIES

- A. Perform commissioning tests at the direction of the CxA and as defined in the contract documents.
- B. Attend construction phase commissioning meetings.
- C. Attend test coordination meetings.
- D. Participate in the electrical system maintenance orientation and inspection for assemblies and equipment as directed by the CxA.
- E. Provide information requested by the CxA, including manufacturer cut sheets and shop drawings 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 startup testing for all normal and emergency power equipment and shall coordinate and execute the electrical tasks for the commissioning checklists for all commissioned equipment.
- I. Provide copies of all submittals as required including all changes thereto.
- J. Facilitate the coordination of the commissioning and incorporate commissioning activities (the Commissioning Plan) into the Overall Project Schedule (OPS).
- K. Ensure that all subcontractors and vendors execute their commissioning responsibilities according to the contract documents.
- L. Provide training in the operation and maintenance of installed equipment for owner personnel.
- M. Review and accept construction checklists provided by the commissioning authority.
- N. Complete startup reports and construction checklists as work is completed and provide to the Commissioning Authority on a weekly basis.
- O. Review and accept commissioning process test procedures provided by the Commissioning Authority.
- P. Complete commissioning process test procedures (functional testing as detailed in functional testing checklists).
- Q. Prepare O&M manuals, according to the contract documents, including clarifying and updating the original sequences of operation to as-built/as-tested conditions.
- R. Cooperate with the CxA for resolution of issues recorded in the "Issues Log".

1.4 CxAS RESPONSIBILITIES

- A. Provide Project-specific construction checklists and commissioning process test procedures for actual electrical systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.
- B. Direct commissioning testing.
- C. Verify testing and operational sequencing per design documents.
- D. Provide a final written report outlining the commissioning process and including commissioning field documentation.

1.5 COMMISSIONING DOCUMENTATION

- A. The contractor shall provide the following information to the CxA for inclusion in the commissioning plan:
 - 1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.

2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
3. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for electrical systems, assemblies, equipment, and components to be verified and tested.
4. Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.
5. System startup reports.
6. Certificate of readiness certifying that electrical systems, subsystems, equipment, and associated controls are ready for testing.
7. Test and inspection reports and certificates.
8. Corrective action documents.
9. Verification of contractually required static and dynamic testing reports.

1.6 SUBMITTALS

- A. Certificates of readiness.
- B. Certificates of completion of installation, prestart, and startup activities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TESTING PREPARATION

- A. Certify that electrical systems, subsystems, and equipment have been installed, calibrated, and started, and that they are operating in the manner required by the Contract Documents.
- B. Certify that electrical instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.
- C. Certify that testing and adjustments have been completed and that testing and adjustment reports have been submitted, discrepancies corrected, and corrective work approved.
- D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
- E. Inspect and verify the position of each device and interlock identified on checklists.
- F. Check safety cutouts, alarms, and interlocks with life-safety systems during each mode of operation.
- G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as required and as directed by the CxA.

3.2 TESTING VERIFICATION

- A. Prior to performance of testing, provide copies of reports, sample forms, checklists, and certificates to the CxA.
- B. Notify the CxA at least (ten) 10 days in advance of testing execution and provide access for the CxA to witness testing procedures.
- C. Provide technicians, instrumentation, and tools to verify testing of electrical systems at the direction of the CxA.
 - 1. The CxA will notify the electrical contractor ten (10) days in advance of the date of field verification. Notice will not include data points to be verified.
 - 2. The electrical contractor shall use the same instruments (by model and serial number) that were used when original data were collected.
 - 3. Failure of an item includes operational sequence as determined in the contract documents including safeties, capacity, and operational integrity.
 - 4. Remedy the deficiency and notify the CxA so verification of failed portions can be performed.

3.3 GENERAL TESTING REQUIREMENTS

- A. Provide technicians, instrumentation, and tools to perform commissioning tests at the direction of the CxA.
- B. Scope of electrical system testing can include, but is not limited to, entire electrical power distribution installation from central distribution to branch circuit to individual equipment served. Testing shall include measuring capacities and effectiveness of operational and control functions.
- C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of interface to the building automation system.
- D. The CxA with coordination of a certified testing agency, shall prepare detailed testing plans, procedures, and checklists for electrical systems, subsystems, and equipment.
- E. Tests will be performed using design conditions whenever possible.
- F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.
- G. The CxA may direct that set points be altered when simulating conditions is not practical.

- H. If tests cannot be completed because of a deficiency outside the scope of the electrical system, document the deficiency and report it to the Construction Management Representative. After deficiencies are resolved, reschedule tests.
- I. 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 check listing by the installing contractors and spot-checked by the CxA during functional testing.

3.4 ELECTRICAL SYSTEMS, SUBSYSTEMS AND EQUIPMENT TESTING PROCEDURES

- A. Electrical Installation and Verification: Testing requirements are specified in Division 26 Sections. Provide submittals, test data, inspection records to the CxA.
 - 1. Insulation resistance testing, mechanical integrity tests and inspections, ground testing, continuity, transformer-specific tests, emergency power system and manufacturer startup according to contract, agency and authority having jurisdiction requirements as indicated in Division 26. Electrical contractor shall prepare supporting documentation for compliance for copy to the CxA.
- B. The following equipment/systems will be commissioned in this project:
 - 1. Lighting Controls.

END OF SECTION 260890

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