PROJECT MANUAL

HVAC Replacement
Gatewood Academy/PEEP
Newport News Public Schools
Newport News, Virginia

IFB # 029-0-2022AP

STATE PROJECT NO. 117-107-01-102

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NEWPORT NEWS PUBLIC SCHOOLS

MJT Project No. 20-127

June 8, 2022

Final Submittal

SECTION 000002 - PROJECT DIRECTORY

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END OF SECTION 000002

Gatewood Senior Center HVAC Replacement
Newport News Public Schools
April 8, 2022

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SECTION 000820 - SPECIAL CONDITIONS

1. SAFETY:

State Occupational Safety and Health Standards apply to this project. The Owner and Engineer shall not be held responsible for enforcement of safety conditions. Particular attention to the following subparts must be observed:

a. Ladders and Scaffolds: All ladders, scaffolds, or temporary work platforms to be kept in locked storage or removed from the job site when not in use or when unattended.

b. Cranes, Hoists, Elevators, and Conveyors: Cranes are to be guarded and/or secured at all times when on the job site so as to avoid becoming a hazard to the public and employees.

Material hoists, lifts, or conveyors are to be secured so as to avoid becoming a hazard when unattended.

c. Motor Vehicles and Mechanized Equipment: Keys must be removed and secured from vehicles and other mobile equipment when not in use or unattended.

Vehicles and mobile equipment with door locking capability will be locked when not in use.

d. Demolition: Pay particular attention to safe procedures for demolition and removal of debris so as not to create a hazard to the public and employees. The disposal of solid waste in open dumps is prohibited.

e. Additional Safety Requirements: No firearms, alcohol, or drugs may be brought onto the project at any time.

All poisonous or otherwise hazardous material will be kept in locked containers when not in use or left unattended.

Contractor’s personnel will strictly adhere to all traffic regulations, traffic patterns, and speed limits.

If any hot work, including but not necessarily limited to welding, burning, or torch cutting, is required, the Contractor will station a watchman inside the building with proper fire extinguisher equipment.

f. Asbestos and all Materials Containing Asbestos: Asbestos containing materials (ACM) are present in the areas of work of this project. All known materials shall be identified to the Contractor by the Owner prior to starting any work. The Owner is responsible for the removal of all ACM required by the work of this project. If the Contractor, during the course of Work, observes or suspects the existence of asbestos in an area of the Work, the Contractor shall promptly notify the Owner. The Owner will provide the Contractor with the instructions relative to the suspected asbestos material. The Contractor shall not perform any

work pertinent to the suspected asbestos material prior to receipt of special instruction from the Owner.

2. APPLICABLE STANDARDS AND CODES:

Wherever reference is made to any published standards, codes, or standard specification, it shall mean the latest standard code, specification, or tentative specification of the technical society, organization, or body referred to, which is in effect at the date of Invitation for Bids. The following is a partial list of typical abbreviations which may be used in the specifications and the organizations to which they refer:

ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
UL	Underwriters Laboratory
NEC	National Electrical Code
USBC	Uniform Statewide Building Code (Virginia)
VBPVRR	Virginia Boiler and Pressure Vessel Rules and Regulations

3. FIRE PROTECTION:

The Contractor shall not use flammable liquids or gases, stoves, salamanders, tar pots, etc., in and on the building unless approved by the Engineer. Where welding, cutting, or burning are necessary, incombustible shields shall be used, and suitable fire extinguishing equipment shall be maintained nearby. Paints, oils, turpentine, and similar materials shall be stored in well-ventilated spaces, and no other materials shall be stored therein. The arrangement for storage must have written approval of the Owner. The Contractor shall provide and maintain an adequate number of fire extinguishers throughout the construction period. Free and unobstructed access shall be maintained at all times to fire extinguishing equipment and fire hydrants.

The Contractor shall designate a regular supervisory employee as a Fire Warden, and he shall be responsible for all fire prevention, fire protective matters, and posting of fire protection procedures at the work site.

4. PREVENTION OF NUISANCE FROM NOISE, ETC.:

The Contractor shall be responsible for curtailing noise, smoke, fumes, or other nuisances resulting from his operations within the limitations set by law and as directed by the Owner or Engineer.

5. PERMITS:

Attention is called to license charges and fees pertaining to construction work, as levied by local governments. Such charges and fees, based on the amount of contracted work, are the responsibility of the Contractor. Such permits include but are not limited to hauling materials, dumping materials, and crossing roads with utilities. All crossings of roads shall be bore crossings unless otherwise agreed to by the Department of Transportation Resident Engineer. The Contractor is also responsible for paying all taxes applicable to the project.

6. TEMPORARY FACILITIES:

The Contractor shall coordinate with Owner Representative for location of trailers, storage, and portable toilet at the pre-construction meeting.

The Contractor shall control workers at all times. Workers are not to use school lounges or telephones.

When possible, parking areas for construction employees in the vicinity of the project site will be allocated. The Contractor is responsible for informing his employees that they cannot park in any location other than the allocated areas. All existing parking regulations will be enforced. Control of vehicles on the site is the responsibility of the Contractor.

Construction fencing, where required, must be adequate to protect persons and property.

7. UNDERGROUND SERVICES:

At all locations, all underground utilities or service lines uncovered or exposed by operations performed under the Contract shall be adequately protected by the Contractor. In the event of damage to underground utilities or service interruptions resulting from failure to follow all applicable procedures, the Contractor will be held responsible for resulting costs.

8. UTILITY OUTAGES:

The Contractor shall not disrupt traffic, utilities, or the normal daily operation of the school nor produce excessive dust, noise, or fumes without prior Owner Representative coordination and permission.

Authority for power outages must be obtained from the Engineer, who will coordinate the interruption of service with the Contractor and the City parties affected. In general, a request for interruption to service will require at least 21 working days for approval.

If telephone, power, cable television, gas, or water lines are to be affected by proposed digging operations, the Contractor shall notify the applicable utility company(s) and request that they locate their utilities in the field.

9. ASBESTOS:

An asbestos inspection was performed and asbestos-containing materials were found as indicated in section 019100 “Asbestos Inspection Reports” included in the project specifications.

END OF SECTION 000820

SECTION 000821 - OWNER'S SPECIAL RULES AND CONDITIONS

The following Rules and Conditions apply to this project. These Rules and Conditions take precedent if in conflict with other similar Rules and Conditions that appear elsewhere in this Specification.

- Contractor shall provide an on-site supervisor for the duration of the contract. Name and local telephone number will be provided to the Owner Representative.
- Contractor shall obtain and post all necessary permits. City Codes Compliance Department will inspect all aspects of the project for compliance with codes and regulations. Contractor's supervisor shall be present during all inspections.
- Contractor shall coordinate with Owner Representative for location of trailers, storage and portable toilet.
- Contractor shall not disrupt traffic, utilities, or the normal daily operation of the school nor produce excessive dust, noise, or fumes without prior Owner Representative permission.
- Contractor will be responsible for removal and proper disposal of all debris and materials generated by the project.
- Contractor shall provide safety barriers or tape around project areas. Contractor shall secure equipment and materials at all times.
- Contractor shall control workers at all times. Workers are not to use school lounges or telephones.
- Smoking is not permitted.
- Any damages sustained through the fault of the contractor shall be repaired or repaid by the contractor.

END OF SECTION 000821

SECTION 010200 - PROJECT SCHEDULE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 PURPOSE

A. The contractor shall submit coordinated equipment shop drawings within ten (10) days after the notice of award for the following equipment:

1. Air Handling Unit (AHU-1 & 2)
2. Condensing Unit (CU-1 & 2)
3. Vertical Classroom Unit Ventilator with Air-Cooled Condenser (UV-A thru G)
4. Split System Air Conditioning Unit (SSAC-1 & 2/OU-1 & 2)
5. Split System Heat Pump Unit (IU-1/OU-3)
6. Boiler (B-1 & 2)

B. The Contractor shall begin work on the date to be specified on the Owner's written "Notice to Proceed" and shall substantially complete the project before December 30, 2022. The Contractor shall pay as liquidated damages the sum of $1,000.00 per day for each consecutive calendar day thereafter for which the project is not substantially complete.

The Contractor shall achieve final completion of the project before January 30, 2023. The Contractor shall pay as liquidated damages the sum of $1,000.00 per day for each consecutive calendar day thereafter for which the project has not achieved final completion.

The Contractor can perform work during any period of time from the Notice to Proceed date and the substantial completion dated noted above, provided the following requirements are met:

- Prior to beginning work on site, the contractor shall present a complete project schedule to the Owner that outlines the intended construction schedule during the occupied and unoccupied periods.
- Any work completed during the occupied periods, shall not disrupt the activities of the students, staff, and operations of the facility.
- All spaces shall be heated or conditioned prior to staff and students returning to the space. If permanent HVAC equipment is not available, the Contractor shall provide temporary cooling or heating as required.
- The Contractor may work during nights, weekends and holidays to complete the project.

1.3 DETAILED DESCRIPTION OF WORK

A. The “Work” generally includes but is not limited to the following:

1. Convert the packaged terminal window units to vertical air-cooled unit ventilators with duct mounted hot water coils.
2. Existing split systems will be replaced in kind as noted on the drawings.
3. Provide three new split systems as indicated on drawings.
4. Remove all existing hot water piping, hot water pumps and boilers.
5. Provide new hot water piping, hot water pumps and condensing boilers.
6. Replace exhaust fans as identified on the drawings.
7. Replace the building automation system with HONEYWELL controls to be provided by a Honeywell Authorized Controls Integrator. This includes the NIAGRA/JACE web server platform.
8. Provide Commissioning for all new mechanical units, boilers, pumps, and controls.
9. All required electrical work to support the mechanical scope.

Contractor shall visit the site and explore the existing conditions prior to bidding. Contractor shall be aware of potential damage to building, sidewalks, roadways, and landscaping in determining the method for removal and installation of equipment. Contractor shall take special care in protecting trees that may interfere with the removal and installation of equipment.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 010200

SECTION 010800 - CODE OF CONDUCT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2. SUMMARY

A. This Section specifies administrative and procedural requirements for the prescribed Code of Conduct while working on school premises.

1.3. CONDUCT

A. The following rules shall apply at all times that students, faculty and staff are on the premises:

1. Owner's Representatives are on site to assist the Contractor (and his subcontractors) in coordination of the Work at the school, and with any required interaction between school personnel. They shall be the only means of communication between the Contractor (and his subcontractors) and persons at the school, except in life threatening emergencies.
2. Minor first-time violation of this relationship will result in a warning or removal from the project. Repeated violations will result in removal from the project.
3. Construction workers shall under no circumstances consult with the school principal and / or teachers regarding any issue of a construction nature, except as noted above.
4. All Contractors (subcontractors) shall wear a colored identification badge while on school premises. Failure to do so is reason for removal from the Job Site.
5. The General Contractor will distribute and maintain badges in accordance with Owner guidelines.
6. Fraternization between construction workers and teachers or students is strictly prohibited. Any contact deviating from normal courteous behavior will be considered reason for removal from the project.
7. If any student or teacher persist in disrupting the activities of construction work, the Owner's representative shall be notified immediately. Any work proceeding at the direction of a teacher, administrator or staff may result in the work being undone, corrected in accordance with the Contract Documents, or no compensation to the contractor.
8. Use of vulgar, suggestive or abusive language is strictly prohibited in the presence of or within earshot of teachers, students, school administrators or staff.
9. Consumption of alcohol or alcohol containing beverages is strictly prohibited on school grounds.
10. Use and / or possession of any controlled substance or substances considered to be illegal are strictly prohibited on school grounds. Any violation will result in removal from the project, and violator shall be turned over to the proper authorities.
11. Use and / or possession of any firearms or weapons considered to be illegal are strictly

prohibited on school grounds. Any violation will result in removal from the project, and violator shall be turned over to the proper authorities.

12. Cigarette smoking is prohibited on school grounds.
13. The use of personal radios / stereos is not permitted.
14. Construction workers shall not use the restrooms throughout the school facility.
15. Contractors shall park in designated areas only.
16. All construction materials and equipment shall be safely secured and stored when not in use.
17. Any demolition work shall not cause any disruption of communication or fire alarm system in occupied areas.
18. All construction work shall be performed to minimize disruption to any school activity. This may require the contractor to schedule work during off peak hours, and shall be accounted for by the contractor during scheduling and included within the bid. Any conflicts shall be brought to the attention of the Architect and Owner's representative prior to proceeding with the work.
19. Construction workers are not permitted free access to the school: Access shall be limited to specific task of construction in designated areas only. The school shall not be used as a shortcut from one portion of construction Work to another, unless specifically designated as a construction route by the Contract Documents or the Owner's representative. This shall apply at all times during the Work without exception.
20. Adequate temporary lighting shall be provided in all demolished / construction areas, including provisions for parking areas which remain in use subsequent to removal of fixtures.
21. Fire exits may not be blocked. (except as indicated in the documents, and as directed by the local authority having jurisdiction)
22. School dumpsters are not for construction debris. The contractor shall provide suitable equipment for prompt and safe removal of all construction debris.
23. Adequate ventilation must be maintained during welding or torch cutting procedures. In addition, spark screens shall be used and adequate fire extinguishing equipment shall be present. All standard safety procedures shall be observed.
24. Appropriate barricading, fencing and signage shall be used to clearly indicate areas of on-going construction, material storage, or any other condition that may create an unsafe environment for non-construction workers.
25. The Contractor is responsible for the safety, security, and cleanliness of all school property which may remain in the assigned areas of construction.
26. For the Contractor's protection, he may solicit the confirmation of the quantity, quality, etc. of the items of concern with the Owner's representative prior to occupancy. Any shortages or damages noted upon returning to the area of the school shall be considered the Contractor's responsibility. This is of special concern in areas where items (such as athletic equipment) are stored. This shall also include, but not be limited to, damage to carpet, vinyl floor, painted walls, blackboards, bulletin boards, clocks, speakers and furniture.
27. Eating from the school cafeteria is not permitted.
28. Fumes from work that occurs adjacent to HVAC intake or exhaust areas shall be blocked so that they do not enter into the HVAC system.

1.4 RESPONSIBILITIES

A. Contractor's responsibilities shall include but not be limited to the following:

1. Owner's Representatives shall be informed and kept advised of all construction activities at the school. They will assist the Contractor in coordination of the Work effecting school systems, such as electrical, mechanical, plumbing, telephone, etc.
2. Minimum 48-hour notice is required prior to disruption of utilities or services to the school.
3. Owner's Representatives shall be informed and kept advised of the schedule for classroom turnover, and the need to have spaces vacated for construction.
4. Owner's Representatives shall be kept advised of any disruptions or concerns that develop at the school, or with any persons at the school not related to the construction.
5. The General Contractor shall have an authorized and qualified representative, project manager or superintendent *on the site at all times* during which Work is proceeding. *No exceptions*.

1.5 SPECIAL COORDINATION AND COOPERATION

A. Owner Occupancy of Existing School Facility: The Owner may occupy all or portions of the existing school facility outside of the construction contract limits for each phase of the construction during some of the construction period. The Contractor shall cooperate with the Owner during the construction period to minimize conflicts and facilitate Owner's usage of the building / premises.

B. The owner will have other contractors working in the immediate area of the scope of this work. Contractors are responsible for coordinating their work with others in the area to minimize and disruption of any work. All contactors are responsible for cleanup of their work area due to their own work activities. The following additional contracts will be active during portions of the work within this contract:

Warwick Health Sciences Academy Contract
NNPS Hazardous Material Abatement Service contract

C. The Contractor shall be responsible for scheduling Work so as not to interfere with the Owner's normal operations.

D. To best facilitate the continued operation of the school (while in session), determine with the Owner a general sequence of construction. The additions can generally be constructed with minimal disturbance of the existing school operation. There will be the need to provide construction tunnels for Life Safety issues. See Plans.

E. Generally, renovations shall be accomplished when areas are vacant or when school is not in session, with full access to the building unless noted otherwise.

F. Where isolating work areas requires closing off existing exit-ways, work shall be coordinated with the Owner and the Fire Marshall, providing and maintaining safe egress from the building.

G. Certain items / materials indicated for removal shall be salvaged and turned over to the Owner.

H. The Contractor shall be advised of the schedule required for the installation of loose furniture, equipment, appliances, etc. as provided by the Owner under separate contract(s) in order to allow time for installation by the owner's forces.

END OF SECTION 010800

SECTION 011100 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DRAWINGS ACCOMPANYING PROJECT MANUAL

A. The Drawings accompanying this Project Manual are listed immediately following the Table of Contents in this Project Manual.

1.3 PROJECT DESCRIPTION

A. The “Work” generally includes but is not limited to the following:

1. Convert the packaged terminal window units to vertical air-cooled unit ventilators with duct mounted hot water coils.
2. Existing split systems will be replaced in kind as noted on the drawings.
3. Provide three new split systems as indicated on drawings.
4. Remove all existing hot water piping, hot water pumps and boilers.
5. Provide new hot water piping, hot water pumps and condensing boilers.
6. Replace exhaust fans as identified on the drawings.
7. Replace the building automation system with HONEYWELL controls to be provided by a Honeywell Authorized Controls Integrator. This includes the NIAGRA/JACE web server platform.
8. Provide Commissioning for all new mechanical units, boilers, pumps, and controls.
9. All required electrical work to support the mechanical scope.

Contractor shall visit the site and explore the existing conditions prior to bidding. Contractor shall be aware of potential damage to building, sidewalks, roadways, and landscaping in determining the method for removal and installation of equipment. Contractor shall take special care in protecting trees that may interfere with the removal and installation of equipment.

1.4 PERMITS, FEES AND CHARGES

A. General: The Contractor shall obtain and pay for all applicable permits, fees and charges.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 011100

SECTION 011400 - CONTRACTOR'S USE OF THE PREMISES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION

A. Work Included: This Section applies to situations in which the Contractor or his representatives, including but not necessarily limited to suppliers, subcontractors, employees, and field engineers, enter upon the Owner's property.

1.3 QUALITY ASSURANCE

A. Promptly, upon award of the Contract, notify all pertinent personnel regarding requirements of this Section.

B. Require that all personnel who will enter upon the Owner's property certify their awareness of and familiarity with the requirements of this Section.

1.4 SUBMITTALS

A. Staff Names: Within 10 days of Notice to Award, submit a list of the Contractor's principal staff assignments, including the Superintendent and other personnel in attendance at the site; identify individuals, their duties and responsibilities; list their addresses and telephone numbers.

B. Post copies of the list in the temporary field office.

1.5 GENERAL

A. Construction areas of the building will be vacated during the construction period. The project shall be substantially complete before December 30, 2022. Final completion shall be achieved before January 30, 2023. The Contractor shall take all precautionary measures required by the Contract Documents, or as deemed necessary by the Owner or Engineer during the construction project, to maintain the site in a safe condition.

B. Permission to interrupt utility service or gain access to the building shall be requested 7 calendar days in advance. Power outages must be coordinated with Owner a minimum of 21 days prior to the outage.

C. Limit use of the premises to construction activities in areas indicated; allow for Owner occupancy and use by the public. Confine operations to areas within limits indicated. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed.

D. The Contractor shall protect all improvements which are to remain from damage. All trees indicated to remain shall have protection devices provided, and the Contractor shall instruct all employees to prevent damage to trees and root systems. All improvement and ground areas damaged during construction shall be restored to like new work. All sidewalks, parking lot surfaces, and curbs shall be protected from the work. Any damaged surfaces shall be restored to new condition.

E. The Contractor shall limit staging areas to prevent scattering of construction materials and equipment throughout site. The Contractor shall indicate at the Pre-Construction meeting the location and limits of staging areas that he anticipates utilizing for approval by Owner.

F. Keep driveways and entrances serving the premises clear and available to the Owner and the Owner's employees at all times. Do not use these areas for parking or storage of materials.

G. During the occupied portions of the project, park in designated pre-approved areas only.

H. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.

I. Maintain the building in a weather-tight condition throughout the construction period. Repair damage caused by construction operations. Take all precautions necessary to protect the building and its occupants during the construction period. Where removal of existing roof construction is necessary to accomplish the Work, have all material and labor ready to provide adequate and approved watertight temporary covering of exposed areas at the end of each day until work is complete.

J. The Contractor shall strictly prohibit weapons, drugs, and tobacco products in all school buildings and property. The Contractor shall restrict and instruct all personnel at the project site that talking to students and/or teachers as well as using school telephones is prohibited. A dress code which requires all construction personnel to wear shirts at all times (without slogans) will be strictly enforced.

1.6 CONTRACTOR'S VEHICLES

A. Parking for Contractor's vehicles, vehicles belonging to employees of the Contractor, and all other vehicles entering upon the Owner's property in performance of the Work of the Contract shall only use the parking and access route as authorized by the Owner.

1.7 SECURITY

A. Restrict the access of all persons entering upon the Owner's property in connection with the work to the access route and to the actual site of the work. Employees of all Contractors shall be required to display a photo identification badge at all times while on Newport News Public School property.

1.8 OWNER OCCUPANCY

A. All work is to be performed outside of normal school operating hours. The owner will have custodial staff and administrative workers onsite during some periods of the construction. The Contractor shall cooperate fully with the Owner and any of his representatives during construction operations to minimize conflicts and to facilitate the Owner's usage of the facilities.

1.9 CONTRACTOR'S USE OF EXISTING BUILDINGS

A. Use of the building will not be permitted, except in the actual area of the work. The Contractor shall not allow the use of the Owner's telephone by the Contractor's personnel, subcontractor personnel, or other persons entering upon the Owner's buildings in connection with the work unless otherwise specified.

1.10 PROJECT SCHEDULE AND PHASING

A. Refer to Section 010200, "Project Schedule".

1.11 RECORD OF EXISTING DAMAGE

A. Prior to beginning work, the Contractor shall photograph or video tape all existing damage to building surfaces, finishes, furniture, equipment, and any other property left in the area of work. A copy of the record video, documentation, and photographs shall be provided to the Owner prior to beginning work. The Contractor shall be responsible for repair or replacement of all property damaged as a result of the Contractor's work. Should a dispute occur, the video tape, documentation, or photographs shall be used to settle the dispute. Any damage not documented shall be considered the Contractor's responsibility. Contractor shall verify the operation of all devices removed to facilitate the construction, including but not limited to speakers, clocks, motion detectors, smoke detectors, light fixtures, etc.

1.12 TIME OF WORK

A. Construction work may be done between the hours of 6:00 A.M. and 4:00 P.M., Monday through Friday. With the Owner's prior approval, work may be done between the hours of 6:00 A.M. and 5:00 P.M., and on Saturday and Sunday.

1.13 SYSTEM SHUTDOWNS

A. The Contractor shall schedule the work in such a manner as to complete the work so that system downtime will be at a minimum. Under no circumstances shall the Contractor shut down any systems without Owner's approval.

B. The Contractor shall not interfere with the operation of equipment and services in those areas of the facility where work is not scheduled and where the Owner, employees, and others occupy the facility, facilities, and/or site.

C. The Owner's representative shall be informed at least 7 calendar days in advance of each scheduled shutdown. The Owner shall approve the shutdown schedule in writing.

1.14 CONTRACTOR'S DUMPSTER

A. Contractor shall provide and dump regularly a minimum 10 cubic yard dumpster on site during the construction period for construction debris disposal.

1.15 MANNER OF CONDUCTING THE WORK

A. Daily Cleanup: The Contractor shall regularly clean up work in a manner consistent with this Specification. The Contractor shall provide daily cleanup of dust and debris to preclude the potential of contamination of new materials and equipment or existing equipment. All building entrances, corridors, sidewalks, and exterior pavement shall be cleaned of debris and materials daily to provide clean and unobstructed vehicular and walk paths. The work shall be so executed, and such temporary facilities furnished, as to preclude interference with access within and between the existing building areas and structures and to cause no possible interference with the operation of any essential service thereof. If daily cleanup is not performed to the satisfaction of the Owner, the Owner reserves the right to perform cleanup after 24 hours' notice and back-charge Contractor at rate of $30.00 per hour.

B. Existing Utilities and Equipment: Do not operate or disturb the setting of valves, switches, or electrical equipment on the service lines to the building, and service within the building, except by proper previous arrangement with the Owner and in the presence of the Owner or his authorized representative.

C. Coordination: Coordinate demolition and installation of temporary and permanent utilities with the Owner. Schedule this work so as to cause no disruption of existing building operation and minimum delay of the work. Notify the Owner a minimum of 7 calendar days in advance of anticipated utility outages, and schedule such work so as not interrupt normal school operations. Coordinate with the LOCALITY to ensure that all underground utilities are marked prior to start of work by Dominion Virginia Power. Coordinate with the LOCALITY Fire Marshal all fire system work and adhere to all requirements of the Fire Marshal for protection of the building.

D. Damage to Existing Facilities: Restore existing work, including concealed work not indicated or specified to be modified, and which is damaged or otherwise affected by the Contractor's operations, to a condition equal to that which existed before the work was commenced. Use workmanlike manner where new construction adjoins, connects to, or abuts existing work. Join new work to existing work in such a manner as to make the joining as inconspicuous as possible. Obvious patching of damaged work will not be acceptable. At the completion, ensure that the buildings and grounds are in first-class condition within the intent of these Specifications, with all new parts well joined to the old as required, all connections completed, and all facilities in full working condition.

E. Protection of Existing Floors, Desks, Carpets, Chairs, and Cabinetry and Other Furnishings: Protect all existing floors, carpets, desks, chairs, cabinetry, chalkboards, tackboards, and any other attached or unattached furnishings in the project areas with a minimum 6-mil polyethylene sheeting. Secure polyethylene sheeting to baseboards to protect floors. Protect wall finishes as required by construction activities. Wall finishes damaged by the attachment of protective sheeting shall be repaired and painted to match surrounding surfaces. Carpet shall be protected with a minimum of two layers of 6-mil polyethylene sheets.

F. Prior to beginning work, the Contractor shall photograph or video tape all existing damage to building surfaces, finishes, furniture, equipment, HVAC equipment, lights, computers and peripherals, intercom, security system, computer drops, and any other property left in the area of work. A copy of the record video and photographs shall be provided to the Owner prior to beginning work. The Contractor shall be responsible for repair or replacement of all property damaged as a result of the Contractor's work. Should a dispute occur, the video tape or photographs shall be used to settle the dispute. Any damage not documented shall be considered the Contractor's responsibility.

G. Final Cleaning: Provide professional cleaners using commercial quality building maintenance equipment and materials to clean the building in accordance with Section 017400, "Final Cleaning", prior to the date of Substantial Completion.

H. Containment: Maintain containment barriers of the project areas as indicated and as required to preclude construction-generated dust and dirt from entering non-construction areas.

I. In the event the Contractor does not comply with the construction documents, the Owner may procure the services of another qualified Contractor and deduct his costs from the Contract amount.

END OF SECTION 011400

SECTION 012000 - APPLICATIONS FOR PAYMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.

B. Coordinate the Schedule of Values and Applications for Payment with the Contractor's Construction Schedule, List of Subcontracts, and Submittal Schedule.

C. The Contractor's Construction Schedule and Submittal Schedule are included in Section "Submittals".

1.3 SCHEDULE OF VALUES

A. Coordinate preparation of the Schedule of Values with preparation of the Contractor's Construction Schedule.

B. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:

1. Contractor's construction schedule.
2. Application for Payment form.
3. List of subcontractors.
4. List of products.
5. List of principal suppliers and fabricators.
6. Schedule of submittals.

C. Submit the Schedule of Values to the Engineer within ten (10) days after receipt of the Notice to Proceed, unless otherwise directed by the Owner.

D. Use the Project Manual Table of Contents as a guide to establish the format for the Schedule of Values.

E. Include the following Project identification on the Schedule of Values:

1. Project name and location.

2. Name of the Engineer.
3. Project number.
4. Contractor's name and address.
5. Date of submittal.

F. Arrange the Schedule of Values in a tabular form with separate columns to indicate the following for each item listed:

1. Generic name.
2. Related Specification Section.
3. Name of subcontractor.
4. Name of manufacturer or fabricator.
5. Name of supplier.
6. Change Orders (numbers) that have affected value.
7. Dollar value.
8. Percentage of Contract Sum to the nearest one-hundredth percent, adjusted to total 100 percent.

G. Provide a breakdown of the Contract Sum in accordance with requirements of the General Conditions and in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Break principal subcontract amounts down into several line items.

H. Round amounts off to the nearest whole dollar; the total shall equal the Contract Sum.

I. For each part of the Work where an Application for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed, provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

J. Margins of Cost: Show line items for indirect costs, and margins on actual costs, only to the extent that such items will be listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete including its total cost and proportionate share of general overhead and profit margin.

K. At the Contractor's option, temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown as separate line items in the Schedule of Values or distributed as general overhead expense.

L. Schedule Updating: Update and resubmit the Schedule of Values when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.4 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by the Engineer and paid for by the Owner.

B. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.

C. Payment Application Times: Each progress payment date is as indicated in the General Conditions. The period of construction Work covered by each Application or Payment is the period indicated in the General Conditions.

D. Payment Application Forms: Use AIA Document G 702 and Continuation Sheets G 703 as the form for Application for Payment.

E. Application Preparation: Complete every entry on the form, including notarization and execution by person authorized to sign legal documents on behalf of the Owner. Incomplete applications will be returned without action.

1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions have been made.
2. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.
3. Email a “pencil copy” to the Engineer for review and concurrence prior to sending the hard copies.

F. Transmittal: Submit **3 executed copies of each Application for Payment** to the Engineer by means ensuring receipt within 24 hours; one copy shall be complete, including waivers of lien, invoices for stored on site material, and similar attachments, when required.

1. Mail hard copies to: Construction Administration Department, 22 Enterprise Parkway, Suite 200, Hampton Virginia 23666.
2. Transmit each copy with a transmittal form listing attachments, and recording appropriate information related to the application in a manner acceptable to the Architect.

G. Waivers of Mechanics Lien: With each Application for Payment submit waivers of mechanics liens from subcontractors or sub-subcontractors and suppliers for the construction period covered by the previous application.

1. Submit partial waivers on each item for the amount requested, prior to deduction for retainage, on each item.
2. When an application shows completion of an item, submit final or full waivers.
3. The Owner reserves the right to designate which entities involved in the Work must Submit waivers.
4. Submit final Application for Payment with or preceded by final waivers from every entity involved with performance of Work covered by the application who could lawfully be entitled to a lien.

H. Waiver Forms: Submit waivers of lien on forms, and executed in a manner, acceptable to Owner.

I. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of the first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of Values.
3. Contractor's Construction Schedule (preliminary if not final).
4. Submittal Schedule (preliminary if not final).
5. Copies of building permits
6. Copies of authorizations and licenses from governing authorities for performance of the Work.
7. Initial progress report.
8. Report of pre-construction meeting.
9. Certificates of insurance and insurance policies.
10. Performance and payment bonds (if required).
11. Data needed to acquire Owner's insurance.

J. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment; this application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

1. Administrative actions and submittals that shall proceed or coincide with this application include:

    a. Occupancy permits and similar approvals.
    b. Test/adjust/balance records.
    c. Maintenance instructions.
    d. Start-up performance reports.
    e. Change-over information related to Owner's use, operation and maintenance.
    f. Final cleaning.
    g. Application for reduction of retainage, and consent of surety.
    h. Advice on shifting insurance coverages.
    i. List of incomplete Work, recognized as exceptions to Architect's Certificate of Substantial Completion.
    j. Waivers of Mechanics Liens.
    k. Items required by the General Conditions.

K. Final Payment Application: Administrative actions and submittals which must precede or coincide with submittal of the final payment Application for Payment include the following:

1. Completion of Project closeout requirements.
2. Completion of items specified for completion after Substantial Completion.
3. Assurance that unsettled claims will be settled.
4. Assurance that Work not complete and accepted will be completed without undue delay.
5. Transmittal of required Project construction records to Owner.
6. Proof that tax, fees and similar obligations have been paid.
7. Removal of temporary facilities and services.
8. Removal of surplus materials, rubbish and similar elements.
9. Final waiver of Mechanics Liens.
10. Items required by the General Conditions.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 012000

SECTION 012500 - PRODUCT SUBSTITUTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for handling requests for substitutions made after award of the Contract.

B. The Contractor's Construction Schedule and the Schedule of Submittals are included under Section 013300, "Submittals".

C. Standards: Refer to Section 014219 "Reference Standards and Definitions" for applicability of industry standards to products specified.

D. Procedural requirements governing the Contractor's selection of products and product options are included under Section 018700 "Materials and Equipment".

1.3 DEFINITIONS

A. Definitions used in this Article are not intended to change or modify the meaning of other terms used in the Contract Documents.

B. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Contractor after award of the Contract are considered requests for "substitutions." The following are not considered substitutions:

1. Substitutions requested by Bidders during the bidding period, and accepted prior to award of Contract, are considered as included in the Contract Documents and are not subject to requirements specified in this Section for substitutions.
2. Revisions to Contract Documents requested by the Owner.
3. Specified options of products and construction methods included in Contract Documents.
4. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

1.4 SUBMITTALS

A. Substitution Request Submittal: Requests for substitution will be considered if received within 30 days after commencement of the Work. Requests received more than 30 days after commencement of the Work may be considered or rejected at the discretion of the Engineer.

B. Submit 6 copies of each request for substitution for consideration. Submit requests in the form and in accordance with procedures required for Change Order proposals.

C. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:

1. Product Data, including Drawings and descriptions of products, fabrication and installation procedures.
2. Samples, where applicable or requested.
3. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.
4. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors that will become necessary to accommodate the proposed substitution.
5. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
6. Cost information, including a proposal of the net change, if any in the Contract Sum.
7. Certification by the Contractor that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

D. Engineer's Action: Within 10 days of receipt of the request for substitution, the Engineer will request additional information or documentation necessary for evaluation of the request. Within 14 days of receipt of the request, or 14 days of receipt of the additional information or documentation, which ever is later, the Engineer will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the product specified by name. Acceptance will be in the form of a Change Order.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Conditions: The Contractor's substitution request will be received and considered by the Engineer when one or more of the following conditions are satisfied, as determined by the

Engineer; otherwise, requests will be returned without action except to record noncompliance with these requirements.

1. Extensive revisions to Contract Documents are not required.
2. Proposed changes are in keeping with the general intent of Contract Documents.
3. The request is timely, fully documented and properly submitted.
4. The request is directly related to an "or equal" clause or similar language in the Contract Documents.
5. The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
6. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
7. A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Engineer for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.
8. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.
9. The specified product or method of construction cannot be coordinated with other materials, and where the Contractor certifies that the proposed substitution can be coordinated.
10. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provide the required warranty.

The Contractor's submittal and Engineer's acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with the Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval.

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 012500

SECTION 012600 - MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing contract modifications.

1.3 MINOR CHANGES IN THE WORK

A. The Engineer will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or Contract Time, on AIA Form G710, Architect's Supplemental Instructions.

1.4 CHANGE ORDER PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: The Engineer will issue a detailed description of proposed changes in the Work that will require adjustment to the Contract Sum or Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

B. Proposal requests issued by the Engineer are for information only. Do not consider them as an instruction either to stop work in progress or to execute the proposed change.

C. Within 10 days of receipt of a proposal request, submit an estimate of cost necessary to execute the change to the Engineer for the Owner's review.

1. Include a list of quantities of products required and unit costs, with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
2. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
3. Include a statement indicating the effect the proposed change in the Work will have on the Contract Time.

D. Contractor-Initiated Proposals: When latent or unforeseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Engineer.

1. Include a statement outlining the reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and Contract Time.
2. Include a list of quantities of products required and unit costs, with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Comply with requirements in Section 012500, "Product Substitutions" if the proposed change requires substitution of one product or system for a product or system specified.

E. Proposal Request Form: Use AIA Document G709 for Change Order Proposal Requests.

1.5 CONSTRUCTION CHANGE DIRECTIVE

A. When the Owner and the Contractor disagree on the terms of a Proposal Request, the Engineer may issue a Construction Change Directive on AIA Form G714. The Construction Change Directive instructs the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

B. The Construction Change Directive contains a complete description of the change in the Work. It also designates the method to be followed to determine change in the Contract Sum or Contract Time.

C. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

D. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.6 CHANGE ORDER PROCEDURES

A. Upon the Owner's approval of a Proposal Request, the Engineer will issue a Change Order for signatures of the Owner and the Contractor on AIA Form G701.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 012600

SECTION 013100 - PROJECT COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and supervisory requirements necessary for Project coordination including, but not necessarily limited to:

1. Coordination.
2. Administrative and supervisory personnel.
3. General installation provisions.
4. Cleaning and protection.

B. Progress meetings, coordination meetings and pre-installation conferences are included in Section 013119, "Project Meetings".

C. Requirements for the Contractor's Construction Schedule are included in Section 013300, "Submittals".

1.3 COORDINATION

A. Coordinate construction activities included under various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections of the Specifications that are dependent upon each other for proper installation, connection, and operation.

1. Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.
2. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.

1. Prepare similar memoranda for the Owner and separate Contractors where coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of schedules.
2. Installation and removal of temporary facilities.
3. Delivery and processing of submittals.
4. Progress meetings.
5. Project Close-out activities.

1.4 SUBMITTALS

A. Staff Names: Within 10 days of Notice to Award, submit a list of the Contractor's principal staff assignments, including the Superintendent and other personnel in attendance at the site; identify individuals, their duties and responsibilities; list their addresses and telephone numbers.

B. Post copies of the list in the temporary field office.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION PROVISIONS

A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.

C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.

D. Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.

E. Visual Effects: Provide uniform joint widths in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Engineer for final decision.

F. Recheck measurements and dimensions, before starting each installation.

G. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.

H. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.

I. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Engineer for final decision.

3.2 CLEANING AND PROTECTION

A. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

B. Clean and maintain completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

C. Limiting Exposures: Supervise construction activities to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:

1. Excessive static or dynamic loading.
2. Excessive internal or external pressures.
3. Excessively high or low temperatures.
4. Thermal shock.
5. Excessively high or low humidity.
6. Air contamination or pollution.
7. Water or ice.
8. Solvents.
9. Chemicals.
10. Light.
11. Radiation.
12. Puncture.
13. Abrasion.
14. Heavy traffic.
15. Soiling, staining and corrosion.
16. Bacteria.
17. Rodent and insect infestation.
18. Combustion.
19. Electrical current.
20. High speed operation.
21. Improper lubrication.

22. Unusual wear or other misuse.
23. Contact between incompatible materials.
24. Destructive testing.
25. Misalignment.
26. Excessive weathering.
27. Unprotected storage.
28. Improper shipping or handling.
29. Theft.
30. Vandalism.

END OF SECTION 013100

SECTION 013119 - PROJECT MEETINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for project meetings including but not limited to:

1. Pre-Construction Conference.
2. Progress Meetings.

B. Construction schedules are specified in another Division-1 Section.

1.3 PRE-CONSTRUCTION CONFERENCE

A. Schedule a pre-construction conference and organizational meeting at the Project site or other convenient location no later than 15 days after execution of the Agreement and prior to commencement of construction activities. Conduct the meeting to review responsibilities and personnel assignments.

B. Attendees: The Owner, Engineer and their consultants, the Contractor and its superintendent, major subcontractors, manufacturers, suppliers and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the Work.

C. Agenda: Discuss items of significance that could affect progress, including such topics as:

1. Tentative construction schedule.
2. Critical Work sequencing.
3. Designation of responsible personnel.
4. Procedures for processing field decisions and Change Orders.
5. Procedures for processing Applications for Payment.
6. Distribution of Contract Documents.
7. Submittal of Shop Drawings, Product Data and Samples.
8. Preparation of record documents.
9. Use of the premises.
10. Office, Work and storage areas.
11. Equipment deliveries and priorities.
12. Safety procedures.

13. First aid.
14. Security.
15. Housekeeping.
16. Working hours.

D. Reporting: No later than 7 days after the pre-construction conference date, the Engineer will distribute copies of minutes of the conference to each party present and to other parties concerned who were not present. Included will be summaries, in narrative form, of all discussions, agreements, decisions and matters concluded.

1.4 PROGRESS MEETINGS

A. Conduct progress meetings at the Project site at regularly scheduled every 2 weeks intervals. Coordinate dates of alternate meetings with preparation of the payment request. The Engineer or the Owner's Construction Program Manager will chair the meeting.

B. Attendees: In addition to representatives of Owner and Engineer, each subcontractor, supplier or other entity concerned with current progress or involved in planning, coordination or performance of future activities shall be represented at these meetings by persons familiar with the Project and authorized to conclude matters relating to progress.

C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project, and topics required by the General Conditions.

D. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

E. Review the present and future needs of each entity present, including such items as:

1. Interface requirements.
2. Time.
3. Sequences.
4. Deliveries.
5. Off-site fabrication problems.
6. Access.
7. Site utilization.
8. Temporary facilities and services.
9. Hours of Work.
10. Hazards and risks.
11. Housekeeping.
12. Quality and Work standards.
13. Change Orders.
14. Documentation of information for payment requests.

F. Reporting: No later than 3 days after each progress meeting date the Engineer will distribute copies of minutes of the meeting to each party present and to other parties who should have been present. The Contractor shall provide a brief summary, in narrative form, of progress since the previous meeting and report, to be attached to the minutes.

G. Schedule Updating: Revise the construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue the revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 PRECONSTRUCTION CONFERENCE FORMAT

A. The format of the Agenda for the Preconstruction Conference shall generally be as follows:

PRE-CONSTRUCTION CONFERENCE FORMAT

PRE-CONSTRUCTION CONFERENCE FOR:

OWNER: _____
PROJECT: _____
LOCATION: _____
COMM. NO.: _____TIME:_____DATE:_____

AGENDA AND MINUTES:

1. GENERAL

   a. Introductions and Registrations of Attendees (sign attached sheet)
   b. Conference Format and Agenda
   c. Agreement, Performance and Payment Bonds and Insurance
   d. Notice to Proceed
   e. Responsibilities of Owner, Contractor, Engineer, and Inspector

2. PROJECT COMMUNICATION AND CORRESPONDENCE

   a. With Contractor:

      Field Superintendent will be: _____
      Company: _____
      Street: _____
      P.O. Box: (if any) _____
      City & Zip: _____
      Attention: _____
      Telephone: Office _____
      Field _____
      Cell _____

   b. With Engineer:

      Project Engineer will be: _____
      Company: _____
      Street: _____
      P.O. Box: (if any) _____
      City & Zip: _____
      Attention: _____
      Telephone: Office _____
      Field _____
      Cell _____

1) For questions, information, etc., Attn:_____
In the absence of Mr. _____, if necessary, contact first _____,
and second_____.

2) For shop drawings and other submittals, use:
_____

3) Discuss submittals and other points on shop drawings, samples, test data, brochures and other submittals.

c. With Owner – Inspector will be_____.
Project Manager: _____.

1) Copies of correspondence
2) Through Inspector and Engineer
3) Project Identification

d. With material suppliers and subcontractors
e. Other

3. SCHEDULE, ESTIMATES, CHANGE ORDERS, AND TIME EXTENSIONS

a. Project Schedule: CPM, bar chart, other
b. Schedule of Values (Lump Sum Breakdown)

c. Monthly requests for payment

1) Closing date
2) Format
3) Preliminary approval by Inspector and Engineer copy to Owner
4) Work done and materials on hand
5) Place and projection of materials on hand
6) Conformance to schedule

d. List of subcontractors and major suppliers

e. Change Orders

1) Request for Proposal and Response
2) Acceptance by Engineer and Owner
3) Change Order execution by Contractor, Engineer, and Owner
4) Time extension, if any
5) Not official until approved by Contractor and Owner

f. Time extensions (other than Change Orders) all are to be on change order request.

4. CONSTRUCTION

a. Manner of conducting the work

b. Construction plant area

1) On-site
2) Off-site
3) Disposal of wastes

c. Project sign(s)
d. Temporary facilities
e. Traffic maintenance
f. Safety – Public, on-site, personnel

g. Contractor's Quality Plan and Owner's Quality Assurance Plan

1) Certificates – mfg.
2) Construction quality

5. PROJECT CLOSEOUT

a. Final cleanup
b. Guarantees

c. Punch lists and final inspections

1) Testing and Adjusting
2) O & M instructions and manuals

d. Final payment, Affidavits for Payments of Debts and Claims, Consent of Surety, Release or Waiver of Liens
e. Record drawings
f. Assessment of Roles in Construction Project
g. Other

6. ADDED COMMENTS BY OWNER

7. ADDED COMMENTS BY CONTRACTOR

8. ADDED COMMENTS BY PRINCIPAL SUBCONTRACTORS

END OF SECTION 013119

SECTION 013300 - SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for submittals required for performance of the Work, including;

1. Contractor's Construction Schedule.
2. Submittal Schedule.
3. Daily Construction Reports.
4. Shop Drawings.
5. Product Data.
6. Samples.
7. Quality Assurance Submittals.

B. Administrative Submittals: Refer to other Division-1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to:

1. Permits.
2. Applications for Payment.
3. Performance and Payment Bonds.
4. Insurance Certificates.
5. List of Subcontractors.

1.3 SUBMITTAL PROCEDURES

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

B. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.

C. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.

1. The Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

2. All samples, shop drawings, and product data for finish materials requiring color selection or verification by the Engineer shall be submitted as follows: All exterior finish materials shall be submitted at one time and the Engineer will take no action on any one submittal until all items have been submitted. All interior finish materials shall also be submitted at one time, and the Engineer will take no action on any one submittal until all items have been submitted.

D. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for re-submittals.

1. Allow 14 days for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Architect will promptly advise the Contractor when a submittal being processed must be delayed for coordination.
2. If an intermediate submittal is necessary, process the same as the initial submittal.
3. Allow 14 days for reprocessing each submittal.
4. No extension of Contract Time will be authorized because of failure to transmit submittals to the Engineer sufficiently in advance of the Work to permit processing.

E. General Contractor's Review: All submittals shall be reviewed and approved by the General Contractor for conformance to the Contract Requirements and coordination with the work of other trades prior to submission to the Engineer. **All submittals submitted without the General Contractor's stamp of approval will not be considered or reviewed by the Engineer** and will be returned to the General Contractor.

F. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.

1. Provide a space approximately 4" x 5" on the label or beside the title block on Shop Drawings to record the Contractor's review and approval markings and the action taken.

2. Include the following information on the label for processing and recording action taken.

a. Project name.
b. Date.
c. Transmittal Number.
d. Transmittal Item Number.
e. Name and address of Engineer.
f. Name and address of Contractor.
g. Name and address of subcontractor.
h. Name and address of supplier.
i. Name of manufacturer.
j. Number and title of appropriate Specification Section.
k. Drawing number and detail references, as appropriate.

G. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Engineer using a transmittal form. Submittals received from sources other than the Contractor will be returned without action.

1. On the transmittal record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.

H. Completion of transmittal form by the Contractor shall be as follows:

1. Transmittal Number: Number each form consecutively as submitted. Re-submittals shall bear the number of the original submission with a letter suffix (A) added to identify it as the first resubmission. The suffix letters (B), (C), etc. shall be used if additional resubmissions are necessary.
2. Date all transmittals.
3. Restrict use of each transmittal form to submittals for one section of Specifications per form.

4. Restrict each transmittal form to a submission in only one of the following categories:

a. For approval.
b. Resubmission for approval.
c. Substitution for approval.

5. Item Number: Number consecutively each item submitted with each transmittal form.
6. Specification section and/or drawing number which describes or requires the item(s) shall be included for each item submitted.
7. Subcontractor: Indicate the Subcontractor for items submitted on each transmittal form.
8. Contractor, or his authorized representative shall sign each transmittal form.

I. Transmittal Form: Use the sample form at the end of this Section for transmittal of submittals.

1.4 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Critical Path Method (CPM) Bar Chart Type Schedule: Prepare a fully developed, critical path method horizontal bar-chart type Contractor's Construction Schedule. Submit within 15 days of the date established for "Commencement of the Work".

1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the Work as indicated in the "Schedule of Values".
2. Within each time bar indicate estimated completion percentage in 10 percent increments. As Work progresses, place a contrasting mark in each bar to indicate Actual Completion.
3. Prepare the schedule on a sheet, or series of sheets, of stable transparency, or other reproducible media, of sufficient width to show data for the entire construction period.
4. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the Work. Show each activity in proper sequence. Indicate graphically sequences necessary for completion of related portions of the Work.

5. Coordinate the Contractor's construction schedule with the Schedule of Values, list of subcontracts, submittal schedule, progress reports, payment requests and other schedules.
6. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Engineer's procedures necessary for certification of Substantial Completion.

B. Distribution: Following response to the initial submittal, print and distribute copies to the Engineer, Owner, subcontractors, and other parties required to comply with scheduled dates. Post copies in the Project temporary field office.

1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

C. Schedule Updating: Revise the schedule after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.

1.5 SUBMITTAL SCHEDULE

A. After development and acceptance of the Contractor's Construction Schedule, prepare a complete schedule of submittals. Submit the schedule within 10 days of the date required for establishment of the Contractor's construction schedule.

B. Coordinate submittal schedule with the list of subcontracts, schedule of values and the list of products as well as the Contractor's construction schedule.

C. Prepare the schedule in chronological order; include submittals required during the first 30 days of construction. Provide the following information:

1. Scheduled date for the first submittal.
2. Related Section number.
3. Submittal category.
4. Name of subcontractor.
5. Description of the part of the Work covered.
6. Scheduled date for re-submittal
7. Scheduled date the Engineer's final release or approval.

D. Distribution: Following response to initial submittal, print and distribute copies to the Engineer, Owner, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the Project and field office.

1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

E. Schedule Updating: Revise the schedule after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.

1.6 DAILY CONSTRUCTION REPORTS

A. Prepare a daily construction report, recording the following information concerning events at the site; and submit copies to the Engineer and Owner at weekly intervals:

1. List of subcontractors at the site.
2. Approximate count of personnel at the site.
3. High and low temperatures, general weather conditions.
4. Accidents and unusual events.
5. Include measured amount of precipitation at project site, occurring daily during period since previous report.
6. Meetings and significant decisions.
7. Stoppages, delays, shortages, losses.
8. Meter readings and similar recordings.
9. Emergency procedures.
10. Orders and requests of governing authorities.
11. Change Orders received, implemented.
12. Services connected, disconnected.
13. Equipment or system tests and start-ups.
14. Partial Completions, occupancies.
15. Substantial Completions authorized.

1.7 SHOP DRAWINGS

A. Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered Shop Drawings.

B. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates and similar drawings. Include the following information:

1. Dimensions.
2. Identification of products and materials included.
3. Compliance with specified standards.
4. Notation of coordination requirements.
5. Notation of dimensions established by field measurement.

C. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2" x 11" but no larger than 30" x 40".

D. Submittals: Submit sufficient number of shop drawings as determined by the Contractor. The Engineer shall retain one copy for his use and two copies for the Owner’s use.

E. Distribution: Furnish copies of final submittal to the installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.

F. Do not proceed with installation until a copy of applicable Shop Drawings is in the installer's possession.

G. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.

H. Engineer will make distribution to the Owner.

1.8 PRODUCT DATA

A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams and performance curves. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as "Shop Drawings."

B. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:

1. Manufacturer's printed recommendations.
2. Compliance with recognized trade association standards.
3. Compliance with recognized testing agency standards.
4. Application of testing agency labels and seals.
5. Notation of dimensions verified by field measurement.
6. Notation of coordination requirements.
7. Material Safety Data Sheets (MSDS).

C. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.

D. Submittals: Submit sufficient number of required submittals as determined by the Contractor. The Engineer shall retain one copy for his use and two copies for the Owner’s use.

1. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.

E. Distribution: Furnish copies of final submittal to the installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.

F. Do not proceed with installation until an applicable copy of Product Data is in the installer's possession.

G. Do not permit use of unmarked copies of Product Data in connection with construction.

H. Engineer will make distribution to the Owner.

1.9 SAMPLES

A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture and pattern.

1. Mount, display, or package Samples in the manner specified to facilitate review of qualities indicated. Prepare Samples to match the Engineer's Sample. Include the following:

a. Generic description of the Sample.
b. Sample source.
c. Product name or name of manufacturer.
d. Compliance with recognized standards.
e. Availability and delivery time.

2. Submit Samples for review of kind, color, pattern, and texture, for a final check of these characteristics with other elements, and for a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
3. Where variation in color, pattern, texture or other characteristics are inherent in the material or product represented, submit multiple units (not less than 3), that show approximate limits of the variations.
4. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation and similar construction characteristics.
5. Refer to other Sections for Samples to be returned to the Contractor for incorporation in the Work. Such Samples must be undamaged at time of use. On the transmittal, indicate special requests regarding disposition of Sample submittals.

B. Preliminary submittals: Where Samples are for selection of color, pattern, texture or similar characteristics from a range of standard choices, submit a full set of choices for the material or product.

1. Preliminary submittals will be reviewed and returned with the Engineer's mark indicating selection and other action.

C. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation and similar characteristics, submit four sets; one will be returned marked with the action taken.

D. Maintain sets of Samples, as returned, at the Project site, for quality comparisons throughout the course of construction.

1. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.

2. Sample sets may be used to obtain final acceptance of the construction associated with each set.

E. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.

F. Field Samples specified in individual Sections are special types of Samples. Field Samples are full-size examples erected on site to illustrate finishes, coatings, or finish materials and to establish the standard by which the Work will be judged.

G. Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

H. Engineer will make distribution to the Owner.

1.10 QUALITY ASSURANCE SUBMITTALS

A. Submit quality-control submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other Sections of the Specifications.

B. Certifications: Where other Sections of the Specifications require certification that a product, material, or installation complies with specified requirements, submit a notarized certification from the manufacturer certifying compliance with specified requirements.

1. Signature: Certification shall be signed by an officer of the manufacturer or other individual authorized to sign documents on behalf of the company.

C. Inspection and Test Reports: Requirements for submittal of inspection and test reports from independent testing agencies are specified in Division 1 Section "Quality Control."

1.11 ENGINEER'S ACTION

A. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Engineer will review each submittal, mark to indicate action taken, and return promptly.

B. Compliance with specified characteristics is the Contractor's responsibility.

C. Action Stamp: The Engineer will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, as follows, to indicate the action taken:

D. Final Unrestricted Release: Where submittals are “FURNISH AS SUBMITTED," that part of the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.

E. Final-But-Restricted Release: When submittals are marked "FURNISH AS CORRECTED," that part of the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.

F. Final-But-Restricted Release Requiring Resubmission: When submittals are marked "REVISE AND RESUBMIT", that part of the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance. Revise or prepare new submittal in accordance with the notations; resubmit without delay.

G. Returned for Re-submittal: When submittal is marked "REJECTED," do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.

1. Do not permit submittals marked "REJECTED" to be used at the Project site, or elsewhere where Work is in progress.

H. Other Action: Where a submittal is primarily for information or record purposes, special processing or other activity, the submittal will be returned, marked "RECEIPT ACKNOWLEDGED".

I. Unsolicited Submittals: The Engineer will return unsolicited submittals to the sender without action.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 013300

SECTION 014219 - REFERENCE STANDARDS AND DEFINITIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

A. General: Basic Contract definitions are included in the General Conditions.

B. Indicated: The term "indicated" refers to graphic representations, notes, or schedules on the Drawings, other paragraphs or schedules in the Specifications, and similar requirements in the Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used, it is to help the reader locate the reference; no limitation on location is intended.

C. Directed: Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean "directed by the Engineer," "requested by the Engineer," and similar phrases.

D. Approve: The term "approved," where used in conjunction with the Engineer's action on the Contractor's submittals, applications, and requests, is limited to the Engineer's duties and responsibilities as stated in General and Supplementary Conditions.

E. Regulation: The term "Regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

F. Furnish: The term "furnish" means supply and deliver to the Project Site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. Install: The term "install" is used to describe operations at project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations".

H. Provide: The term "provide" means "to furnish and install, complete and ready for the intended use".

I. Installer: An "Installer" is the Contractor or an entity engaged by the Contractor, either as an employee, subcontractor, or sub-subcontractor, for performance of a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.

J. The term "experienced" when used with the term "Installer" means having a minimum of 5 previous Projects similar in size and scope to this Project, being familiar with the precautions required, and having complied with requirements of the authority having jurisdiction.

K. Trades: Use of titles such as "carpentry" is not intended to imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter". It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.

L. Assignment of Specialists: Certain Sections of the Specifications require that specific construction activities shall be performed by specialists who are recognized experts in the operations to be performed. The specialists must be engaged for those activities, and assignments are requirements over which the Contractor has no choice or option. Nevertheless, the ultimate responsibility for fulfilling Contract requirements remains with the Contractor.

1. This requirement shall not be interpreted to conflict with enforcement of building codes and similar regulations governing the Work. It is also not intended to interfere with local trade union jurisdictional settlements and similar conventions.

M. Project Site is the space available to the Contractor for performance of construction activities, either exclusively or in conjunction with others performing other work as part of the Project. The extent of the Project Site is shown on the Drawings and may or may not be identical with the description of the land upon which the Project is to be built.

N. Testing Laboratories: A "testing laboratory" is an independent entity engaged to perform specific inspections or tests, either at the Project Site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

1.3 SPECIFICATION FORMAT AND CONTENT EXPLANATION

A. Specification Format: These Specifications are organized into Divisions and Sections based on the Construction Specifications Institute's 16-Division format and MASTERFORMAT numbering system.

B. Specification Content: This Specification uses certain conventions in the use of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are explained as follows:

C. Abbreviated Language: Language used in Specifications and other Contract Documents is the abbreviated type. Implied words and meanings will be appropriately interpreted. Singular words will be interpreted as plural and plural words interpreted as singular where applicable and the full context of the Contract Documents so indicates.

D. Imperative and streamlined language is used generally in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the text, for clarity, subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.

1. The words "shall be" shall be included by inference wherever a colon (:) is used within a sentence or phrase.

1.4 INDUSTRY STANDARDS

A. Applicability of Standards: Except where the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Where the date of issue of a referenced standard is not specified, comply with the standard in effect as of date of Contract Documents.

C. Conflicting Requirements: Where compliance with two or more standards is specified, and the standards establish different or conflicting requirements for minimum quantities or quality levels, refer requirements that are different, but apparently equal, and uncertainties to the Engineer for a decision before proceeding.

1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. In complying with these requirements, indicated numeric values are minimum or maximum, as appropriate for the context of the requirements. Refer uncertainties to the Engineer for a decision before proceeding.

D. Copies of Standards: Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to that entity's construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed for performance of a required construction activity, the Contractor shall obtain copies directly from the publication source.

E. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where such acronyms or abbreviations are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards generating organization, authority having jurisdiction, or other entity applicable to the context of the text provision. Refer to the "Encyclopedia of Associations," published by Gale Research Co., available in most libraries.

1.5 GOVERNING REGULATIONS/AUTHORITIES

A. The Engineer has contacted authorities having jurisdiction where necessary to obtain information necessary for preparation of Contract Documents; that information may or may not be of significance to the Contractor. Contact authorities having jurisdiction directly for information and decisions having a bearing on the Work.

1.6 SUBMITTALS

A. Permits, Licenses, and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence, and records established in conjunction with compliance with standards and regulations bearing upon performance of the Work.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 014219

SECTION 015000 - TEMPORARY FACILITIES AND PROTECTION OF PROPERTY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies requirements for temporary services and facilities, including utilities, construction and support facilities, security and protection of property.

B. Temporary utilities required include but are not limited to:

1. Use of electric power and water.
2. Provision of telephone and fax.
3. Sanitary facilities, including drinking water.

C. Temporary construction and support facilities required include but are not limited to:

1. Temporary job office.
2. Waste disposal services.
3. Construction aids and miscellaneous services and facilities.

D. Security and protection facilities required include but are not limited to:

1. Staging and storage areas.
2. Temporary fire protection.
3. Barricades, warning signs, lights.
4. Protection of installed work.
5. Security against theft and vandalism.

1.3 SUBMITTALS

A. Drawings: Submit partial site plans that indicate the following:

1. Proposed locations of fenced temporary storage areas for material and equipment.
2. Dimensions of fenced storage locations indicating gates.
3. Location of job office.
4. Contractor parking area.
5. Proposed crane access for setting of roof mounted equipment.

1.4 QUALITY ASSURANCE

A. Regulations: Comply with industry standards and applicable laws and regulations if authorities having jurisdiction, including but not limited to:

1. Building Code requirements.
2. Health and safety regulations.
3. Utility company regulations.
4. Police, Fire Department and Rescue Squad rules.
5. Environmental protection regulations.

B. Standards: Comply with NFPA Code 241, "Building Construction and Demolition Operations", ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition".

1.5 PROJECT CONDITIONS

A. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

B. Maintain security against theft and vandalism for the site and the building at all times until the date of Substantial Completion.

1.6 DESCRIPTION OF REQUIREMENTS

A. Definitions: Specific administrative and procedure minimum actions are specified in this section, as extensions of provisions in General Conditions and other contract documents. These requirements have been included for special purposes as indicated. Nothing in this section is intended to limit types and amount of temporary work required, and no omission from this section will be recognized as an indication by the Engineer that such temporary activity is not required for successful completion of the work and compliance with requirements of contract documents. Provisions of this section are applicable to, but not limited to utility services, construction facilities, security/protection provisions and support facilities.

B. It shall be the responsibility of the Contractor to determine the applicable requirements to initiate and maintain all required safety and health programs, and to follow the recommendations of Federal, State and Local officials.

1.7 JOB OFFICE

A. Contractor is not required by the contract to have separate office space or trailer onsite. The contractor shall designate the place where all contract information will be posted as required.

1.8 TEMPORARY ELECTRIC POWER AND WATER

A. The contractor may utilize existing permanent electric power and water within the facility during the construction phase of the work. Coordinate connection requirements with Owner's representative. All connection costs shall be borne by the Contractor. Usage costs shall be borne by the Owner. Contractor's use of Owner's existing permanent power and water shall in no way limit availability of these utilities to the Owner's facilities. Contractor shall restore Owner's permanent utilities to pre-construction conditions after removal of temporary utility connections.

1.9 TEMPORARY TELEPHONE AND FAX

A. Provide a job telephone and fax machine through the completion of all punch list items until Substantial Completion and Owner occupancy.

B. Pay for installation, maintenance, removal, and local service charges.

C. Long-distance calls shall be paid by the party who places the call.

1.10 SANITARY FACILITIES

A. Provide and maintain temporary toilets as necessary for use of all construction personnel. Place toilets in convenient locations, and maintain in sanitary condition. Provide portable container or sanitary bubbler drinking fountains.

B. Provide adequate washing facilities for all construction personnel. Place in convenient locations.

C. Existing toilet facilities shall not be used by construction personnel.

D. Sanitary facilities shall be located as directed by Owner. Provide sanitary facilities for the duration of the project including the punch list period.

1.11 SIGNS

A. A project sign may be provided in accordance with the Owner's standards.

1.12 FIRE PROTECTION

A. Provide temporary fire protection as required by authorities having jurisdiction throughout the entire construction period. Maintain access to the site and to the building at all times for Fire Department apparatus and personnel. Maintain access to fire protection devices at all times.

1.13 STAGING AND STORAGE AREAS

A. Locate staging and storage areas within areas designated or approved by the Owner. Provide gates, double gates, fencing and locks as required to secure all construction materials and protect from vandalism. Remove any potentially hazardous or flammable materials, including all welding materials, from the site at the end of each workday. Materials which will be installed in the project area shall not be stored in uncontrolled exterior locations where they may be susceptible to temperature, humidity, rain, dirt, and dust.

B. Provide and maintain weathertight storage as required.

1.14 PROTECTION OF INSTALLED WORK

A. Protect installed work from elevated temperature and humidity, dust, and dirt. Provide special protection where specified in individual Specification Sections.

B. Provide protective coverings at openings in air-handling units, ductwork, chases, walls, and other items of construction to prevent damage, contamination by dust, and transmission of dust to other spaces.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to minimize damage.

D. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

E. Use all means necessary to protect the site, the building, and all materials stored or installed at all times, including the employment of a watchman or guard when required.

F. Provide weather protection as described in this specification for any penetrations made in the existing building.

G. Where mechanical and other construction work is performed from the roof, the immediate area or as indicated shall be protected with plywood, particle board, or other approved protection board. Where construction workers are likely to walk, protect similarly. Protection shall be secured in an approved manner to prevent damage to roof. Remove protection board from the site upon completion of the work.

1.15 REMOVAL

A. Remove all temporary facilities from the site and leave the site and affected off-site areas in a clean and finished condition prior to final acceptance.

1.16 OSHA (Occupational Safety and Health Act)

A. Comply with all requirements of the Occupational Safety and Health Act for job safety and health standards.

1.17 CONSTRUCTION AIDS

A. Provide all temporary stairs, ladders, ramps, runways, hoists, chutes, and other facilities necessary for the proper execution of the work. Provide guard rails and warning lights as required for job safety.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials suitable for the use intended.

2.2 EQUIPMENT

A. General: Provide equipment suitable for use intended.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed, or are replaced by authorized use of completed permanent facilities.

C. Temporary Lighting: Whenever overhead floor or roof deck has been installed, provide temporary lighting with local switching.

D. Install and operate temporary lighting that will fulfill security and protection requirements, without operating the entire system, and will provide adequate illumination for construction operations and traffic conditions.

E. Telephones: Provide cellular telephone service for all personnel engaged in construction activities, throughout the construction period, until final completion.

F. Sanitary facilities include temporary toilets, wash facilities and drinking water fixtures. Comply with regulations and health codes for the type, number, location, operation and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs.

G. Provide toilet tissue, paper towels, paper cups and similar disposable materials for each facility. Provide covered waste containers for used material.

H. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy. Use of pit-type privies will not be permitted.

I. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for a healthy and sanitary condition. Dispose of drainage properly. Supply cleaning compounds appropriate for each condition.

J. Drinking Water Facilities: Provide containerized tap-dispenser bottled-water type drinking water units, including paper supply.

3.2 TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES INSTALLATION

A. Maintain temporary construction and support facilities until near Substantial Completion. Remove prior to Substantial Completion, unless otherwise indicated. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.

B. Temporary Enclosures: Provide temporary enclosure for protection of construction in progress and completed, from exposure, foul weather, other construction operations and similar activities.

C. Install tarpaulins securely, with incombustible wood framing and other materials. Close openings of 25 square feet or less with plywood or similar materials.

D. Close openings through floor or roof decks and horizontal surfaces with load-bearing wood-framed construction.

E. Temporary Lifts and Hoists: Provide facilities for hoisting materials and employees. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

F. Project Identification and Temporary Signs: Signs are not permitted.

G. Collection and Disposal of Debris and Waste: Collect debris and waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80 deg F

(27 deg C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material in a lawful manner.

H. Burying of waste materials on the site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

I. Provide rodent proof containers located convenient to areas of construction.

J. Provide a dumpster for use by all subcontractors.

3.3 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer as requested by the Engineer.

B. Temporary Fire Protection: Until fire protection needs are supplied by permanent facilities, install and maintain temporary fire protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers," and NFPA 241 "Standard for Safeguarding Construction, Alterations and Demolition Operations."

1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stairwell.
2. Store combustible materials in containers in fire-safe locations.
3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways and other access routes for fighting fires. Prohibit smoking in hazardous fire exposure areas.

C. Provide supervision of welding operations, combustion type temporary heating units, and similar sources of fire ignition.

D. Barricades, Warning Signs and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed provide lighting, including flashing red or amber lights.

E. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft and similar violations of security.

F. Storage: Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.

G. Environmental Protection: Provide protection, operate temporary facilities and conduct construction in ways and by methods that comply with environmental regulations, and

minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment which produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near the site.

3.4 OPERATION, TERMINATION AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.

B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation and similar facilities on a 24-hour day basis where required to achieve indicated results and to avoid possibility of damage.
2. Protection: Prevent water filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

C. Termination and Removal: Unless the Engineer requests that it be maintained longer, remove each temporary facility when the need has ended, or when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces and replace construction that cannot be satisfactorily repaired.

D. Materials and facilities that constitute temporary facilities are property of the Contractor. The Owner reserves the right to take possession of Project identification signs.

E. Repair or replace street paving, curbs and sidewalks damaged by construction activities to match surrounding conditions.

F. Seed the staging and storage areas within construction fences and any other areas on the school property where damage has occurred due to trucks, cranes, excavations, or other construction activities.

G. A satisfactory stand of turf from the seeding operation is defined as a minimum of 15 grass plants per square foot. Bare spots can be no larger than 6" square. Total bare spots must be less than 2% of the total seeded area.

H. Contractor is responsible for maintenance of seeded area until acceptance by Owner.

END OF SECTION 015000

SECTION 017000 - PROJECT CLOSEOUT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:

1. Punch List procedures.
2. Project record document submittal.
3. Operating and maintenance manual submittal.
4. Submittal of warranties.
5. Final cleaning.

B. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions 1 through 26.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting punch list for certification of Substantial Completion, complete the following. List exceptions in the request.

1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100% completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.

    a. If 100% completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.

2. Advise Owner of pending insurance change-over requirements.
3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.
4. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities; include occupancy permits, operating certificates and similar releases.

5. Submit record drawings, operations and maintenance manuals, and similar final record information. Operations and maintenance manuals shall be furnished to Owner 14 days before date operation and maintenance instructions and demonstrations are to occur.
6. Deliver tools, spare parts, extra stock, and similar items.
7. Make final changeover of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of changeover in security provisions.
8. Complete start-up testing of systems, and instruction of the Owner's operating and maintenance personnel.
9. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.
10. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

B. Contractor's Punch List Report: Prepare a complete list of all work remaining to be completed, deficiencies to be corrected, and any other items or requirements not yet fulfilled.

C. Punch List Procedures: On receipt of a request for Punch List and the Contractor's Punch List Report, the Engineer will either proceed with Punch List or advise the Contractor of unfulfilled requirements. The Engineer will prepare the Certificate of Substantial Completion following Punch List, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.

D. The Engineer will repeat Punch List when requested and assured that the Work has been substantially completed.

E. Results of the completed Punch List will form the basis of requirements for final acceptance.

1.4 FINAL ACCEPTANCE

A. Preliminary Procedures: Before requesting final Punch List for certification of final acceptance and final payment, complete the following. List exceptions in the request.

1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
3. Submit a certified copy of the Engineer's final Punch List of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance and the list has been endorsed and dated by the Engineer.
4. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion, or when the Owner took possession of and responsibility for corresponding elements of the Work.
5. Submit Consent of Surety to Final Payment.
6. Submit a final liquidated damages settlement statement.
7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
8. See Project Closeout Checklist at the end of this Section for additional requirements.

B. Punch List Backcheck Procedure: The Engineer will backcheck the Work upon receipt of notice that the Work, including Punch List items from earlier Punch Lists, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Engineer.

1. Upon completion of backcheck, the Engineer will prepare a certificate of final acceptance or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
2. Only if absolutely necessary, will the Punch List backcheck procedure be repeated. It is the Contractor's responsibility to inspect the Work and have all items completed prior to requesting a Punch List backcheck. All Engineer's costs incurred beyond the initial Punch List backcheck shall be borne by the Contractor.

1.5 RECORD DOCUMENT SUBMITTALS

A. General: Refer to Section 017839, “Project Record Documents”, for additional requirements. Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Engineer's reference during normal working hours.

B. Maintenance Manuals: Refer to Section 017823, “Operation and Maintenance Data” for submittal requirements.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 CLOSEOUT PROCEDURES

A. Operating and Maintenance Instructions: Arrange for each installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. Two weeks prior to all demonstrations, such as the mechanical and electrical controls and equipment, plumbing, and, fire alarm, the Owner shall have in his possession all related manuals of operation and maintenance for the system. The Owner shall be notified one week in advance of intended time and date of all above demonstrations. Include a detailed review of the following items:

1. Maintenance manuals.
2. Record documents.
3. Spare parts and materials.
4. Tools.
5. Lubricants.
6. Fuels.

7. Identification systems.
8. Control sequences.
9. Hazards.
10. Cleaning.
11. Warranties and bonds.
12. Maintenance agreements and similar continuing commitments.

B. As part of instruction for operating equipment, demonstrate the following procedures:

1. Start-up.
2. Shutdown.
3. Emergency operations.
4. Noise and vibration adjustments.
5. Safety procedures.
6. Economy and efficiency adjustments.
7. Effective energy utilization.
8. Trouble-shooting procedures and corrections (explain most frequent causes of failure).

P R O J E C T C L O S E O U T C H E C K L I S T

The following items must be submitted prior to processing Final Application and Certificate for Payment and Closeout of Project.

ITEM	**STATUS**
Certificate of Substantial Completion	Engineer will provide
Letter from Contractor indicating that items on the Punch List have been completed, corrected and accepted by the Engineer	Contractor will provide
Consent of the Surety Company to final payment General Release from Contractor	Contractor will provide
Release of Liens from Major Subcontractors	Contractor will provide
Affidavit of the Contractor that all Subcontractors and material men have been paid in full	Contractor will provide
Written certification from the Contractor to the Engineer and Owner that no asbestos containing materials or products were included in the Project	Contractor will provide
Record Drawings	Contractor will provide
Record Specifications	Contractor will provide
Operations and Maintenance Manuals	Contractor will provide
Standard Warranty from Contractor	Contractor will provide
Special Warranties from Materials & Equipment Suppliers	Contractor will provide
Cost proposals for all outstanding changes in the Contract.	Contractor will provide
Final Application and Certificate for Payment	Contractor will provide

END OF SECTION 017000

SECTION 017400 - FINAL CLEANING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for final cleaning at Substantial Completion.

B. Special cleaning requirements for specific elements of the Work area included in appropriate Sections of Divisions 1 through 16.

C. General Project closeout requirements are included in Section 017000, "Project Closeout".

D. General cleanup and waste removal requirements are included in Section 015000, "Temporary Facilities".

E. Environmental Requirements: Conduct cleaning and waste disposal operations in compliance with local laws and ordinances. Comply fully with federal and local environmental and anti-pollution regulations.

1. Do not dispose of volatile wastes such as mineral spirits, oil or paint thinner in storm or sanitary drains.
2. Burying of debris, rubbish or other waste material on the premises will not be permitted.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by the manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property, or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Provide final cleaning operations when indicated. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of Work to the condition expected from a commercial building cleaning and maintenance program. Comply with manufacturer's instructions.

B. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion for the entire Project or a portion of the Project.

C. Clean the Project site, yard and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste materials, litter and foreign substances. Sweep paved areas broom clean. Remove petro-chemical spills, stains and other foreign deposits. Rake grounds that are neither planted nor paved, to a smooth even-textured surface.

D. Remove tools, construction equipment, machinery and surplus material from the site.

E. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.

F. Remove debris and surface dust from limited access spaces, including roofs, plenums, and similar spaces.

G. Remove labels that are not permanent labels.

H. Touch-up and otherwise repair and restore marred exposed finishes and surfaces. Replace finishes and surfaces that can not be satisfactorily repaired or restored, or that show evidence of repair or restoration. Do not paint over "UL" and similar labels, including mechanical and electrical name plates.

I. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication, paint and mortar droppings and other foreign substances.

J. Leave the Project clean and ready for occupancy.

K. Removal of Temporary Protection: Remove temporary protection and facilities installed during construction to protect previously completed installations during the remainder of the construction period.

L. Compliances: Comply with governing regulations and safety standards for cleaning operations. Remove waste materials from the site and dispose of in a lawful manner.

M. Where extra materials of value remain after completion of associated construction have become the Owner's property, dispose of these materials as directed.

END OF SECTION 017400

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION

A. Work Included: To aid the continued instruction of operating and maintenance personnel, and to provide a positive source of information regarding the products incorporated into the work, furnish and deliver the data described in this section and in pertinent other sections of these Specifications.

B. Related Work: Required contents of submittals also may be amplified in pertinent other sections of these Specifications.

1.3 QUALITY ASSURANCE

A. In preparing data required by this Section, use only personnel who are thoroughly trained and experienced in the operation and maintenance of the described items, completely familiar with the requirements of this Section, and skilled in communicating the essential data.

1.4 SUBMITTALS

A. Unless otherwise directed in other sections or in writing by the Engineer, submit three copies of the final manual to the Engineer for approval prior to indoctrination of operation and maintenance personnel.

PART 2 - PRODUCTS

2.1 INSTRUCTION MANUALS

A. Where instruction manuals are required to be submitted under other Sections of these Specifications, prepare in accordance with the provisions of this Section.

B. Format:

1. Size: 8-1/2" x11"

2. Paper: White bond, at least 20 lb weight.
3. Text: Typed (Hand printed or written is not acceptable)
4. Drawings: 11" x 8" preferable; bind in with text; foldouts are acceptable; larger drawings are acceptable if folded to fit within the manual and provide a drawing pocket inside rear cover or bind in with text.
5. Fly Sheets: Separate each portion of the manual with neatly prepared Fly Sheets or tabbed index sheets briefly describing the contents of the ensuing portion. Fly Sheets or index tabs may be in color.
6. Binding: Use heavy-duty plastic covers with binding mechanism concealed inside the manual; 3-ring binders or GBC binding is acceptable. All binding is subject to the Engineer's approval.

C. Provide front and back covers for each manual, using durable plastic material approved by the Engineer, and clearly identified on the front cover with at least the following information:

OPERATING AND MAINTENANCE INSTRUCTIONS

FOR

HVAC REPLACEMENT – GATEWOOD ACADEMY/PEEP
(Name, addresses, and telephone numbers of Contractor and Subcontractors)

(name and address of Engineer)

(Engineer's approval and date approved)

D. Contents:

1. Neatly prepared and typewritten detailed table of contents.
2. Complete instructions regarding operation and maintenance of all equipment involved, including lubrication, disassembly, and re-assembly.
3. Complete nomenclature of all parts of all equipment.
4. Complete nomenclature and part number of all replaceable parts, name and address of nearest vendor, and all other data pertinent to procurement procedures.
5. Copy of all guarantees and warranties issued.
6. Manufacturer's bulletin, cuts, and descriptive data, where pertinent, clearly indicating the precise items included in this installation and deleting, or otherwise clearly indicating, all manufacturers' data with which this installation is not concerned.
7. Equipment inventory, refer to specification sections 230100 and 260100.
8. Such other data as required in pertinent Sections of these Specifications.

PART 3 - EXECUTION

3.1 INSTRUCTION MANUALS

A. Final Manuals: Complete the Manuals in strict accordance with the Specifications and the Engineer's review comments.

B. Submit one copy of the manual to Engineer for review.

C. Revisions: Following the indoctrination and instruction of operation and maintenance personnel, review all proposed revisions of the Manual with the Engineer.

D. Submit three copies of the manual and a CD containing an electronic version of the Manual in PDF format to the Engineer after completion of reviews.

END OF SECTION 017823

SECTION 017836 - WARRANTIES AND BONDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturers' standard warranties on products and special warranties.

B. Refer to the General Conditions for terms of the Contractor's special warranty of workmanship and materials.

C. General closeout requirements are included in Section 017000, "Project Closeout".

D. Specific requirements for warranties for the Work and products and installations that are specified to be warranted are included in the individual Sections of Divisions 1 through 26.

E. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

F. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.3 DEFINITIONS

A. Standard Product Warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

B. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

1.4 WARRANTY REQUIREMENTS

A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.

E. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

F. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

1.5 SUBMITTALS

A. Submit written warranties directly to the Owner, with copies to the Engineer prior to the date of final payment.

B. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Engineer within fifteen days of completion of that designated portion of the Work.

C. Form of Submittal: At Final Completion compile three copies of each required warranty and bond properly executed by the Contractor, or by the Contractor’s subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

D. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, one for each set, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper.

1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer.
2. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS", the Project title or name, and the name of the Contractor.

E. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 017836

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION

A. Work Included:

1. Throughout progress of the work, maintain an accurate record of changes in the Contract Documents, as described in this Section.
2. Upon completion of the work, transfer the recorded changes to a set of Record Documents, as described in this Section. Cross reference all changes to addenda, change orders, etc.

1.3 QUALITY ASSURANCE

A. Assign the responsibility for maintenance of Record Documents to one person on the Contractor's staff as approved by the Engineer.

B. Accuracy of Records:

1. Thoroughly coordinate changes within the Record Documents, making adequate and proper entries on each page of the Specifications and each sheet of drawings and other documents where such entry is required to show the change properly.
2. Accuracy of records shall be such that future search for items shown in the Contract Documents may rely reasonably on information obtained from the approved Project Record Documents.

C. Make entries within 24 hours after receipt of information that the change has occurred.

1.4 SUBMITTALS

A. The Engineer's approval of the current status of Project Record Documents is a prerequisite to the Engineer's approval of requests for progress payment and request for final payment under the Contract.

B. Prior to submitting each request for progress payment, secure the Engineer's approval of the current status of the Project Record Documents.

C. Prior to submitting request for final payment, submit the final Project Record Documents to the Engineer and secure his approval.

1.5 PRODUCT HANDLING

A. Maintain the job set of Record Documents completely protected from deterioration and from loss and damage until completion of the work and transfer of all recorded data to the final Project Record Documents.

B. In the event of loss of the recorded data, use means necessary to again secure the data to the Engineer's approval.

1. Such means shall include, if necessary in the opinion of the Engineer, removal and replacement of concealed materials.
2. In such case, provide replacements to the standards originally required by the Contract Documents.

1.6 MAINTENANCE OF JOB SET

A. Identify each of the job set documents with the title, "RECORD DOCUMENTS - JOB SET".

B. Preservation of Documents:

1. Considering the Contract completion time, the probable number of occasions upon which the job set must be taken out for new entries and for examination, and the conditions under which these activities will be performed, devise a suitable method for protecting the job set suitable to the Engineer.
2. Do not use the job set for any purpose except entry of new data and for review by the Engineer, until start of transfer of data to the final Project Record Documents.
3. Maintain the job set at the site of work as that site is designated by the Engineer.

C. Making Entries on Drawings:

1. Using an erasable colored pencil (not ink or indelible pencil), clearly describe the change by graphic line and note as required. Colors that are not reproducible using standard printing procedures shall not be used.
2. Date all entries.
3. Call attention to the entry by drawing a box or other shape in a manner that avoids confusion with the original shapes and elements on the drawing around the area or areas affected.
4. In the event of overlapping changes, use different colors for the overlapping changes.

D. Make entries in the pertinent other documents as approved by the Engineer.

E. Conversion of Schematic Layouts:

1. In some cases on the drawings, arrangements of conduits, circuits, piping, ducts, and similar items, are shown schematically and are not intended to portray precise physical layout.

    a. Final physical arrangement is determined by the Contractor, subject to the Engineer's approval.
    b. However, design of future modifications of the facility may require accurate information as to the final physical layout of items which are shown only schematically on the drawings.

2. The Engineer may waive the requirements for conversion of schematic layouts where, in the Engineer's judgment, conversion served no useful purpose. However, do not rely upon waivers being issued except as specifically issued in writing by the Engineer.

1.7 FINAL PROJECT RECORD DOCUMENTS

A. The purpose of the final Project Record Documents is to provide factual information regarding all aspects of the work, both concealed and visible, to enable future modification of the work to proceed without lengthy and expensive site measurement, investigation, and examination.

B. Review and Submittal:

1. Submit the completed set of Project Record Documents to the Engineer for approval.
2. Make required changes and promptly deliver the final Project Record Documents to the Engineer.

1.8 CHANGES SUBSEQUENT TO ACCEPTANCE

A. The Contractor has no responsibility for recording changes in the work subsequent to final completion, except for changes resulting from work performed under warranty.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 017839

SECTION 018700 - MATERIALS AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 QUALITY ASSURANCE

A. Source Limitations: To the fullest extent possible, provide products of the same kind, from a single source.

B. Compatibility of Options: When the Contractor is given the option of selecting between two or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.

C. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products which will be exposed to view in occupied spaces or on the exterior.

D. Labels: Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface that is not conspicuous.

E. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface which is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:

1. Name of product and manufacturer.
2. Model and serial number.
3. Capacity.
4. Speed.
5. Ratings.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle products in accordance with the manufacturer's recommendations, using means and methods that will prevent damage, deterioration and loss, including theft.

B. Schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.

C. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.

D. Deliver products to the site in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installing.

E. Inspect products upon delivery to ensure compliance with the Contract Documents, and to ensure that products are undamaged and properly protected.

F. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.

G. Store heavy materials away from the Project structure in a manner that will not endanger the supporting construction.

H. Store products subject to damage by the elements above ground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, unused at the time of installation.

B. Provide products complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.

C. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.

D. Product Selection Procedures: Product selection is governed by the Contract Documents and governing regulations, not by previous Project experience. Procedures governing product selection include the following:

E. Semi-proprietary Specification Requirements: Where three or more products or manufacturers are named, provide one of the products indicated. No substitutions will be permitted.

F. Where products or manufacturers are specified by name, accompanied by the term "or equal" or "or approved equal" comply with the Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.

G. Non-Proprietary Specifications: When the Specifications list products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to use of these products only, the Contractor may propose any available product that complies with Contract

requirements. Comply with Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.

H. Descriptive Specification Requirements: Where Specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.

I. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements, and are recommended by the manufacturer for the application indicated. General overall performance of a product is implied where the product is specified for a specific application.

1. Manufacturer's recommendations may be contained in published product literature, or by the manufacturer's certification of performance.

J. Compliance with Standards, Codes and Regulations: Where the Specifications only require compliance with an imposed code, standard or regulation, select a product that complies with the standards, codes or regulations specified.

K. Visual Matching: Where Specifications require matching an established Sample, the Engineer's decision will be final on whether a proposed product matches satisfactorily.

1. Where no product available within the specified category matches satisfactorily and also complies with other specified requirements, comply with provisions of the Contract Documents concerning "substitutions" for selection of a matching product in another product category, or for noncompliance with specified requirements.

L. Visual Selection: Where specified product requirements include the phrase "...as selected from manufacturer's standard colors, patterns, textures..." or a similar phrase, select a product and manufacturer that complies with other specified requirements. The Engineer will select the color, pattern and texture from the product line selected.

PART 3 - EXECUTION

3.1 INSTALLATION OF PRODUCTS

A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.

B. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION 018700

Marine Chemist Service, Inc.
11850 TUG BOAT LANE
NEWPORT NEWS, VA 23606-2527
TEL: (757) 873-0933 · NORFOLK (757) 640-1122
FAX: (757) 873-1074 · NORFOLK (757) 625-5696
www.MarineChemist.com

Credentials	Agency	Scope
Approval	DOD-US Navy	Resin
Accreditation	ABS	Hull Thickness
Accreditation	AIHA-LAP, LLC	Laboratory ID: 100551
	ELLAP	Paint, Soil, Wipe & Air
	EMLAP	Direct Examination: Air & Tape
	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	Laboratory Code: 200628-0
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	Laboratory No: 460257
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	License No.: 3333 000004
		Asbestos: PLM & PCM

NOTE: Laboratory Credentials cover only to the scopes listed above.

April 15, 2021

Newport News Public Schools
12580 Patrick Henry Drive
Newport News, Virginia 23606

Attention: Pennie Boyack

Reference: (1st and 2nd Floor)
Gatewood Peep / Warwick Senior Center
Newport News, Virginia
MCS Job #21-022S

Dear Mrs. Boyack:

Please find enclosed the Asbestos Inspection Report including Lab Analyses for the above referenced job site.

If you have any questions, please do not hesitate to contact us.

Sincerely,

Ryan Stanley
Virginia Asbestos Inspector
License #3303 004642

FOR REFERENCE ONLY: REMOVAL TO BE DONE BY NEWPORT NEWS PUBLIC SCHOOLS.

PARTIAL ASBESTOS INSPECTION REPORT
OF
GATEWOOD PEEP / WARWICK SENIOR CENTER
NEWPORT NEWS, VIRGINIA
(1st AND 2nd FLOOR)
MCS JOB #21-022S

Marine Chemist Service, Inc.

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Phone: (757) 873-0933 · Norfolk (757) 640-1122
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Marine Chemist Service, Inc.

Partial Asbestos Inspection Report

of

Gatewood Peep / Warwick Senior Center
Newport News, Virginia
(1st and 2nd Floor)

on

February 22nd and March 6th of 2021

Prepared For:

Pennie Boyack
Newport News Public Schools
12580 Patrick Henry Boulevard
Newport News, Virginia, 23606
MCS Job #21-022S

By

Ryan Stanley
Virginia Asbestos Inspector License #3303 004642
Marine Chemist Service, Inc.
11850 Tug Boat Lane
Newport News, Virginia 23606
(757) 873-0933

April 15, 2021
Date

Inspector Signature

TABLE OF CONTENTS

SECTION 1
Partial Asbestos Inspection Report

PARTIAL ASBESTOS INSPECTION OF GATEWOOD PEEP / WARWICK SENIOR CENTER NEWPORT NEWS, VIRGINIA (1st AND 2ND FLOOR)

INTRODUCTION

Background and Purpose

There has been a growing public awareness of the link between the inhalation of asbestos fibers and various diseases such as asbestosis, mesothelioma, lung, and other cancers. As a result, the Asbestos Hazard Emergency Response Act (AHERA 40 CFR Part 763) for schools grades K through 12 was established by EPA.

The necessary components of an AHERA inspection require the accredited inspector to visually inspect and assess the condition of all known or assumed friable asbestos containing building materials (ACBM); to visually inspect non - friable ACBM and touch it to determine friability, and to identify homogeneous areas of friable materials.

EPA's National Emission Standards for Hazardous Air Pollutants (NESHAPS) require thorough inspections for asbestos in structures before the renovation or demolition of those structures.

Virginia law requires that if the initial building permit was issued prior to January 1, 1985, an asbestos inspection must be performed prior to the local authorities issuing a building permit.

In order to comply with NESHAPS, buildings to be renovated or demolished must be thoroughly inspected for asbestos containing building materials. Marine Chemist Service, Inc. follows the AHERA sampling protocol for interior surveys and the Virginia standard for roof surveys.

The purpose of this survey was to provide information for this property concerning the location and type of accessible and/or visible asbestos containing materials prior to renovation.

In compliance with Virginia Regulations, Marine Chemist Service Inc. performed asbestos sampling and a partial asbestos inspection of the First and Second Floor at Gatewood Peep / Warwick Senior Center, located in Newport News, Virginia on February 22nd and March 6th of 2021.

General Information

Marine Chemist Service, Inc. was hired by Pennie Boyack, on February 22, 2021 to conduct asbestos bulk sampling for suspect asbestos-containing building materials at Gatewood Peep / Warwick Senior Center, located in Newport News, Virginia.

Authorization

Authorization to perform this testing was provided in the form of a phone call notice to proceed by Pennie Boyack on January 4, 2021. The building was occupied at the time of the inspection.

Warranty

This visual inspection and laboratory report has been prepared in accordance with AHERA and Virginia requirements and current accepted professional practices. A minimum number of bulk asbestos samples were collected to determine the presence or absence of asbestos. This inspection has been performed to provide the client with information concerning the presence of accessible and/or exposed suspect asbestos containing building materials. Destructive testing was performed during the inspection. This inspection documents conditions at the time of the inspection only. No other warranties are implied or expressed.

SURVEY METHODS

Inspection Methods

The asbestos survey was performed by a Virginia licensed asbestos inspector. A visual walk through inspection was performed to identify suspect asbestos containing materials and homogeneous areas.

Sampling Methods

The Virginia licensed asbestos inspector sampled the identified suspect materials within the homogeneous areas following the visual inspection. Sampling was not performed on any inaccessible materials and did not involve destructive testing of building components. Sample locations were selected randomly.

LABORATORY METHODS

Analysis Methods

The bulk sample was first visually observed and described. The sample was mounted onto a slide, covered with dispersion staining oil and a cover slip, and observed under a polarized light microscope (PLM). The asbestos and non-asbestos materials in the sample are identified by this method.

The PLM microscopist estimates the amounts of asbestos and non-asbestos components by determining visually the relative volume of each to the total volume of the sample.

ASBESTOS INSPECTION

Document Review and On-Site Survey

Blueprints were provided for the inspection and a sketch was made upon which sample/asbestos material locations were marked.

Identification of Suspect Asbestos Containing Materials

A visual inspection was performed on the suspect asbestos containing materials found in the surveyed areas. The suspect asbestos containing materials are as follows:

1. 12” Floor Tile / Adhesive
2. Carpet / Adhesive
3. Stair Tread / Adhesive
4. Brick and Mortar
5. 6” Base Cove / Adhesive
6. 4” Base Cove / Adhesive
7. Drywall
8. Block / Wall Sealer / Paint
9. Door Caulk
10. Window Caulk
11. Window Glaze
12. 2’ x 4’ Ceiling Tile
13. 2’ x 2’ Ceiling Tile
14. Duct Insulation
15. Sink Undercoating
16. Pipe Insulation
17. Cementitious Material
18. Heater Insulation
19. 9” Ceiling Tile
20. Ceramic Wall Tile
21. 9” Tile/ Mastic
22. Terrazzo
23. 12” Ceiling Tile

Bulk Sampling

Bulk sampling was performed on all suspect asbestos-containing materials found in the areas and the minimum number of samples were taken as required in the AHERA Standards.

Bulk samples were taken penetrating all layers of the material. The samples were at least one cubic centimeter and were placed in a sealed container at the time of collection. All precautions were taken to prevent exposure to those present in or around the facility during the collection of samples. All sampling locations were patched with an encapsulant after the sampling was complete.

Samples listed below are grouped into homogeneous areas. Homogeneous areas are areas, which are uniform by color, texture, construction/application date, and general appearance.

Some sample results in the % asbestos column may be displayed in this report with a slash between two numbers, (#/#). The first number represents the first material listed under the material location/description and the second number represents the second material listed.

When N/A is placed in the friable category it means the sample tested negative - (0) or less than one percent - ($\leq$1%) for asbestos and the friable description does not apply.

Samples were analyzed utilizing Polarized Light Microscopy (PLM) with dispersion staining by a NVLAP accredited laboratory (Marine Chemist Service, Inc. NVLAP Lab Code 200628-0). The results are in section 6.

SECTION 2
Sample Summary Table

Gatewood Peep / Warwick Senior Center
Newport News, Virginia
(Interior)

Sample #	Lab Sample #	Material Location and Description	% Asbestos	Friable Y/N
WSC-1	0132244-001	Men's Restroom, 12" Pinkish-Brown with Dark Speckles, Floor Tile / Mastic	0/0	N/A
WSC-2	0132244-002	Women's Restroom, 12" Pinkish-Brown with Dark Speckles, Floor Tile / Mastic	0/10	N
WSC-3	0132244-003	Hallway, 12" Pinkish-Brown with Dark Speckles, Floor Tile / Mastic	0/0	N/A
WSC-4	0132244-004	Women's Restroom, 12" Tan with Dark Brown Speckles, Floor Tile / Mastic	2/10	N
WSC-5	0132244-005	408, 12" Tan with Dark Brown Speckles, Floor Tile / Mastic	3/10	N
WSC-6	0132244-006	400A 12" Tan with Dark Brown Speckles, Floor Tile / Mastic	0/10	N
WSC-7	0132244-007	400A, 12" Light Gray with Gray Speckles, Floor Tile / Mastic	0/10/0	N
WSC-8	0132244-008	400A, 12" Light Gray with Gray Speckles Floor Tile / Mastic	0/10	N
WSC-9	0132244-009	400A, 12" Light Gray with Gray Speckles, Floor Tile/ Mastic	0/0/0	N/A
WSC-10	0132244-010	400, Red Carpet / Adhesive	0/0/0	N/A
WSC-11	0132244-011	Conference, Red Carpet / Adhesive	0/0/0	N/A
WSC-12	0132244-012	401A, Red Carpet / Adhesive	0/0/0	N/A
WSC-13	0132244-013	409A, Blue Carpet / Adhesive	0/0/0	N/A
WSC-14	0132244-014	409A, Blue Carpet / Adhesive	0/0/0	N/A
WSC-15	0132244-015	409A, Blue Carpet / Adhesive	0/0/0	N/A
WSC-16	0132244-016	Southeast Stairwell, 12" Cream with Multi-Speckles, Floor Tile / Mastic	0/0	N/A
WSC-17	0132244-017	405, 12" Cream with Multi-Speckles, Floor Tile / Mastic	0/0	N/A
WSC-18	0132244-018	402, 12" Cream with Multi-Speckles, Floor Tile/ Mastic	0/0/0	N/A
WSC-19	0132244-019	Southeast Stairwell, Red Stair Tread / Adhesive	0/0/0	N/A
WSC-20	0132244-020	Northwest Stairwell, Red Stair Tread / Adhesive	0/0	N/A
WSC-21	0132244-021	409A, Brick and Mortar	0/0	N/A
WSC-22	0132244-022	409A, Brick and Mortar	0	N/A

Sample #	Lab Sample #	Material Location and Description	% Asbestos	Friable Y/N
WSC-23	0132244-023	Hallway, 6" Black Base Cove / Adhesive	0/0	N/A
WSC-24	0132244-024	401B, 6" Black Base Cove / Adhesive	0/0/0	N/A
WSC-25	0132244-025	406, 4" Red Base Cove / Adhesive	0/0	N/A
WSC-26	0132244-026	403, 4" Red Base Cove / Adhesive	0/0	N/A
WSC-27	0132244-027	400A, 6" Brown Base Cove / Adhesive	0/0	N/A
WSC-28	0132244-028	400A, 6" Brown Base Cove / Adhesive	0/0	N/A
WSC-29	0132244-029	406, Drywall	0/0	N/A
WSC-30	0132244-030	405, Drywall	0/0	N/A
WSC-31	0132244-031	Hallway, Drywall	0/0/0	N/A
WSC-32	0132244-032	Women's Restroom, Block / Wall Sealer / Paint	0	N/A
WSC-33	0132244-033	Stairwell Southeast, Door Caulk	0	N/A
WSC-34	0132244-034	400, Door Caulk	0	N/A
WSC-35	0132244-035	408, Window Glaze	0	N/A
WSC-36	0132244-036	403, Window Glaze	0	N/A
WSC-37	0132244-037	Interior of 409, Window Glaze	2	N
WSC-38	0132244-038	406, Window Caulk	0	N/A
WSC-39	0132244-039	401A, Window Caulk	0	N/A
WSC-40	0132244-040	409, 2' x 4' Dotted Ceiling Tile, White	0	N/A
WSC-41	0132244-041	406, 2' x 4' Dotted Ceiling Tile, White	0	N/A
WSC-42	0132244-042	Hallway, 2' x 4' Dotted Ceiling Tile, White	0	N/A
WSC-43	0132244-043	Hallway, 2' x 4' Dotted/ Small Wormed Ceiling Tile	0	N/A
WSC-44	0132244-044	402, 2' x 4' Dotted/ Small Wormed Ceiling Tile	0	N/A
WSC-45	0132244-045	403, 2' x 4' Dotted/ Small Wormed Ceiling Tile	0	N/A
WSC-46	0132244-046	405, 2' x 4' Large Wormed Ceiling Tile	0	N/A
WSC-47	0132244-047	Hallway, 2' x 4' Large Wormed Ceiling Tile	0	N/A
WSC-48	0132244-048	Hallway, 2' x 4' Large Wormed Ceiling Tile	0	N/A
WSC-49	0132244-049	400A, 2' x 2' Dotted Ceiling Tile, Yellow	0	N/A
WSC-50	0132244-050	400A, 2' x 2' Dotted Ceiling Tile, Yellow	0	N/A

Sample #	Lab Sample #	Material Location and Description	% Asbestos	Friable Y/N
WSC-51	0132244-051	400A, 2' x 2' Dotted Ceiling Tile, Yellow	0	N/A
WSC-52	0132244-052	Hallway, Duct Insulation	0/0	N/A
WSC-53	0132244-053	Hallway, Duct Insulation	0/0	N/A
WSC-54	0132244-054	Hallway, Duct Insulation	0/0	N/A
WSC-55	0132244-055	408, Sink Undercoating	10	N
WSC-56	0132357-001	Senior Center, 1st Floor Hall, Cementitious Ceiling Material/Mastic	0/0	N/A
WSC-57	0132357-002	Senior Center, 1st Floor Hall, Cementitious Ceiling Material/ Mastic	0/0	N/A
WSC-58	0132357-003	Senior Center, 1st Floor Hall, Cementitious Ceiling Material/Mastic	0/0	N/A
WSC-59	0132357-004	Senior Center, 1st Floor Hall, Brown Pipe Insulation	0/0	N/A
WSC-60	0132357-005	Senior Center, 1st Floor Hall, Brown Pipe Insulation	0/0	N/A
WSC-61	0132357-006	Senior Center, 1st Floor Hall, Brown Pipe Insulation	0/0	N/A
WSC-62	0132357-007	Senior Center, 1st Floor, 12" Ceiling Tile	0	N/A
WSC-63	0132357-008	Senior Center, 1st Floor 12" Ceiling Tile	0	N/A
WSC-64	0132357-009	Senior Center, 1st Floor 12" Ceiling Tile	0	N/A
WSC-65	0132357-010	Senior Center, 1st Floor, Heater Insulation	0/0	N/A
WSC-66	0132357-011	Senior Center, 1st Floor, Heater Insulation	0/0	N/A
WSC-67	0132357-012	Senior Center, 1st Floor, Heater Insulation	0/0	N/A
WSC-68	0132357-013	Senior Center, 1st Floor, 2' x 4' Wormed Ceiling Tile	0	N/A
WSC-69	0132357-014	Senior Center, 1st Floor, 2' x 4' Wormed Ciling Tile	0	N/A
WSC-70	0132357-015	Senior Center, 1st Floor, 2' x 4' Wormed Ciling Tile	0	N/A
WSC-71	0132357-016	Senior Center, 1st Floor, 2' x 4' Dotted Ceiling Tile	0	N/A
WSC-72	0132357-017	Senior Center, 1st Floor, 2' x 4' Dotted Ceiling Tile	0	N/A
WSC-73	0132357-018	Senior Center, 1st Floor, 2' x 4' Dotted Ceiling Tile	0	N/A
WSC-74	0132357-019	Senior Center, 1st Floor, 2' x 4' Pitted Ceiling Tile	0	N/A
WSC-75	0132357-020	Senior Center, 1st Floor, 2' x 4' Pitted Ceiling Tile	0	N/A

Sample #	Lab Sample #	Material Location and Description	% Asbestos	Friable Y/N
WSC-76	0132357-021	Senior Center, 1st Floor, 2' x 4' Pitted Ceiling Tile	0	N/A
WSC-77	0132357-022	Senior Center, 1st Floor, Room 303, 9" Ceiling Tile	0	N/A
WSC-78	0132357-023	Senior Center, 1st Floor, Room 303, 9" Ceiling Tile	0	N/A
WSC-79	0132357-024	Senior Center, 1st Floor, Room 303, 9" Ceiling Tile	0	N/A
WSC-80	0132357-025	Senior Center, 1st Floor, Brick / Mortar	0	N/A
WSC-81	0132357-026	Senior Center, 1st Floor, Brick / Mortar	0	N/A
WSC-82	0132357-027	Senior Center, 1st Floor, Ceramic Wall Tile / Blue	0	N/A
WSC-83	0132357-028	Senior Center, 1st Floor, Ceramic Wall Tile / Blue	0	N/A
WSC-84	0132357-029	Senior Center, 1st Floor, Door Caulk	0	N/A
WSC-85	0132357-030	Senior Center, 1st Floor, Door Caulk	0	N/A
WSC-86	0132357-031	Senior Center, 1st Floor, Window Caulk	0	N/A
WSC-87	0132357-032	Senior Center, 1st Floor, Window Caulk	0	N/A
WSC-88	0132357-033	Senior Center, 1st Floor, Drywall	0/0	N/A
WSC-89	0132357-034	Senior Center, 1st Floor, Drywall	0/0	N/A
WSC-90	0132357-035	Senior Center, 1st Floor, Drywall	0/0	N/A
WSC-91	0132357-036	Senior Center, 1st Floor, Janitor, Pipe Insulation / Patch	0/0/30	Y
WSC-92	0132357-037	Senior Center, 1st Floor, 6" Black Base Cove / Mastic	0/0/0	N/A
WSC-93	0132357-038	Senior Center, 1st Floor, 6" Black Base Cove / Mastic	0/0/0	N/A
WSC-94	0132357-039	Senior Center, 1st Floor 4" Brown Base Cove / Mastic	0/0	N/A
WSC-95	0132357-040	Senior Center, 1st Floor, 4" Brown Base Cove / Mastic	0/0	N/A
WSC-96	0132357-041	Senior Center, 1st Floor, 9" Red Tile / Mastic	5/10	N
WSC-97	0132357-042	Senior Center, 1st Floor, 9" Red Tile / Mastic	5/5	N
WSC-98	0132357-043	Senior Center, 1st Floor, 9" Red Tile / Mastic	5/5	N
WSC-99	0132357-044	Senior Center, 1st Floor, White / Black Speckled Terrazzo	0	N/A
WSC-100	0132357-045	Senior Center, 1st Floor, White / Black Speckled Terrazzo	0	N/A
WSC-101	0132357-046	Senior Center, 1st Floor 12" Ivory Floor Tile / Mastic	0/0/0	N/A
WSC-102	0132357-047	Senior Center, 1st Floor 12" Ivory Floor Tile / Mastic	0/0/0	N/A

Sample #	Lab Sample #	Material Location and Description	% Asbestos	Friable Y/N
WSC-103	0132357-048	Senior Center, 1st Floor 12" Ivory Floor Tile / Mastic	0/0	N/A
WSC-104	0132357-049	Senior Center 1st Floor 12" White Floor Tile / Mastic	3/10	N
WSC-105	0132357-050	Senior Center 1st Floor 12" White Floor Tile / Mastic	3/10	N
WSC-106	0132357-051	Senior Center 1st Floor 12" White Floor Tile / Mastic	3/10	N
GWP-1	0132358-001	Gatewood Peep, 12" Yellow Floor Tile/ Mastic	0/0	N/A
GWP-2	0132358-002	Gatewood Peep, 12" Yellow Floor Tile/ Mastic	0/0	N/A
GWP-3	0132358-003	Gatewood Peep, 12" Yellow Floor Tile/ Mastic	0/0	N/A
GWP-4	0132358-004	Gatewood Peep, 12" Orange Floor Tile/ Mastic	0/0	N/A
GWP-5	0132358-005	Gatewood Peep, 12" Orange Floor Tile/ Mastic	0/0/0	N/A
GWP-6	0132358-006	Gatewood Peep, 12" Orange Floor Tile/ Mastic	0/0/0	N/A
GWP-7	0132358-007	Gatewood Peep, 12" Red Floor Tile/ Mastic	0/0/0	N/A
GWP-8	0132358-008	Gatewood Peep, 12" Red Floor Tile/ Mastic	0/0	N/A
GWP-9	0132358-009	Gatewood Peep, 12" Red Floor Tile/ Mastic	0/0	N/A
GWP-10	0132358-010	Gatewood Peep Left, 2' x 4' Wormed Ceiling Tile	0	N/A
GWP-11	0132358-011	Gatewood Peep Middle, 2' x 4' Wormed Ceiling Tile	0	N/A
GWP-12	0132358-012	Gatewood Peep Right, 2' x 4' Wormed Ceiling Tile	0	N/A
GWP-13	0132358-013	Gatewood Peep, Pipe Insulation	0/0	N/A
GWP-14	0132358-014	Gatewood Peep, Pipe Insulation	0/0	N/A
GWP-15	0132358-015	Gatewood Peep, Pipe Insulation	0/0	N/A
GWP-16	0132358-016	Gatewood Peep, Multi-Colored Carpet/ Mastic	0/0/0	N/A
GWP-17	0132358-017	Gatewood Peep, Multi-Colored Carpet/ Mastic	0/0/0	N/A
GWP-18	0132358-018	Gatewood Peep, Multi-Colored Carept/ Mastic	0/0/0	N/A
GWP-19	0132358-019	Gatewood Peep, 4" Tan Base Cove/ Mastic	0/0	N/A
GWP-20	0132358-020	Gatewood Peep, 4" Tan Base Cove/ Mastic	0/0	N/A
GWP-21	0132358-021	Gatewood Peep, 4" Brown Base Cove/ Mastic	0/0	N/A
GWP-22	0132358-022	Gatewood Peep, 4" Brown Base Cove/ Mastic	0/0	N/A

Comments

1. The following sampled materials tested positive for asbestos:
   - Mastic under 12" Pinkish-Brown w/ Dark Speckled Floor Tile (Women's Room)
   - 12" Tan w/ Dark Brown Speckled Floor Tile/ Mastic (Women's Room, Room 408, 400A)
   - Mastic under 12" Light Gray w/ Gray Speckled Floor Tile (Room 400A)
   - Interior Window Glaze (Room 409)
   - Sink Undercoating (Room 408)
   - Beige Pipe Insulation (1st Floor Senior Center Janitor's Room)
   - 9" Red Tile and Mastic (1st Floor Senior Center Janitor's Room)
   - 12" White Floor Tile and Mastic (1st Floor Senior Center Clinic Bathroom)

2. Asbestos might be found within the walls, ceiling and or pipe chases during the renovation or demolition of the building. If any suspect materials are found, they should be treated as asbestos or tested for asbestos.

Approximate Quantities of Asbestos Materials

ASBESTOS CONTAINING MATERIALS	QUANTITY
Mastic under 12" Pinkish-Brown w/ Dark Speckled Floor Tile (Women's Room)	500 Sq. Ft.
12" Tan w/ Dark Brown Speckled Floor Tile/ Mastic (Women's Room 408, 400A)	600 Sq. Ft.
Mastic under 12" Light Gray w/ Gray Speckled Floor Tile (Room 400A)	100 Sq. Ft
Interior Window Glaze (Room 409)	100 Lin Ft.
Sink Undercoating (Room 408)	1 Sink
Beige Pipe Insulation (1st Floor Senior Center Janitor's Room)	20 Lin. Ft.
9" Red Tile and Mastic(1st Floor Senior Center Janitor's Room)	75 Sq. Ft.
12" White Floor Tile and Mastic (1st Floor Senior Center Clinic Bathroom)	240 Sq. Ft.

SECTION 3
General Legend and Notes

GENERAL LEGEND

O - Sample number/location - non-asbestos

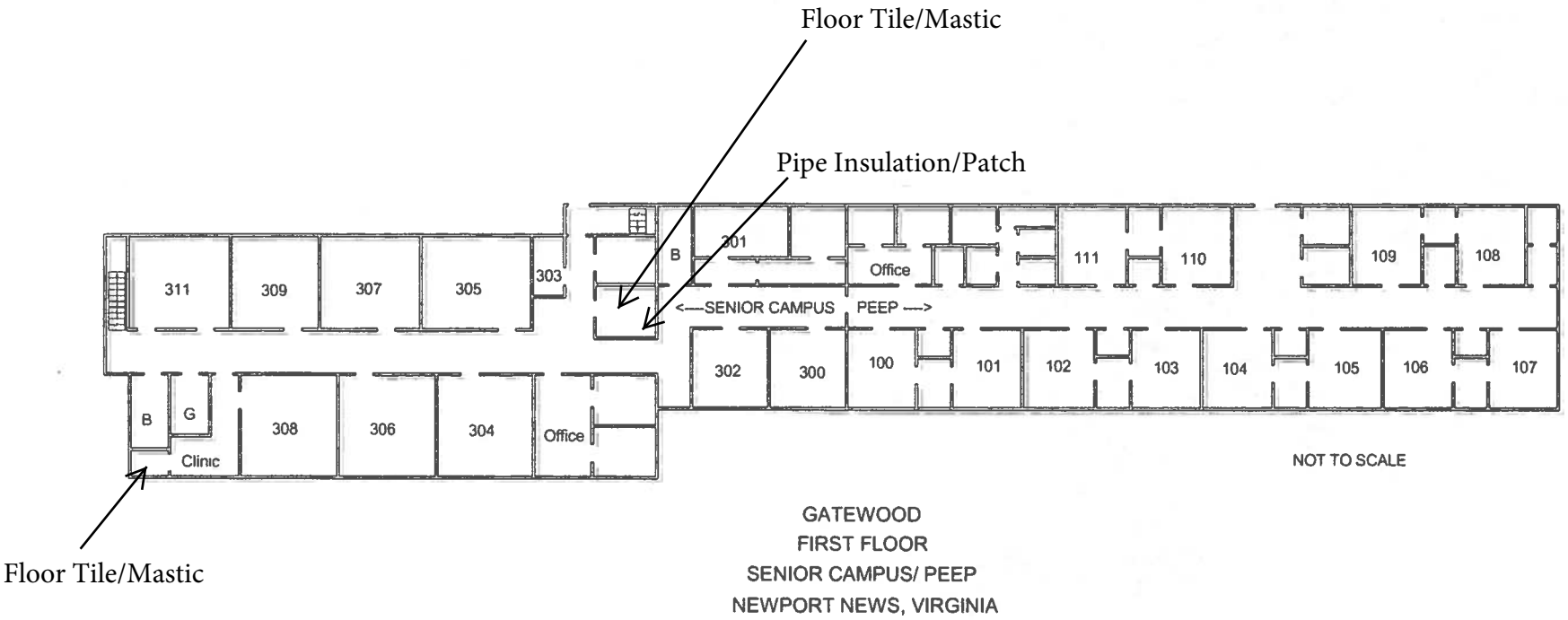
Δ - Sample number/location - contains asbestos

GENERAL NOTES

1. The EPA's definition of a friable material is one that contains more than 1% asbestos by weight and can be crumbled, pulverized or reduced to a powder by hand pressure when dry, or which under normal use or maintenance emits or can be expected to emit asbestos fibers into the air.

2. All quantities are approximate.

SECTION 4
Asbestos Containing Material Sketches


Floor Tile/Mastic
Pipe Insulation/Patch
311
309
307
305
303
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301
Office
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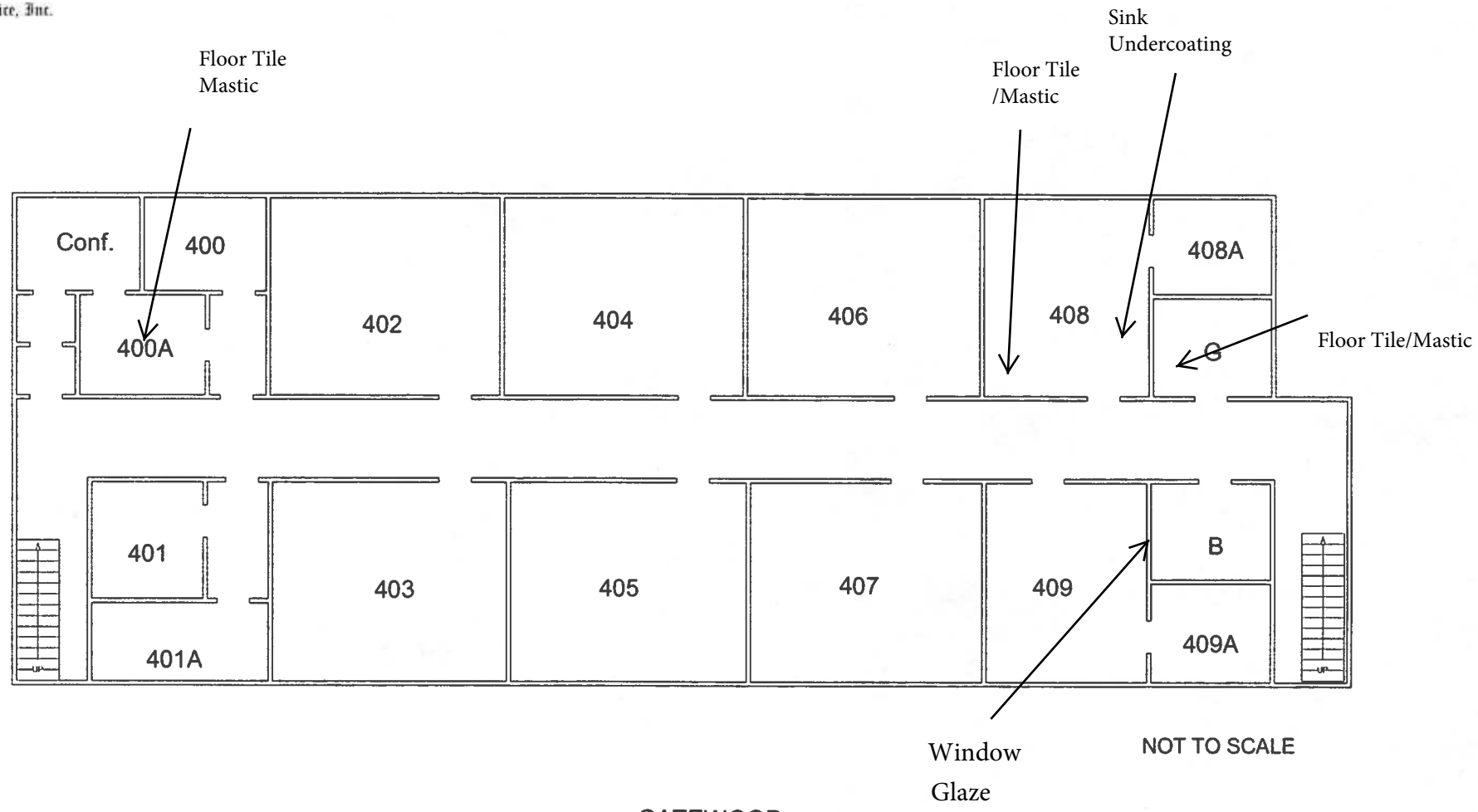
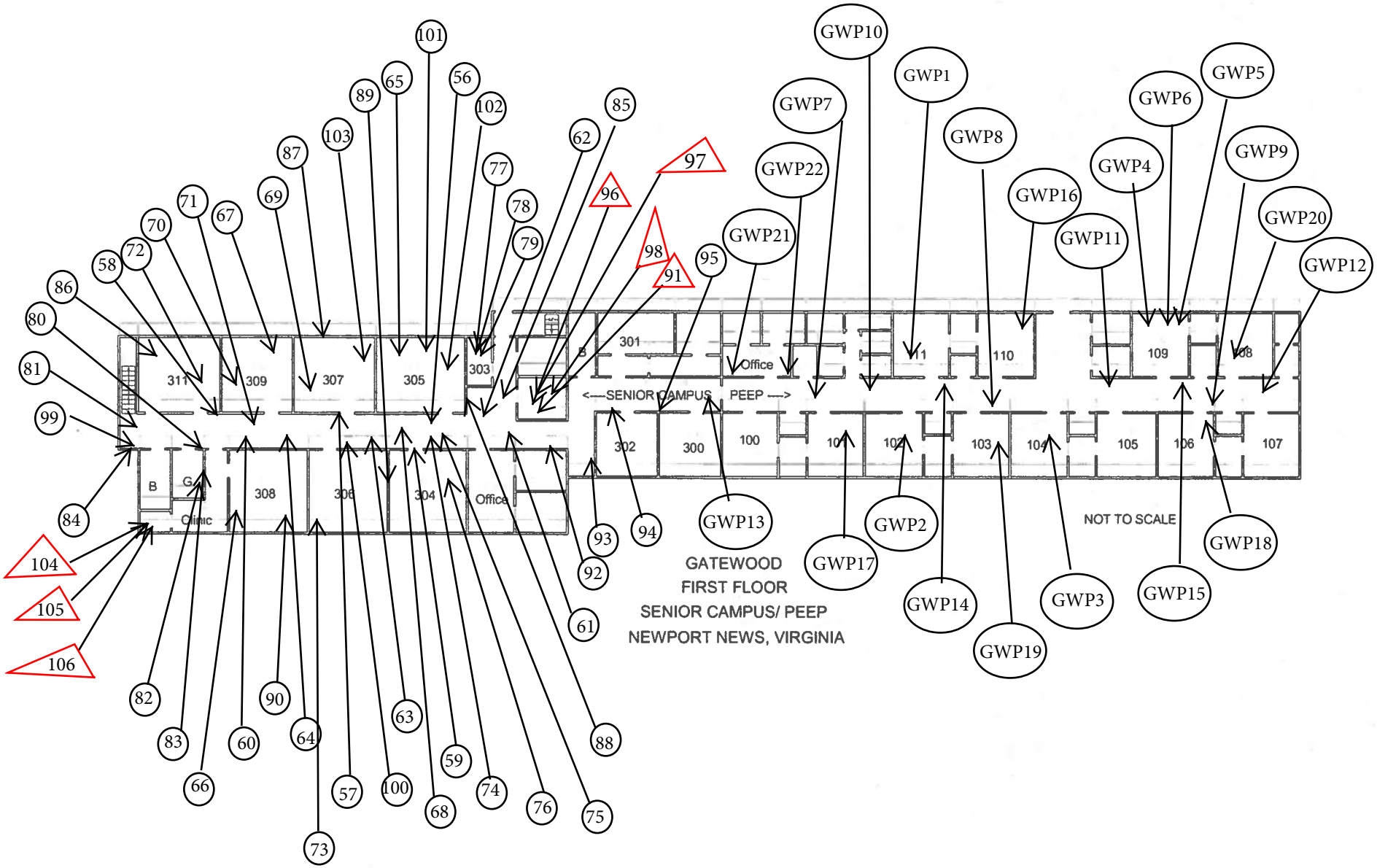
110
109
108
<—SENIOR CAMPUS
PEEP —>
302
300
100
101
102
103
104
105
106
107
B
G
Clinic
308
306
304
Office
NOT TO SCALE
Floor Tile/Mastic
GATEWOOD
FIRST FLOOR
SENIOR CAMPUS/ PEEP
NEWPORT NEWS, VIRGINIA



GATEWOOD
SECOND FLOOR
SENIOR CAMPUS
NEWPORT NEWS, VIRGINIA

SECTION 5
Survey Sample Location Sketches


GWP10
GWP1
GWP5
GWP7
GWP6
GWP8
GWP4
GWP9
GWP22
GWP16
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GWP21
GWP11
GWP12
GWP13
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Office
<—SENIOR CAMPUS
PEEP —>
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Clinic
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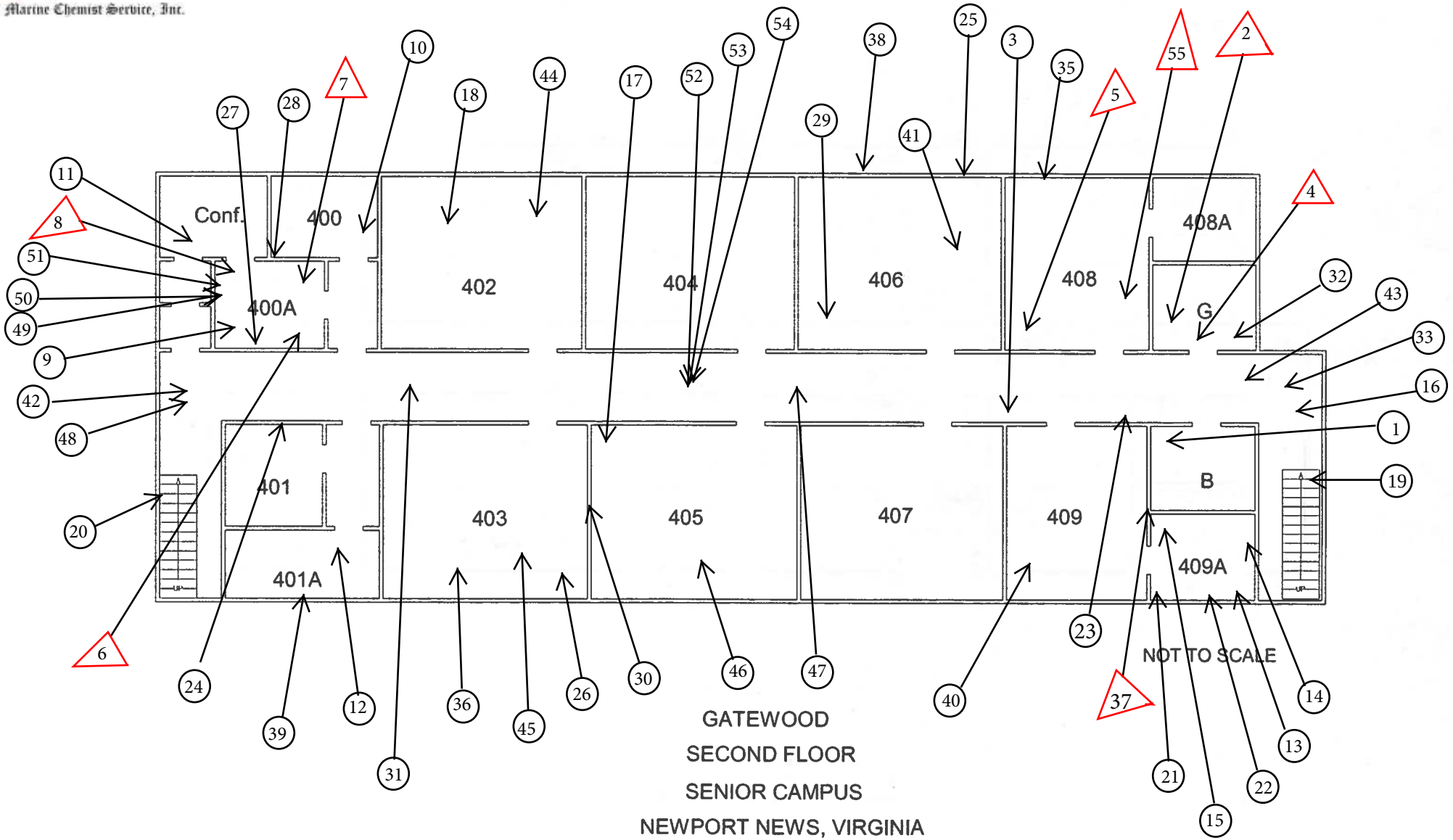
Office
NOT TO SCALE
GATEWOOD
FIRST FLOOR
SENIOR CAMPUS/ PEEP
NEWPORT NEWS, VIRGINIA


Conf.
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400A
401
401A
402
403
404
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406
407
408
408A
409
409A
G
B
NOT TO SCALE
GATEWOOD
SECOND FLOOR
SENIOR CAMPUS
NEWPORT NEWS, VIRGINIA

SECTION 6
Reports of Analysis

Marine Chemist Service, Inc.
11850 TUG BOAT LANE
NEWPORT NEWS, VA 23606-2527
TEL: (757) 873-0933 · NORFOLK (757) 640-1122
FAX: (757) 873-1074 · NORFOLK (757) 625-5696
www.MarineChemist.com

Credentials	Agency	Scope
Approval	DOD-US Navy	Resin
Accreditation	ABS	Hull Thickness
Accreditation	AIHA-LAP, LLC	Laboratory ID: 100551
	ELLAP	Paint, Soil, Wipe & Air
	EMLAP	Direct Examination: Air & Tape
	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	Laboratory Code: 200628-0
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	Laboratory No: 460257
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	License No.: 3333 000004
		Asbestos: PLM & PCM

NOTE: Laboratory Credentials cover only to the scopes listed above.

Plant Services - NNPS
Attn: Pennie Robbins Boyack
12580 Patrick Henry Dr.
Newport News VA 23602

MCS Report No.: 0132244
Report Date: 04/01/2021
MCS Job No.: 21-022S
Customer PO No.:

Date Sampled: 02/22/2021
Sampled By: Ryan Stanley
Job Location: Warwick Senior Center (2nd Floor)

Date Received: 02/22/2021
Received By: JAS
Sample Matrix: BULK
Date Analyzed: 02/25/2021

Method of Analysis: Polarized Light Microscopy (PLM) using Environmental Protection Agency (EPA) Methods: EPA - 40 CFR Appendix E to Subpart E of Part 763 and EPA 600/R93-116, July 1993.

REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132244-001	Men's Restroom, 12" Floor Tile/ Mastic, Pinkish-Brown w/ Dark Specs					
WSC-1	Floor Tile, White	LAYER 1	None Detected			
		90%			Non-Fibrous Material	100%
	Mastic, Beige	LAYER 2	None Detected		Cellulose Fiber	10%
		10%			Non-Fibrous Material	90%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132244-002	Women's Restroom, 12" Floor Tile/ Mastic, Pinkish-Brown w/ Dark Specs					
WSC-2	Floor Tile, White	LAYER 1	None Detected			
		90%			Non-Fibrous Material	100%
	Mastic, Black	LAYER 2	Chrysotile	10%	Cellulose Fiber	20%
		10%			Non-Fibrous Material	70%
	Asbestos Present: Yes	**Total % Asbestos:**		**1%**		
0132244-003	Hallway, 12" Floor Tile/ Mastic, Pinkish-Brown w/ Dark Specs					
WSC-3	Floor Tile, White	LAYER 1	None Detected			
		90%			Non-Fibrous Material	100%
	Flooring Material, Beige	LAYER 2	None Detected		Cellulose Fiber	5%
		10%			Non-Fibrous Material	95%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		

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www.MarineChemist.com

Credentials	Agency	Scope
Approval	DOD-US Navy	Resin
Accreditation	ABS	Hull Thickness
Accreditation	AIHA-LAP, LLC	Laboratory ID: 100551
	ELLAP	Paint, Soil, Wipe & Air
	EMLAP	Direct Examination: Air & Tape
	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	Laboratory Code: 200628-0
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	Laboratory No: 460257
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	License No.: 3333 000004
		Asbestos: PLM & PCM

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Customer PO No.:

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Sampled By: Ryan Stanley
Job Location: Warwick Senior Center (2nd Floor)

Date Received: 02/22/2021
Received By: JAS
Sample Matrix: BULK
Date Analyzed: 02/25/2021

Method of Analysis: Polarized Light Microscopy (PLM) using Environmental Protection Agency (EPA) Methods: EPA - 40 CFR Appendix E to Subpart E of Part 763 and EPA 600/R93-116, July 1993.

REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132244-004	Women's Restroom, 12" Floor Tile/ Mastic, Tan w/ Many Dark Brown Specs					
WSC-4	Floor Tile, White	LAYER 1	Chrysotile	2%		
		80%			Non-Fibrous Material	98%
	Mastic, Black	LAYER 2	Chrysotile	10%	Cellulose Fiber	10%
		20%			Non-Fibrous Material	80%
	Asbestos Present: Yes	**Total % Asbestos:**		**4%**		
0132244-005	408, 12" Floor Tile/ Mastic, Tan w/ Many Dark Brown Specs					
WSC-5	Floor Tile, Beige	LAYER 1	Chrysotile	3%		
		80%			Non-Fibrous Material	97%
	Mastic, Black	LAYER 2	Chrysotile	10%	Cellulose Fiber	10%
		20%			Non-Fibrous Material	80%
	Asbestos Present: Yes	**Total % Asbestos:**		**4%**		
0132244-006	400A, 12" Floor Tile/ Mastic, Tan w/ Many Dark Brown Specs					
WSC-6	Floor Tile, Beige	LAYER 1	None Detected			
		80%			Non-Fibrous Material	100%
	Mastic, Black	LAYER 2	Chrysotile	10%	Cellulose Fiber	10%
		20%			Non-Fibrous Material	80%
	Asbestos Present: Yes	**Total % Asbestos:**		**2%**		

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www.MarineChemist.com

Credentials	Agency	Scope
Approval	DOD-US Navy	Resin
Accreditation	ABS	Hull Thickness
Accreditation	AIHA-LAP, LLC	Laboratory ID: 100551
	ELLAP	Paint, Soil, Wipe & Air
	EMLAP	Direct Examination: Air & Tape
	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	Laboratory Code: 200628-0
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	Laboratory No: 460257
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	License No.: 3333 000004
		Asbestos: PLM & PCM

NOTE: Laboratory Credentials cover only to the scopes listed above.

Plant Services - NNPS
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Newport News VA 23602

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Customer PO No.:

Date Sampled: 02/22/2021
Sampled By: Ryan Stanley
Job Location: Warwick Senior Center (2nd Floor)

Date Received: 02/22/2021
Received By: JAS
Sample Matrix: BULK
Date Analyzed: 02/25/2021

Method of Analysis: Polarized Light Microscopy (PLM) using Environmental Protection Agency (EPA) Methods: EPA - 40 CFR Appendix E to Subpart E of Part 763 and EPA 600/R93-116, July 1993.

REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132244-007	400A, 12" Floor Tile / Mastic, Light Gray w/ Gray Specs					
WSC-7	Floor Tile, White	LAYER 1	None Detected			
		70%			Non-Fibrous Material	100%
	Mastic, Black	LAYER 2	Chrysotile	10%		
		20%			Non-Fibrous Material	90%
	Flooring Material, Gray	LAYER 3	None Detected		Cellulose Fiber	5%
		10%			Non-Fibrous Material	95%
	Asbestos Present: Yes	**Total % Asbestos:**		**2%**		
0132244-008	400A, 12" Floor Tile/ Mastic, Light Gray w/ Gray Specs					
WSC-8	Floor Tile, White	LAYER 1	None Detected			
		80%			Non-Fibrous Material	100%
	Mastic, Black and Beige	LAYER 2	Chrysotile	10%	Cellulose Fiber	10%
		20%			Non-Fibrous Material	80%
	Asbestos Present: Yes	**Total % Asbestos:**		**2%**		

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www.MarineChemist.com

Credentials	Agency	Scope
Approval	DOD-US Navy	Resin
Accreditation	ABS	Hull Thickness
Accreditation	AIHA-LAP, LLC	Laboratory ID: 100551
	ELLAP	Paint, Soil, Wipe & Air
	EMLAP	Direct Examination: Air & Tape
	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	Laboratory Code: 200628-0
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	Laboratory No: 460257
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	License No.: 3333 000004
		Asbestos: PLM & PCM

NOTE: Laboratory Credentials cover only to the scopes listed above.

Plant Services - NNPS
Attn: Pennie Robbins Boyack
12580 Patrick Henry Dr.
Newport News VA 23602

MCS Report No.: 0132244
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MCS Job No.: 21-022S
Customer PO No.:

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Sampled By: Ryan Stanley
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Sample Matrix: BULK
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Method of Analysis: Polarized Light Microscopy (PLM) using Environmental Protection Agency (EPA) Methods: EPA - 40 CFR Appendix E to Subpart E of Part 763 and EPA 600/R93-116, July 1993.

REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132244-009	400A, 12" Floor Tile/ Mastic, Light Gray w/ Gray Specs					
WSC-9	Floor Tile, Beige	LAYER 1	None Detected			
		80%			Non-Fibrous Material	100%
	Mastic, Beige	LAYER 2	None Detected		Cellulose Fiber	5%
		10%			Non-Fibrous Material	95%
	Flooring Material, Beige	LAYER 3	None Detected		Cellulose Fiber	5%
		10%			Non-Fibrous Material	95%
	Asbestos Present: No	**Total % Asbestos:**	**No Asbestos Detected**			
0132244-010	400, Red Carpet/ Adhesive					
WSC-10	Carpet, Red	LAYER 1	None Detected		Synthetic Fiber	80%
		50%			Non-Fibrous Material	20%
	Fibrous Material, Beige	LAYER 2	None Detected		Cellulose Fiber	90%
		40%			Non-Fibrous Material	10%
	Mastic, Beige	LAYER 3	None Detected		Cellulose Fiber	5%
		10%			Synthetic Fiber	5%
					Non-Fibrous Material	90%
	Asbestos Present: No	**Total % Asbestos:**	**No Asbestos Detected**			

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Credentials	Agency	Scope
Approval	DOD-US Navy	Resin
Accreditation	ABS	Hull Thickness
Accreditation	AIHA-LAP, LLC	Laboratory ID: 100551
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	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	Laboratory Code: 200628-0
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	Laboratory No: 460257
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	License No.: 3333 000004
		Asbestos: PLM & PCM

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Plant Services - NNPS
Attn: Pennie Robbins Boyack
12580 Patrick Henry Dr.
Newport News VA 23602

MCS Report No.: 0132244
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MCS Job No.: 21-022S
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Date Sampled: 02/22/2021
Sampled By: Ryan Stanley
Job Location: Warwick Senior Center (2nd Floor)

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Method of Analysis: Polarized Light Microscopy (PLM) using Environmental Protection Agency (EPA) Methods: EPA - 40 CFR Appendix E to Subpart E of Part 763 and EPA 600/R93-116, July 1993.

REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132244-011	Conference, Red Carpet/ Adhesive					
WSC-11	Carpet, Red	LAYER 1	None Detected		Synthetic Fiber	80%
		60%			Non-Fibrous Material	20%
	Fibrous Material, Beige	LAYER 2	None Detected		Synthetic Fiber	60%
		20%			Cellulose Fiber	10%
					Non-Fibrous Material	30%
	Mastic, Beige	LAYER 3	None Detected		Cellulose Fiber	10%
		20%			Non-Fibrous Material	90%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132244-012	401A, Red Carpet/ Adhesive					
WSC-12	Carpet, Red	LAYER 1	None Detected		Synthetic Fiber	80%
		60%			Non-Fibrous Material	20%
	Fibrous Material, Beige	LAYER 2	None Detected		Synthetic Fiber	60%
		20%			Non-Fibrous Material	40%
	Mastic, Beige	LAYER 3	None Detected		Cellulose Fiber	5%
		20%			Non-Fibrous Material	95%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		

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Accreditation	AIHA-LAP, LLC	Laboratory ID: 100551
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		Metals: Air
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Date Sampled: 02/22/2021
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Job Location: Warwick Senior Center (2nd Floor)

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REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132244-013	409A, Blue Carpet/ Adhesive					
WSC-13	Carpet, Blue	LAYER 1	None Detected		Synthetic Fiber	80%
		70%			Non-Fibrous Material	20%
	Fibrous Material, Beige	LAYER 2	None Detected		Synthetic Fiber	60%
		20%			Non-Fibrous Material	40%
	Mastic, Beige	LAYER 3	None Detected		Cellulose Fiber	5%
		10%			Non-Fibrous Material	95%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132244-014	409A, Blue Carpet/ Adhesive					
WSC-14	Carpet, Blue	LAYER 1	None Detected		Synthetic Fiber	80%
		60%			Non-Fibrous Material	20%
	Fibrous Material, Beige	LAYER 2	None Detected		Synthetic Fiber	60%
		30%			Non-Fibrous Material	40%
	Mastic, Beige	LAYER 3	None Detected		Cellulose Fiber	10%
		10%			Non-Fibrous Material	90%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		

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	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	License No.: 3333 000004
		Asbestos: PLM & PCM

NOTE: Laboratory Credentials cover only to the scopes listed above.

Plant Services - NNPS
Attn: Pennie Robbins Boyack
12580 Patrick Henry Dr.
Newport News VA 23602

MCS Report No.: 0132244
Report Date: 04/01/2021
MCS Job No.: 21-022S
Customer PO No.:

Date Sampled: 02/22/2021
Sampled By: Ryan Stanley
Job Location: Warwick Senior Center (2nd Floor)

Date Received: 02/22/2021
Received By: JAS
Sample Matrix: BULK
Date Analyzed: 02/25/2021

Method of Analysis: Polarized Light Microscopy (PLM) using Environmental Protection Agency (EPA) Methods: EPA - 40 CFR Appendix E to Subpart E of Part 763 and EPA 600/R93-116, July 1993.

REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132244-015	409A, Blue Carpet/Adhesive					
WSC-15	Carpet, Blue	LAYER 1	None Detected		Synthetic Fiber	80%
		60%			Non-Fibrous Material	20%
	Fibrous Material, Beige	LAYER 2	None Detected		Synthetic Fiber	60%
		30%			Non-Fibrous Material	40%
	Mastic, Beige	LAYER 3	None Detected		Cellulose Fiber	5%
		10%			Non-Fibrous Material	95%
	Asbestos Present: No	**Total % Asbestos:**	**No Asbestos Detected**			
0132244-016	Southeast Stairwell, 12" Cream w/ Multi-Specs Floor Tile/ Mastic					
WSC-16	Floor Tile, Beige	LAYER 1	None Detected			
		90%			Non-Fibrous Material	100%
	Mastic, Beige	LAYER 2	None Detected		Cellulose Fiber	5%
		10%			Non-Fibrous Material	95%
	Asbestos Present: No	**Total % Asbestos:**	**No Asbestos Detected**			

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TEL: (757) 873-0933 · NORFOLK (757) 640-1122
FAX: (757) 873-1074 · NORFOLK (757) 625-5696
www.MarineChemist.com

Credentials	Agency	Scope
Approval	DOD-US Navy	Resin
Accreditation	ABS	Hull Thickness
Accreditation	AIHA-LAP, LLC	Laboratory ID: 100551
	ELLAP	Paint, Soil, Wipe & Air
	EMLAP	Direct Examination: Air & Tape
	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	Laboratory Code: 200628-0
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	Laboratory No: 460257
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	License No.: 3333 000004
		Asbestos: PLM & PCM

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REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132244-017	405, 12" Cream w/ Multi-Specs Floor Tile/ Mastic					
WSC-17	Floor Tile, Beige	LAYER 1	None Detected			
		90%			Non-Fibrous Material	100%
	Mastic, Beige	LAYER 2	None Detected		Cellulose Fiber	10%
		10%			Non-Fibrous Material	90%
	Asbestos Present: No	**Total % Asbestos:**	**No Asbestos Detected**			
0132244-018	402, 12" Cream w/ Multi-Specs Floor Tile/ Mastic					
WSC-18	Floor Tile, White	LAYER 1	None Detected			
		80%			Non-Fibrous Material	100%
	Mastic, Beige	LAYER 2	None Detected		Cellulose Fiber	5%
		10%			Non-Fibrous Material	95%
	Flooring Material, Gray	LAYER 3	None Detected		Cellulose Fiber	10%
		10%			Non-Fibrous Material	90%
	Asbestos Present: No	**Total % Asbestos:**	**No Asbestos Detected**			

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	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	Laboratory Code: 200628-0
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	Laboratory No: 460257
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	License No.: 3333 000004
		Asbestos: PLM & PCM

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Job Location: Warwick Senior Center (2nd Floor)

Date Received: 02/22/2021
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Sample Matrix: BULK
Date Analyzed: 02/25/2021

Method of Analysis: Polarized Light Microscopy (PLM) using Environmental Protection Agency (EPA) Methods: EPA - 40 CFR Appendix E to Subpart E of Part 763 and EPA 600/R93-116, July 1993.

REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132244-019	Southeast Stairwell, Red Stair Tread/ Adhesive					
WSC-19	Stair Tread, Pink	LAYER 1	None Detected			
		80%			Non-Fibrous Material	100%
	Mastic, Beige	LAYER 2	None Detected		Cellulose Fiber	5%
		10%			Non-Fibrous Material	95%
	Floor Tile, White	LAYER 3	None Detected			
		10%			Non-Fibrous Material	100%
	Asbestos Present: No	**Total % Asbestos:**	**No Asbestos Detected**			
0132244-020	Northwest Stairwell, Red Stair Tread/ Adhesive					
WSC-20	Stair Tread, Pink	LAYER 1	None Detected			
		90%			Non-Fibrous Material	100%
	Mastic, Beige	LAYER 2	None Detected		Cellulose Fiber	10%
		10%			Non-Fibrous Material	90%
	Asbestos Present: No	**Total % Asbestos:**	**No Asbestos Detected**			

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	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	Laboratory Code: 200628-0
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	Laboratory No: 460257
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	License No.: 3333 000004
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Job Location: Warwick Senior Center (2nd Floor)

Date Received: 02/22/2021
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Sample Matrix: BULK
Date Analyzed: 02/25/2021

Method of Analysis: Polarized Light Microscopy (PLM) using Environmental Protection Agency (EPA) Methods: EPA - 40 CFR Appendix E to Subpart E of Part 763 and EPA 600/R93-116, July 1993.

REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132244-021	409A, Brick and Mortar					
WSC-21	Cementitious Material, Gray	LAYER 1	None Detected		Cellulose Fiber	5%
		60%			Non-Fibrous Material	95%
	Cementitious Material, Beige	LAYER 2	None Detected			
		40%			Non-Fibrous Material	100%
	Asbestos Present: No	**Total % Asbestos:**			**No Asbestos Detected**	
0132244-022	409A, Brick and Mortar					
WSC-22	Cementitious Material, Gray	LAYER 1	None Detected		Cellulose Fiber	5%
		100%			Non-Fibrous Material	95%
	Asbestos Present: No	**Total % Asbestos:**			**No Asbestos Detected**	
0132244-023	Hallway, 6" Black Base Cove/ Adhesive					
WSC-23	Cove Base, Black	LAYER 1	None Detected			
		80%			Non-Fibrous Material	100%
	Mastic, Beige	LAYER 2	None Detected		Cellulose Fiber	5%
		20%			Non-Fibrous Material	95%
	Asbestos Present: No	**Total % Asbestos:**			**No Asbestos Detected**	

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		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	Laboratory Code: 200628-0
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	Laboratory No: 460257
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	License No.: 3333 000004
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MCS Report No.: 0132244
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Date Sampled: 02/22/2021
Sampled By: Ryan Stanley
Job Location: Warwick Senior Center (2nd Floor)

Date Received: 02/22/2021
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Sample Matrix: BULK
Date Analyzed: 02/25/2021

Method of Analysis: Polarized Light Microscopy (PLM) using Environmental Protection Agency (EPA) Methods: EPA - 40 CFR Appendix E to Subpart E of Part 763 and EPA 600/R93-116, July 1993.

REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132244-024	401B, 6" Black Base Cove/ Adhesive					
WSC-24	Cove Base, Black	LAYER 1	None Detected			
		70%			Non-Fibrous Material	100%
	Mastic, Beige	LAYER 2	None Detected		Cellulose Fiber	10%
		20%			Non-Fibrous Material	90%
	Paper, Brown	LAYER 3	None Detected		Cellulose Fiber	90%
		10%			Non-Fibrous Material	10%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132244-025	406, 4" Red Base Cove/ Adhesive					
WSC-25	Cove Base, Red	LAYER 1	None Detected			
		80%			Non-Fibrous Material	100%
	Mastic, Beige and White	LAYER 2	None Detected		Cellulose Fiber	10%
		20%			Non-Fibrous Material	90%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132244-026	403, 4" Red Base Cove/ Adhesive					
WSC-26	Cove Base, Red	LAYER 1	None Detected			
		80%			Non-Fibrous Material	100%
	Mastic, Beige	LAYER 2	None Detected		Cellulose Fiber	5%
		20%			Non-Fibrous Material	95%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		

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		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	Laboratory Code: 200628-0
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	Laboratory No: 460257
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	License No.: 3333 000004
		Asbestos: PLM & PCM

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REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132244-027	400A, 6" Brown Base Cove/ Adhesive					
WSC-27	Cove Base, Brown	LAYER 1	None Detected			
		80%			Non-Fibrous Material	100%
	Mastic, Beige	LAYER 2	None Detected		Cellulose Fiber	5%
		20%			Non-Fibrous Material	95%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132244-028	400A, 6" Brown Base Cove/ Adhesive					
WSC-28	Cove Base, Brown	LAYER 1	None Detected			
		90%			Non-Fibrous Material	100%
	Mastic, Beige	LAYER 2	None Detected		Cellulose Fiber	5%
		10%			Non-Fibrous Material	95%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132244-029	406, Drywall					
WSC-29	Paper, Brown	LAYER 1	None Detected		Cellulose Fiber	90%
		30%			Non-Fibrous Material	10%
	Drywall, Beige	LAYER 2	None Detected		Cellulose Fiber	5%
		70%			Non-Fibrous Material	95%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		

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REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132244-030	405, Drywall					
WSC-30	Brown Paper, White Paint	LAYER 1 40%	None Detected		Cellulose Fiber	90%
					Non-Fibrous Material	10%
	Drywall, Gray	LAYER 2 60%	None Detected		Cellulose Fiber	5%
					Non-Fibrous Material	95%
	Asbestos Present: No	**Total % Asbestos:**	**No Asbestos Detected**			
0132244-031	Hallway, Drywall					
WSC-31	Joint Compound, White	LAYER 1 20%	None Detected		Cellulose Fiber	5%
					Non-Fibrous Material	95%
	Paper, Brown	LAYER 2 30%	None Detected		Cellulose Fiber	90%
					Non-Fibrous Material	10%
	Drywall, White	LAYER 3 50%	None Detected		Cellulose Fiber	5%
					Non-Fibrous Material	95%
	Asbestos Present: No	**Total % Asbestos:**	**No Asbestos Detected**			
0132244-032	Women's Restroom, Block/ Wall Sealer/ Paint					
WSC-32	Gray Sealer, White Paint	LAYER 1 100%	None Detected		Non-Fibrous Material	100%
	Asbestos Present: No	**Total % Asbestos:**	**No Asbestos Detected**			

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REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132244-033	Stairwell Southeast, Door Caulk					
WSC-33	Gray Caulk, White and Green Paint	LAYER 1	None Detected		Cellulose Fiber	5%
		100%			Non-Asbestos Residue	95%
	Asbestos Present: No	**Total % Asbestos:**	**No Asbestos Detected**			
0132244-034	400, Door Caulk					
WSC-34	Caulking and Paint, White	LAYER 1	None Detected		Cellulose Fiber	5%
		100%			Non-Fibrous Material	95%
	Asbestos Present: No	**Total % Asbestos:**	**No Asbestos Detected**			
0132244-035	408, Window Glaze					
WSC-35	Glazing, Black	LAYER 1	None Detected			
		100%			Non-Fibrous Material	100%
	Asbestos Present: No	**Total % Asbestos:**	**No Asbestos Detected**			
0132244-036	403, Window Glaze					
WSC-36	Glazing, White and Black	LAYER 1	None Detected			
		100%			Non-Fibrous Material	100%
	Asbestos Present: No	**Total % Asbestos:**	**No Asbestos Detected**			

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		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	Laboratory Code: 200628-0
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	Laboratory No: 460257
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	License No.: 3333 000004
		Asbestos: PLM & PCM

NOTE: Laboratory Credentials cover only to the scopes listed above.

Plant Services - NNPS
Attn: Pennie Robbins Boyack
12580 Patrick Henry Dr.
Newport News VA 23602

MCS Report No.: 0132244
Report Date: 04/01/2021
MCS Job No.: 21-022S
Customer PO No.:

Date Sampled: 02/22/2021
Sampled By: Ryan Stanley
Job Location: Warwick Senior Center (2nd Floor)

Date Received: 02/22/2021
Received By: JAS
Sample Matrix: BULK
Date Analyzed: 02/25/2021

Method of Analysis: Polarized Light Microscopy (PLM) using Environmental Protection Agency (EPA) Methods: EPA - 40 CFR Appendix E to Subpart E of Part 763 and EPA 600/R93-116, July 1993.

REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132244-037	Interior 409, Window Glaze					
WSC-37	Glazing, Gray	LAYER 1	Chrysotile	2%	Wollastonite	5%
		100%			Non-Fibrous Material	93%
	Asbestos Present: Yes	**Total % Asbestos:**		**2%**		
0132244-038	406, Window Caulk					
WSC-38	Caulking, White	LAYER 1	None Detected			
		100%			Non-Fibrous Material	100%
	Asbestos Present: No	**Total % Asbestos:**	**No Asbestos Detected**			
0132244-039	401A, Window Caulk					
WSC-39	Caulking, White	LAYER 1	None Detected		Wollastonite	5%
		100%			Non-Fibrous Material	95%
	Asbestos Present: No	**Total % Asbestos:**	**No Asbestos Detected**			
0132244-040	409, 2'x4' Dotted Ceiling Tile White					
WSC-40	Ceiling Tile, Beige	LAYER 1	None Detected		Cellulose Fiber	30%
		100%			Fibrous Glass	20%
					Non-Fibrous Material	50%
	Asbestos Present: No	**Total % Asbestos:**	**No Asbestos Detected**			

SAMPLING ANALYSIS, CONSULTING, WRITTEN PLANS / SPECIFICATIONS AND TRAINING CLASSES
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11850 TUG BOAT LANE
NEWPORT NEWS, VA 23606-2527
TEL: (757) 873-0933 · NORFOLK (757) 640-1122
FAX: (757) 873-1074 · NORFOLK (757) 625-5696
www.MarineChemist.com

Credentials	Agency	Scope
Approval	DOD-US Navy	Resin
Accreditation	ABS	Hull Thickness
Accreditation	AIHA-LAP, LLC	Laboratory ID: 100551
	ELLAP	Paint, Soil, Wipe & Air
	EMLAP	Direct Examination: Air & Tape
	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	Laboratory Code: 200628-0
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	Laboratory No: 460257
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	License No.: 3333 000004
		Asbestos: PLM & PCM

NOTE: Laboratory Credentials cover only to the scopes listed above.

Plant Services - NNPS
Attn: Pennie Robbins Boyack
12580 Patrick Henry Dr.
Newport News VA 23602

MCS Report No.: 0132244
Report Date: 04/01/2021
MCS Job No.: 21-022S
Customer PO No.:

Date Sampled: 02/22/2021
Sampled By: Ryan Stanley
Job Location: Warwick Senior Center (2nd Floor)

Date Received: 02/22/2021
Received By: JAS
Sample Matrix: BULK
Date Analyzed: 02/25/2021

Method of Analysis: Polarized Light Microscopy (PLM) using Environmental Protection Agency (EPA) Methods: EPA - 40 CFR Appendix E to Subpart E of Part 763 and EPA 600/R93-116, July 1993.

REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132244-041	406, 2'x4' Dotted Ceiling Tile White					
WSC-41	Ceiling Tile, Beige	LAYER 1	None Detected		Cellulose Fiber	30%
		100%			Fibrous Glass	20%
					Non-Fibrous Material	50%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132244-042	Hallway, 2'x4' Dotted Ceiling Tile White					
WSC-42	Ceiling Tile, Beige	LAYER 1	None Detected		Cellulose Fiber	30%
		100%			Fibrous Glass	20%
					Non-Fibrous Material	50%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132244-043	Hallway, 2'x4' Dotted/ Small Worm Ceiling Tile					
WSC-43	Ceiling Tile, Beige	LAYER 1	None Detected		Cellulose Fiber	30%
		100%			Fibrous Glass	20%
					Non-Fibrous Material	50%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132244-044	402, 2'x4' Dotted/ Small Worm Ceiling Tile					
WSC-44	Ceiling Tile, Beige	LAYER 1	None Detected		Cellulose Fiber	30%
		100%			Fibrous Glass	20%
					Non-Fibrous Material	50%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		

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www.MarineChemist.com

Credentials	Agency	Scope
Approval	DOD-US Navy	Resin
Accreditation	ABS	Hull Thickness
Accreditation	AIHA-LAP, LLC	Laboratory ID: 100551
	ELLAP	Paint, Soil, Wipe & Air
	EMLAP	Direct Examination: Air & Tape
	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	Laboratory Code: 200628-0
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	Laboratory No: 460257
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	License No.: 3333 000004
		Asbestos: PLM & PCM

NOTE: Laboratory Credentials cover only to the scopes listed above.

Plant Services - NNPS
Attn: Pennie Robbins Boyack
12580 Patrick Henry Dr.
Newport News VA 23602

MCS Report No.: 0132244
Report Date: 04/01/2021
MCS Job No.: 21-022S
Customer PO No.:

Date Sampled: 02/22/2021
Sampled By: Ryan Stanley
Job Location: Warwick Senior Center (2nd Floor)

Date Received: 02/22/2021
Received By: JAS
Sample Matrix: BULK
Date Analyzed: 02/25/2021

Method of Analysis: Polarized Light Microscopy (PLM) using Environmental Protection Agency (EPA) Methods: EPA - 40 CFR Appendix E to Subpart E of Part 763 and EPA 600/R93-116, July 1993.

REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location / Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132244-045	403, 2'x4' Dotted/ Small Worm Ceiling Tile					
WSC-45	Ceiling Tile, Beige	LAYER 1 100%	None Detected		Cellulose Fiber Fibrous Glass Non-Fibrous Material	30% 20% 50%
	Asbestos Present: No	**Total % Asbestos:**	**No Asbestos Detected**			
0132244-046	405, 2'x4' Large Worm Ceiling Tile					
WSC-46	Ceiling Tile, Beige	LAYER 1 100%	None Detected		Cellulose Fiber Fibrous Glass Non-Fibrous Material	30% 20% 50%
	Asbestos Present: No	**Total % Asbestos:**	**No Asbestos Detected**			
0132244-047	Hallway, 2'x4' Large Worm Ceiling Tile					
WSC-47	Ceiling Tile, Beige	LAYER 1 100%	None Detected		Cellulose Fiber Fibrous Glass Non-Fibrous Material	30% 20% 50%
	Asbestos Present: No	**Total % Asbestos:**	**No Asbestos Detected**			
0132244-048	Hallway, 2'x4' Large Worm Ceiling Tile					
WSC-48	Ceiling Tile, Beige	LAYER 1 100%	None Detected		Cellulose Fiber Fibrous Glass Non-Fibrous Material	30% 20% 50%
	Asbestos Present: No	**Total % Asbestos:**	**No Asbestos Detected**			

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www.MarineChemist.com

Credentials	Agency	Scope
Approval	DOD-US Navy	Resin
Accreditation	ABS	Hull Thickness
Accreditation	AIHA-LAP, LLC	Laboratory ID: 100551
	ELLAP	Paint, Soil, Wipe & Air
	EMLAP	Direct Examination: Air & Tape
	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	Laboratory Code: 200628-0
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	Laboratory No: 460257
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	License No.: 3333 000004
		Asbestos: PLM & PCM

NOTE: Laboratory Credentials cover only to the scopes listed above.

Plant Services - NNPS
Attn: Pennie Robbins Boyack
12580 Patrick Henry Dr.
Newport News VA 23602

MCS Report No.: 0132244
Report Date: 04/01/2021
MCS Job No.: 21-022S
Customer PO No.:

Date Sampled: 02/22/2021
Sampled By: Ryan Stanley
Job Location: Warwick Senior Center (2nd Floor)

Date Received: 02/22/2021
Received By: JAS
Sample Matrix: BULK
Date Analyzed: 02/25/2021

Method of Analysis: Polarized Light Microscopy (PLM) using Environmental Protection Agency (EPA) Methods: EPA - 40 CFR Appendix E to Subpart E of Part 763 and EPA 600/R93-116, July 1993.

REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location / Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132244-049	400A, 2'x2' Dotted Ceiling Tile Yellow					
WSC-49	Ceiling Tile, Beige	LAYER 1	None Detected		Cellulose Fiber	30%
		100%			Fibrous Glass	20%
					Non-Fibrous Material	50%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132244-050	400A, 2'x2' Dotted Ceiling Tile Yellow					
WSC-50	Ceiling Tile, Beige	LAYER 1	None Detected		Cellulose Fiber	30%
		100%			Fibrous Glass	20%
					Non-Fibrous Material	50%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132244-051	400A, 2'x2' Dotted Ceiling Tile Yellow					
WSC-51	Ceiling Tile, Beige	LAYER 1	None Detected		Cellulose Fiber	30%
		100%			Fibrous Glass	20%
					Non-Fibrous Material	50%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		

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Credentials	Agency	Scope
Approval	DOD-US Navy	Resin
Accreditation	ABS	Hull Thickness
Accreditation	AIHA-LAP, LLC	Laboratory ID: 100551
	ELLAP	Paint, Soil, Wipe & Air
	EMLAP	Direct Examination: Air & Tape
	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	Laboratory Code: 200628-0
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	Laboratory No: 460257
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	License No.: 3333 000004
		Asbestos: PLM & PCM

NOTE: Laboratory Credentials cover only to the scopes listed above.

Plant Services - NNPS
Attn: Pennie Robbins Boyack
12580 Patrick Henry Dr.
Newport News VA 23602

MCS Report No.: 0132244
Report Date: 04/01/2021
MCS Job No.: 21-022S
Customer PO No.:

Date Sampled: 02/22/2021
Sampled By: Ryan Stanley
Job Location: Warwick Senior Center (2nd Floor)

Date Received: 02/22/2021
Received By: JAS
Sample Matrix: BULK
Date Analyzed: 02/25/2021

Method of Analysis: Polarized Light Microscopy (PLM) using Environmental Protection Agency (EPA) Methods: EPA - 40 CFR Appendix E to Subpart E of Part 763 and EPA 600/R93-116, July 1993.

REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132244-052	Hallway, Duct Insulation					
WSC-52	Jacket, White	LAYER 1	None Detected		Cellulose Fiber	40%
		40%			Fibrous Glass	40%
					Non-Fibrous Material	20%
	Insulation, Yellow	LAYER 2	None Detected		Fibrous Glass	90%
		60%			Non-Fibrous Material	10%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132244-053	Hallway, Duct Insulation					
WSC-53	Jacket, White	LAYER 1	None Detected		Cellulose Fiber	40%
		40%			Fibrous Glass	40%
					Non-Fibrous Material	20%
	Insulation, Yellow	LAYER 2	None Detected		Fibrous Glass	90%
		60%			Non-Fibrous Material	10%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132244-054	Hallway, Duct Insulation					
WSC-54	Jacket, White	LAYER 1	None Detected		Cellulose Fiber	40%
		40%			Fibrous Glass	40%
					Non-Fibrous Material	20%
	Insulation, Yellow	LAYER 2	None Detected		Fibrous Glass	90%
		60%			Non-Fibrous Material	10%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		

SAMPLING ANALYSIS, CONSULTING, WRITTEN PLANS / SPECIFICATIONS AND TRAINING CLASSES
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Credentials	Agency	Scope
Approval	DOD-US Navy	Resin
Accreditation	ABS	Hull Thickness
Accreditation	AIHA-LAP, LLC	Laboratory ID: 100551
	ELLAP	Paint, Soil, Wipe & Air
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	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	Laboratory Code: 200628-0
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	Laboratory No: 460257
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	License No.: 3333 000004
		Asbestos: PLM & PCM

NOTE: Laboratory Credentials cover only to the scopes listed above.

Plant Services - NNPS
Attn: Pennie Robbins Boyack
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Newport News VA 23602

MCS Report No.: 0132244
Report Date: 04/01/2021
MCS Job No.: 21-022S
Customer PO No.:

Date Sampled: 02/22/2021
Sampled By: Ryan Stanley
Job Location: Warwick Senior Center (2nd Floor)

Date Received: 02/22/2021
Received By: JAS
Sample Matrix: BULK
Date Analyzed: 02/25/2021

Method of Analysis: Polarized Light Microscopy (PLM) using Environmental Protection Agency (EPA) Methods: EPA - 40 CFR Appendix E to Subpart E of Part 763 and EPA 600/R93-116, July 1993.

REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132244-055	408, Sink Undercoating					
WSC-55	Undercoating, Black and White	LAYER 1	Chrysotile	10%	Cellulose Fiber	5%
		100%			Non-Fibrous Material	85%
	Asbestos Present: Yes	**Total % Asbestos:**		**10%**		

NOTE: Original report dated 03/02/2021 was amended for Sample Descriptions of samples 0132244-052, 0132244-053 and 0132244-054.

Analyst - Mary Helen Scott

Approved Signatory - Mary Helen Scott
Laboratory Supervisor

Method Detection Limit: = <1%

* Fiber concentrations were determined by visually estimating the area percentage for each type.
* Asbestos fibers may not be detected by PLM in certain samples because of their size (<5um) or being bound with non-friable organic matrix. In such cases an alternative method of analysis may be necessary.
* Analyzed only readily discernable layers.
* All laboratory test results meet the applicable quality control requirements unless otherwise mentioned.
* MCS. Inc. can not attest to nor be held responsible for the proper collection of samples and/or accuracy of the sample information provided by customers for samples not collected by MCS, Inc.
* Test report relates only to the items tested.
* The samples will be stored at the MCS, Inc. laboratory for a period of thirty days after the analysis. At the end of the period, it will be our policy to dispose of the samples unless prior arrangements have been made for a longer storage period.
* This report shall not be reproduced, except in full, without the written approval of this laboratory.
* The Report must not be used by the customer to claim product certification, approval or endorsement by NVLAP, NIST or any agency of the Federal Government.
* The Report includes Chain of Custody.

SAMPLING ANALYSIS, CONSULTING, WRITTEN PLANS / SPECIFICATIONS AND TRAINING CLASSES
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www.MarineChemist.com

Customer: Newport News Public Schools
Address: 12465 Warwick Blvd, NN, VA
Email: pennie.boyack@nn.k12.va.us
Attention: Pennie Boyack
Phone: 757-881-5024 Fax: 757-249-5638
MCS Job #: 21-~~22~~0225 Customer PO: —

BULK Chain of Custody Form

(use separate form for each matrix)

Job Location: Warwick Senior Center, 2nd Floor

[X] Building Material
[ ] Paint
[ ] Soil
[ ] Other _____

Requested Turnaround Time (markup)
[ ] Same Day (100%)
[ ] 1-Day (75%)
[ ] 2-Day (50%)
[ ] 3-Day (25%)
[ ] 4-Day (12.5%)
[X] 5-Day (standard)

RESULTS DUE BY: 3/1/21
ANALYSIS: PLM

MCS Use Only
Special Instructions: _____
MCS Project Manager: _____
DO NOT MAIL [ ] Give Report To: _____
Email: _____ @
MCS Lab Report No. 0132244 2r 2/22/21
Samples Acceptable to Lab [X] Yes [ ] No By _____
Date _____ If "No" Reason _____

Field ID	Sample Location	Sample Description	MCS Sample No.
example	*room or area*	*size / color / material*	*lab use only*
WSC-1	Mens restroom	12" floor tile/Mastic, Pinkish brown w/ dark specs	0132244-001
WSC-2	Women restroom	12" floor tile/mastic, pinkish-brown w/ dark specs	0132244-002
WSC-3	hallway	12" floor tile/mastic, pinkish-brown w/dark specs	0132244-003
WSC-4	Women restroom	12" floor tile/mastic, tan w/many dark brown specs	0132244-004
WSC-5	408	12" floor tile/mastic, tan w/many dark brown specs	0132244-005
WSC-6	400A	12" floor tile/mastic, tan w/many dark brown specs	0132244-006
WSC-7	400A	12" floor tile/mastic, light gray w/gray specs	0132244-007
WSC-8	400A	12" floor tile/mastic, light gray w/gray specs	0132244-008
WSC-9	400A	12" floor tile/mastic, light gray w/gray specs	0132244-009
WSC-10	400	red carpet/adhesive	0132244-010
WSC-11	conference	red carpet/adhesive	0132244-011
WSC-12	401A	red carpet/adhesive	0132244-012
WSC-13	409A	blue carpet/adhesive	0132244-013
WSC-14	409A	blue carpet/adhesive	0132244-014
WSC-15	409A	blue carpet/adhesive	0132244-015
WSC-16	southeast stairwell	12" cream w/multi-specs floor tile/mastic	0132244-016
WSC-17	405	12" cream w/multi specs floor tile/mastic	0132244-017
WSC-18	402	12" cream w/multi specs floor tile/mastic	0132244-018
WSC-19	southeast stairwell	red stair tread ~~mastic~~ adhesive	0132244-019
WSC-20	northwest stairwell	red stair tread/~~mastic~~ adhesive	0132244-020

Ryan Stanley — Sampled by (Print) — Signature — 2/22/21 — Date/Time — Amended 2/25/21
Kallie Brown — Transported by (Print) — Signature — 2/22/21 — Date/Time
Jennie Swain — Received by (Print) — Signature — 2/22/21 15:19 — Date/Time

OFFICE USE ONLY
Verbal _____
Faxed _____
Copied 3/3/21 RH
Emailed _____
(date and initial above areas)
[ ] Mailed [ ] Billing

Marine Chemist Service, Inc.
11850 Tug Boat Lane • Newport News, VA 23606
(757) 873-0933 • (757) 873-1074 (fax)
www.MarineChemist.com

Customer: Newport News Public Schools
Address: 12465 Warwick Blvd, NN, VA
Email: Pennie.boyack@nn.k12.va.us
Attention: Pennie Boyack
Phone: 757-881-5024 Fax: 757-249-5638
MCS Job #: 21-0225 Customer PO: —

BULK Chain of Custody Form

(use separate form for each matrix)
Job Location: Warwick Senior Center, 2nd Floor

- [X] Building Material
- [ ] Paint
- [ ] Soil
- [ ] Other _____

Requested Turnaround Time (markup)

- [ ] Same Day (100%)
- [ ] 1-Day (75%)
- [ ] 2-Day (50%)
- [ ] 3-Day (25%)
- [ ] 4-Day (12.5%)
- [X] 5-Day (standard)

RESULTS DUE BY: 3/1/21
ANALYSIS: PLM

MCS Use Only
Special Instructions: _____
MCS Project Manager: _____
DO NOT MAIL ☐ Give Report To: _____
Email: _____ @ _____
MCS Lab Report No. 0132244 Th 2/22/21
Samples Acceptable to Lab ☐ Yes ☐ No By _____
Date _____ If "No" Reason _____

Field ID	Sample Location	Sample Description	MCS Sample No.
example	*room or area*	*size / color / material*	*lab use only*
WSC -21	409A	brick and mortar	0132244-021
WSC-22	409A	brick and mortar	0132244-022
WSC -23	hallway	6" black base cove/adhesive	0132244-023
WSC -24	401B	6" black base cove/adhesive	0132244-024
WSC-25	406	4" red base cove/adhesive	0132244-025
WSC-26	403	4" red base cove/adhesive	0132244-026
WSC-27	400A	6" brown base cove/adhesive	0132244-027
WSC-28	400A	6" brown base cove/adhesive	0132244-028
WSC-29	406	drywall	0132244-029
WSC-30	405	drywall	0132244-030
WSC-31	hallway	drywall	0132244-031
WSC-32	women restroom	block/wall sealer/paint	0132244-032
WSC-33	stairwell southeast	door caulk	0132244-033
WSC-34	400	door caulk	0132244-034
WSC-35	408	window glaze	0132244-035
WSC-310	403	window glaze	0132244-036
WSC-37	interior 409	window glaze	0132244-037
WSC-38	406	window caulk	0132244-038
WSC-39	~~400~~ 401A	window caulk	0132244-039
WSC-40	409	2'x4' dotted ceiling tile white	0132244-040

Ryan Stanley — Sampled by (Print) — Signature — 2/22/21 — Date/Time
Kallie Brown — Transported by (Print) — Signature — 2/22/21 — Date/Time
Jennie Swan — Received by (Print) — Signature — 2/22/21 15:19 — Date/Time

OFFICE USE ONLY:
Verbal _____
Faxed _____
Copied _____
Emailed _____ (date and initial above areas)
☐ Mailed ☐ Billing

Marine Chemist Service, Inc.
11850 Tug Boat Lane • Newport News, VA 23606
(757) 873-0933 • (757) 873-1074 (fax)
www.MarineChemist.com

Customer: Newport News Public Schools
Address: 12465 Warwick Blvd, NN, VA
Email: pennie.boyack@nn.k12.va.us
Attention: Pennie Boyack
Phone: 757-881-5024 **Fax:** 757-249-5638
MCS Job #: 21-0225 **Customer PO:** —

BULK Chain of Custody Form

(use separate form for each matrix)

Job Location: Warwick Senior Center, 2nd Floor

- [x] Building Material
- [ ] Paint
- [ ] Soil
- [ ] Other ______

Requested Turnaround Time (markup)

- [ ] Same Day (100%)
- [ ] 1-Day (75%)
- [ ] 2-Day (50%)
- [ ] 3-Day (25%)
- [ ] 4-Day (12.5%)
- [x] 5-Day (standard)

RESULTS DUE BY: 3/1/21

ANALYSIS: PLM

MCS Use Only

Special Instructions:

MCS Project Manager:

DO NOT MAIL ☐ **Give Report To:**

Email: @

MCS Lab Report No. 0132244 & 2/22/21

Samples Acceptable to Lab ☐ Yes ☐ No By ______

Date ______ If "No" Reason ______

Field ID	Sample Location	Sample Description	MCS Sample No.
example	*room or area*	*size / color / material*	*lab use only*
WSC-41	406	2'x4' dotted ceiling tile white	0132244-041
WSC-42	hallway	2'x4' dotted ceiling tile white	0132244-042
WSC-43	hallway	2'x4' dotted / small worm ceiling tile	0132244-043
WSC-44	402	2'x4' dotted/small worm ceiling tile	0132244-044
WSC-45	403	2'x4' dotted/small worm ceiling tile	0132244-045
WSC-46	405	2'x4' large worm ceiling tile	0132244-046
WSC-47	hallway	2'x4' large worm ceiling tile	0132244-047
WSC-48	hallway	2'x4' large worm ceiling tile	0132244-048
WSC-49	~~400B~~ 400A	2'x2' dotted ceiling tile yellow	0132244-049
WSC-50	~~400B~~ 400A	2'x2' dotted ceiling tile yellow	0132244-050
WSC-51	~~400B~~ 400A	2'x2' dotted ceiling tile yellow	0132244-051
WSC-52	hallway	~~pipe~~ duct insulation	0132244-052
WSC-53	hallway	duct insulation	0132244-053
WSC-54	hallway	duct insulation	0132244-054
WSC-55	408	sink undercoating	0132244-055

Ryan Stanley — Sampled by (Print) — [signature] Signature — 2/22/21 Date/Time

Kallie Brown — Transported by (Print) — [signature] Signature — 2/22/21 Date/Time

Jennie Swain — Received by (Print) — [signature] Signature — 2/22/21 15:19 Date/Time

Amended [illegible]

OFFICE USE ONLY:

Verbal ______
Faxed ______
Copied ______
Emailed ______

(date and initial above areas)

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www.MarineChemist.com

Credentials	Agency	Scope
Approval	DOD-US Navy	Resin
Accreditation	ABS	Hull Thickness
Accreditation	AIHA-LAP, LLC	Laboratory ID: 100551
	ELLAP	Paint, Soil, Wipe & Air
	EMLAP	Direct Examination: Air & Tape
	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	Laboratory Code: 200628-0
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	Laboratory No: 460257
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	License No.: 3333 000004
		Asbestos: PLM & PCM

NOTE: Laboratory Credentials cover only to the scopes listed above.

Plant Services - NNPS
Attn: Pennie Robbins Boyack
12580 Patrick Henry Dr.
Newport News VA 23602

MCS Report No.: 0132357
Report Date: 03/23/2021
MCS Job No.: 21-022S
Customer PO No.:

Date Sampled: 03/06/2021
Sampled By: Ryan Stanley
Job Location: Warwick Senior Center/ Gatewood Peep

Date Received: 03/08/2021
Received By: SGH
Sample Matrix: BULK
Date Analyzed: 03/18/2021

Method of Analysis: Polarized Light Microscopy (PLM) using Environmental Protection Agency (EPA) Methods: EPA - 40 CFR Appendix E to Subpart E of Part 763 and EPA 600/R93-116, July 1993.

REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132357-001	1st Floor Hall, Cementitious Ceiling Material/ Mastic					
WSC-56	Cementitious Material, Gray	LAYER 1	None Detected			
		70%			Non-Fibrous Material	100%
	Mastic, Beige	LAYER 2	None Detected			
		30%			Non-Fibrous Material	100%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132357-002	1st Floor Hall, Cementitious Ceiling Material/ Mastic					
WSC-57	Cementitious Material, Gray	LAYER 1	None Detected			
		60%			Non-Fibrous Material	100%
	Mastic, Beige	LAYER 2	None Detected		Fibrous Glass	10%
		40%			Non-Fibrous Material	90%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132357-003	1st Floor Hall, Cementitious Ceiling Material/ Mastic					
WSC-58	Cementitious Material, Gray	LAYER 1	None Detected			
		30%			Non-Fibrous Material	100%
	Mastic, Beige	LAYER 2	None Detected		Fibrous Glass	10%
		70%			Non-Fibrous Material	90%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		

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www.MarineChemist.com

Credentials	Agency	Scope
Approval	DOD-US Navy	Resin
Accreditation	ABS	Hull Thickness
Accreditation	AIHA-LAP, LLC	Laboratory ID: 100551
	ELLAP	Paint, Soil, Wipe & Air
	EMLAP	Direct Examination: Air & Tape
	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	Laboratory Code: 200628-0
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	Laboratory No: 460257
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	License No.: 3333 000004
		Asbestos: PLM & PCM

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Plant Services - NNPS
Attn: Pennie Robbins Boyack
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MCS Report No.: 0132357
Report Date: 03/23/2021
MCS Job No.: 21-022S
Customer PO No.:

Date Sampled: 03/06/2021
Sampled By: Ryan Stanley
Job Location: Warwick Senior Center/ Gatewood Peep

Date Received: 03/08/2021
Received By: SGH
Sample Matrix: BULK
Date Analyzed: 03/18/2021

Method of Analysis: Polarized Light Microscopy (PLM) using Environmental Protection Agency (EPA) Methods: EPA - 40 CFR Appendix E to Subpart E of Part 763 and EPA 600/R93-116, July 1993.

REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132357-004	1st Floor Hall, Brown Pipe Insulation					
WSC-59	Brown and Silver Jacket, Black Tar	LAYER 1	None Detected		Fibrous Glass	40%
		60%			Cellulose Fiber	40%
					Non-Fibrous Material	20%
	Insulation, Orange	LAYER 2	None Detected		Fibrous Glass	90%
		40%			Non-Fibrous Material	10%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132357-005	1st Floor Hall, Brown Pipe Insulation					
WSC-60	Brown and Silver Jacket, Black Tar	LAYER 1	None Detected		Fibrous Glass	40%
		80%			Cellulose Fiber	40%
					Non-Fibrous Material	20%
	Insulation, Orange	LAYER 2	None Detected		Fibrous Glass	90%
		20%			Non-Fibrous Material	10%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132357-006	1st Floor Hall, Brown Pipe Insulation					
WSC-61	Jacket, Brown and Silver	LAYER 1	None Detected		Fibrous Glass	40%
		40%			Cellulose Fiber	40%
					Non-Fibrous Material	20%
	Insulation, Orange	LAYER 2	None Detected		Fibrous Glass	90%
		60%			Non-Fibrous Material	10%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		

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Credentials	Agency	Scope
Approval	DOD-US Navy	Resin
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Accreditation	AIHA-LAP, LLC	Laboratory ID: 100551
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	EMLAP	Direct Examination: Air & Tape
	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	Laboratory Code: 200628-0
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	Laboratory No: 460257
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	License No.: 3333 000004
		Asbestos: PLM & PCM

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Report Date: 03/23/2021
MCS Job No.: 21-022S
Customer PO No.:

Date Sampled: 03/06/2021
Sampled By: Ryan Stanley
Job Location: Warwick Senior Center/ Gatewood Peep

Date Received: 03/08/2021
Received By: SGH
Sample Matrix: BULK
Date Analyzed: 03/18/2021

Method of Analysis: Polarized Light Microscopy (PLM) using Environmental Protection Agency (EPA) Methods: EPA - 40 CFR Appendix E to Subpart E of Part 763 and EPA 600/R93-116, July 1993.

REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132357-007	1st Floor, 12" Ceiling Tile					
WSC-62	Orange Ceiling Tile, White Paint	LAYER 1	None Detected		Fibrous Glass	90%
		100%			Non-Fibrous Material	10%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132357-008	1st Floor, 12" Ceiling Tile					
WSC-63	Orange Ceiling Tile, White Paint	LAYER 1	None Detected		Fibrous Glass	90%
		100%			Non-Fibrous Material	10%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132357-009	1st Floor, 12" Ceiling Tile					
WSC-64	Ceiling Tile, Orange	LAYER 1	None Detected		Fibrous Glass	90%
		100%			Non-Fibrous Material	10%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132357-010	1st Floor, Heater Insulation					
WSC-65	Plastic-Like Material and Paint, White	LAYER 1	None Detected		Fibrous Glass	90%
		30%			Non-Fibrous Material	10%
	Insulation, Orange	LAYER 2	None Detected			
		70%			Non-Fibrous Material	100%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		

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Credentials	Agency	Scope
Approval	DOD-US Navy	Resin
Accreditation	ABS	Hull Thickness
Accreditation	AIHA-LAP, LLC	Laboratory ID: 100551
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	EMLAP	Direct Examination: Air & Tape
	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	Laboratory Code: 200628-0
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	Laboratory No: 460257
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	License No.: 3333 000004
		Asbestos: PLM & PCM

NOTE: Laboratory Credentials cover only to the scopes listed above.

Plant Services - NNPS
Attn: Pennie Robbins Boyack
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Newport News VA 23602

MCS Report No.: 0132357
Report Date: 03/23/2021
MCS Job No.: 21-022S
Customer PO No.:

Date Sampled: 03/06/2021
Sampled By: Ryan Stanley
Job Location: Warwick Senior Center/ Gatewood Peep

Date Received: 03/08/2021
Received By: SGH
Sample Matrix: BULK
Date Analyzed: 03/18/2021

Method of Analysis: Polarized Light Microscopy (PLM) using Environmental Protection Agency (EPA) Methods: EPA - 40 CFR Appendix E to Subpart E of Part 763 and EPA 600/R93-116, July 1993.

REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132357-011	1st Floor, Heater Insulation					
WSC-66	Jacket, White	LAYER 1	None Detected		Cellulose Fiber	40%
		50%			Fibrous Glass	40%
					Non-Fibrous Material	20%
	Insulation, Orange	LAYER 2	None Detected		Fibrous Glass	90%
		50%			Non-Fibrous Material	10%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132357-012	1st Floor, Heater Insulation					
WSC-67	Plastic-Like Material and Paint, White	LAYER 1	None Detected			
		40%			Non-Fibrous Material	100%
	Insulation, Orange	LAYER 2	None Detected		Fibrous Glass	90%
		60%			Non-Fibrous Material	10%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132357-013	1st Floor, 2x4 Wormed Ceiling Tile					
WSC-68	Ceiling Tile, Beige	LAYER 1	None Detected		Cellulose Fiber	30%
		100%			Fibrous Glass	20%
					Non-Fibrous Material	50%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		

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Virginia Certification	VELAP	Laboratory No: 460257
	NELAC	RCRA 8 Metals: TCLP & NPW
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Attn: Pennie Robbins Boyack
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MCS Report No.: 0132357
Report Date: 03/23/2021
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Customer PO No.:

Date Sampled: 03/06/2021
Sampled By: Ryan Stanley
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Date Received: 03/08/2021
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Sample Matrix: BULK
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Method of Analysis: Polarized Light Microscopy (PLM) using Environmental Protection Agency (EPA) Methods: EPA - 40 CFR Appendix E to Subpart E of Part 763 and EPA 600/R93-116, July 1993.

REPORT OF ANALYSIS

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0132357-014	1st Floor, 2x4 Wormed Ceiling Tile					
WSC-69	Ceiling Tile, Beige	LAYER 1	None Detected		Cellulose Fiber	30%
		100%			Fibrous Glass	20%
					Non-Fibrous Material	50%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132357-015	1st Floor, 2x4 Wormed Ceiling Tile					
WSC-70	Ceiling Tile, Beige	LAYER 1	None Detected		Cellulose Fiber	30%
		100%			Fibrous Glass	20%
					Non-Fibrous Material	50%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132357-016	1st Floor, 2x4 Dotted Ceiling Tile					
WSC-71	Ceiling Tile, Beige	LAYER 1	None Detected		Cellulose Fiber	30%
		100%			Fibrous Glass	20%
					Non-Fibrous Material	50%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132357-017	1st Floor, 2x4 Dotted Ceiling Tile					
WSC-72	Ceiling Tile, Beige	LAYER 1	None Detected		Cellulose Fiber	30%
		100%			Fibrous Glass	20%
					Non-Fibrous Material	50%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		

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Accreditation	AIHA-LAP, LLC	Laboratory ID: 100551
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MCS Report No.: 0132357
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Sample Matrix: BULK
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REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132357-018	1st Floor, 2x4 Dotted Ceiling Tile					
WSC-73	Ceiling Tile, Beige	LAYER 1	None Detected		Cellulose Fiber	30%
		100%			Fibrous Glass	20%
					Non-Fibrous Material	50%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132357-019	1st Floor, 2x4 Pitted Ceiling Tile					
WSC-74	Ceiling Tile, Beige	LAYER 1	None Detected		Cellulose Fiber	30%
		100%			Fibrous Glass	20%
					Non-Fibrous Material	50%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132357-020	1st Floor, 2x4 Pitted Ceiling Tile					
WSC-75	Ceiling Tile, Beige	LAYER 1	None Detected		Cellulose Fiber	30%
		100%			Fibrous Glass	20%
					Non-Fibrous Material	50%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132357-021	1st Floor, 2x4 Pitted Ceiling Tile					
WSC-76	Ceiling Tile, Beige	LAYER 1	None Detected		Cellulose Fiber	30%
		100%			Fibrous Glass	20%
					Non-Fibrous Material	50%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		

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Received By: SGH
Sample Matrix: BULK
Date Analyzed: 03/18/2021

Method of Analysis: Polarized Light Microscopy (PLM) using Environmental Protection Agency (EPA) Methods: EPA - 40 CFR Appendix E to Subpart E of Part 763 and EPA 600/R93-116, July 1993.

REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132357-022	1st Floor 303, 9" Ceiling Tile					
WSC-77	Orange Ceiling Tile, White Paint	LAYER 1	None Detected		Cellulose Fiber	90%
		100%			Non-Fibrous Material	10%
	Asbestos Present: No	**Total % Asbestos:**	**No Asbestos Detected**			
0132357-023	1st Floor 303, 9" Ceiling Tile					
WSC-78	Orange Ceiling Tile, White Paint	LAYER 1	None Detected		Cellulose Fiber	90%
		100%			Non-Fibrous Material	10%
	Asbestos Present: No	**Total % Asbestos:**	**No Asbestos Detected**			
0132357-024	1st Floor 303, 9" Ceiling Tile					
WSC-79	Orange Ceiling Tile, White Paint	LAYER 1	None Detected		Cellulose Fiber	90%
		100%			Non-Fibrous Material	10%
	Asbestos Present: No	**Total % Asbestos:**	**No Asbestos Detected**			
0132357-025	1st Floor, Brick/ Mortar					
WSC-80	Gray Cementitious Material, White Paint	LAYER 1	None Detected		Cellulose Fiber	5%
		100%			Non-Fibrous Material	95%
	Asbestos Present: No	**Total % Asbestos:**	**No Asbestos Detected**			

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FAX: (757) 873-1074 · NORFOLK (757) 625-5696
www.MarineChemist.com

Credentials	Agency	Scope
Approval	DOD-US Navy	Resin
Accreditation	ABS	Hull Thickness
Accreditation	AIHA-LAP, LLC	Laboratory ID: 100551
	ELLAP	Paint, Soil, Wipe & Air
	EMLAP	Direct Examination: Air & Tape
	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	Laboratory Code: 200628-0
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	Laboratory No: 460257
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	License No.: 3333 000004
		Asbestos: PLM & PCM

NOTE: Laboratory Credentials cover only to the scopes listed above.

Plant Services - NNPS
Attn: Pennie Robbins Boyack
12580 Patrick Henry Dr.
Newport News VA 23602

MCS Report No.: 0132357
Report Date: 03/23/2021
MCS Job No.: 21-022S
Customer PO No.:

Date Sampled: 03/06/2021
Sampled By: Ryan Stanley
Job Location: Warwick Senior Center/ Gatewood Peep

Date Received: 03/08/2021
Received By: SGH
Sample Matrix: BULK
Date Analyzed: 03/18/2021

Method of Analysis: Polarized Light Microscopy (PLM) using Environmental Protection Agency (EPA) Methods: EPA - 40 CFR Appendix E to Subpart E of Part 763 and EPA 600/R93-116, July 1993.

REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132357-026	1st Floor, Brick/ Mortar					
WSC-81	Gray Cementitious Material, White Paint	LAYER 1	None Detected		Cellulose Fiber	5%
		100%			Non-Fibrous Material	95%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132357-027	1st Floor, Ceramic Wall Tile/ Blue					
WSC-82	Ceramic Tile, Blue	LAYER 1	None Detected		Cellulose Fiber	5%
		100%			Non-Fibrous Material	95%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132357-028	1st Floor, Ceramic Wall Tile/ Blue					
WSC-83	Ceramic Tile, Beige	LAYER 1	None Detected		Cellulose Fiber	5%
		100%			Non-Fibrous Material	95%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132357-029	1st Floor, Door Caulk					
WSC-84	Caulking and Paint, White	LAYER 1	None Detected		Cellulose Fiber	5%
		100%			Wollastonite	5%
					Non-Fibrous Material	90%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		

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Credentials	Agency	Scope
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Accreditation	ABS	Hull Thickness
Accreditation	AIHA-LAP, LLC	Laboratory ID: 100551
	ELLAP	Paint, Soil, Wipe & Air
	EMLAP	Direct Examination: Air & Tape
	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	Laboratory Code: 200628-0
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	Laboratory No: 460257
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	License No.: 3333 000004
		Asbestos: PLM & PCM

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MCS Report No.: 0132357
Report Date: 03/23/2021
MCS Job No.: 21-022S
Customer PO No.:

Date Sampled: 03/06/2021
Sampled By: Ryan Stanley
Job Location: Warwick Senior Center/ Gatewood Peep

Date Received: 03/08/2021
Received By: SGH
Sample Matrix: BULK
Date Analyzed: 03/18/2021

Method of Analysis: Polarized Light Microscopy (PLM) using Environmental Protection Agency (EPA) Methods: EPA - 40 CFR Appendix E to Subpart E of Part 763 and EPA 600/R93-116, July 1993.

REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132357-030	1st Floor, Door Caulk					
WSC-85	Caulking and Paint, White	LAYER 1	None Detected			
		100%			Non-Fibrous Material	100%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132357-031	1st Floor, Window Caulk					
WSC-86	Caulking and Paint, White	LAYER 1	None Detected			
		100%			Non-Fibrous Material	100%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132357-032	1st Floor, Window Caulk					
WSC-87	Caulking, White	LAYER 1	None Detected		Wollastonite	10%
		100%			Non-Fibrous Material	90%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132357-033	1st Floor, Drywall					
WSC-88	Brown Paper, White Paint	LAYER 1	None Detected		Cellulose Fiber	90%
		40%			Non-Fibrous Material	10%
	Drywall, White	LAYER 2	None Detected		Cellulose Fiber	5%
		60%			Non-Fibrous Material	95%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		

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Credentials	Agency	Scope
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	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	Laboratory Code: 200628-0
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	Laboratory No: 460257
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	License No.: 3333 000004
		Asbestos: PLM & PCM

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Customer PO No.:

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REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132357-034	1st Floor, Drywall					
WSC-89	Brown Paper, White Paint	LAYER 1	None Detected		Cellulose Fiber	90%
		30%			Non-Fibrous Material	10%
	Drywall, White	LAYER 2	None Detected		Cellulose Fiber	5%
		70%			Non-Fibrous Material	95%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132357-035	1st Floor, Drywall					
WSC-90	Brown Paper, White Paint	LAYER 1	None Detected		Cellulose Fiber	90%
		30%			Non-Fibrous Material	10%
	Drywall, White	LAYER 2	None Detected		Cellulose Fiber	5%
		70%			Non-Fibrous Material	95%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132357-036	1st Floor Janitors, Pipe Insulation/ Patch					
WSC-91	Red Jacket, White Paint	LAYER 1	None Detected		Fibrous Glass	80%
		60%			Non-Fibrous Material	20%
	Fibrous Material, Beige	LAYER 2	None Detected		Cellulose Fiber	90%
		20%			Non-Fibrous Material	10%
	Insulation, Beige	LAYER 3	Chrysotile	30%		
		20%			Non-Fibrous Material	70%
	Asbestos Present: Yes	**Total % Asbestos:**		**6%**		

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	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	Laboratory Code: 200628-0
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	Laboratory No: 460257
	NELAC	RCRA 8 Metals: TCLP & NPW
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REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132357-037	1st Floor, 6" Black Base Cove/ Mastic					
WSC-92	Cove Base, Black	LAYER 1	None Detected			
		70%			Non-Fibrous Material	100%
	Mastic, Beige	LAYER 2	None Detected			
		20%			Non-Fibrous Material	100%
	Wall Material, White	LAYER 3	None Detected			
		10%			Non-Fibrous Material	100%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132357-038	1st Floor, 6" Black Base Cove/ Mastic					
WSC-93	Cove Base, Black	LAYER 1	None Detected			
		70%			Non-Fibrous Material	100%
	Mastic, Beige	LAYER 2	None Detected			
		20%			Non-Fibrous Material	100%
	Wall Material, Beige	LAYER 3	None Detected		Cellulose Fiber	5%
		10%			Non-Fibrous Material	95%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		

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		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	Laboratory Code: 200628-0
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	Laboratory No: 460257
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	License No.: 3333 000004
		Asbestos: PLM & PCM

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REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132357-039	1st Floor, 4" Brown Base Cove/ Mastic					
WSC-94	Cove Base, Brown	LAYER 1	None Detected			
		80%			Non-Fibrous Material	100%
	Mastic, Brown	LAYER 2	None Detected		Cellulose Fiber	5%
		20%			Non-Fibrous Material	95%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132357-040	1st Floor, 4" Brown Base Cove/ Mastic					
WSC-95	Cove Base, Brown	LAYER 1	None Detected			
		90%			Non-Fibrous Material	100%
	Mastic, Brown	LAYER 2	None Detected		Cellulose Fiber	10%
		10%			Non-Fibrous Material	90%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132357-041	1st Floor, 9" Red Tile/ Mastic					
WSC-96	Floor Tile, Red	LAYER 1	Chrysotile	5%		
		90%			Non-Fibrous Material	95%
	Mastic, Black	LAYER 2	Chrysotile	10%	Cellulose Fiber	10%
		10%			Non-Fibrous Material	80%
	Asbestos Present: Yes	**Total % Asbestos:**		**6%**		

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REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132357-042	1st Floor, 9" Red Tile/ Mastic					
WSC-97	Floor Tile, Red	LAYER 1	Chrysotile	5%		
		80%			Non-Fibrous Material	95%
	Mastic, Black	LAYER 2	Chrysotile	5%	Cellulose Fiber	5%
		20%			Non-Fibrous Material	90%
	Asbestos Present: Yes	**Total % Asbestos:**		**5%**		
0132357-043	1st Floor, 9" Red Tile/ Mastic					
WSC-98	Floor Tile, Red	LAYER 1	Chrysotile	5%		
		80%			Non-Fibrous Material	95%
	Mastic, Black	LAYER 2	Chrysotile	5%	Cellulose Fiber	5%
		20%			Non-Fibrous Material	90%
	Asbestos Present: Yes	**Total % Asbestos:**		**5%**		
0132357-044	1st Floor, White/ Black Speckled Terrazzo					
WSC-99	Floor Tile, White	LAYER 1	None Detected			
		100%			Non-Fibrous Material	100%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132357-045	1st Floor, White/ Black Speckled Terrazzo					
WSC-100	Floor Tile, White	LAYER 1	None Detected			
		100%			Non-Fibrous Material	100%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		

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		Dust: Gravimetry
		Metals: Air
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	NVLAP	Asbestos Bulk: PLM
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REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132357-046	1st Floor, 12" Ivory Floor Tile/ Mastic					
WSC-101	Floor Tile, White	LAYER 1	None Detected			
		70%			Non-Fibrous Material	100%
	Mastic, Beige	LAYER 2	None Detected		Cellulose Fiber	5%
		10%			Non-Fibrous Material	95%
	Flooring Material, Gray	LAYER 3	None Detected		Cellulose Fiber	5%
		20%			Non-Fibrous Material	95%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132357-047	1st Floor, 12" Ivory Floor Tile/ Mastic					
WSC-102	Floor Tile, White	LAYER 1	None Detected			
		70%			Non-Fibrous Material	100%
	Mastic, Beige	LAYER 2	None Detected		Cellulose Fiber	5%
		10%			Non-Fibrous Material	95%
	Flooring Material, Gray	LAYER 3	None Detected		Cellulose Fiber	5%
		20%			Non-Fibrous Material	95%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		

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Credentials	Agency	Scope
Approval	DOD-US Navy	Resin
Accreditation	ABS	Hull Thickness
Accreditation	AIHA-LAP, LLC	Laboratory ID: 100551
	ELLAP	Paint, Soil, Wipe & Air
	EMLAP	Direct Examination: Air & Tape
	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	Laboratory Code: 200628-0
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	Laboratory No: 460257
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	License No.: 3333 000004
		Asbestos: PLM & PCM

NOTE: Laboratory Credentials cover only to the scopes listed above.

Plant Services - NNPS
Attn: Pennie Robbins Boyack
12580 Patrick Henry Dr.
Newport News VA 23602

MCS Report No.: 0132357
Report Date: 03/23/2021
MCS Job No.: 21-022S
Customer PO No.:

Date Sampled: 03/06/2021
Sampled By: Ryan Stanley
Job Location: Warwick Senior Center/ Gatewood Peep

Date Received: 03/08/2021
Received By: SGH
Sample Matrix: BULK
Date Analyzed: 03/18/2021

Method of Analysis: Polarized Light Microscopy (PLM) using Environmental Protection Agency (EPA) Methods: EPA - 40 CFR Appendix E to Subpart E of Part 763 and EPA 600/R93-116, July 1993.

REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132357-048	1st Floor, 12" Ivory Floor Tile/ Mastic					
WSC-103	Floor Tile, White	LAYER 1	None Detected			
		90%			Non-Fibrous Material	100%
	Mastic, Clear	LAYER 2	None Detected		Cellulose Fiber	5%
		10%			Non-Fibrous Material	95%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132357-049	1st Floor, 12" White Floor Tile/ Mastic					
WSC-104	Floor Tile, White	LAYER 1	Chrysotile	3%		
		90%			Non-Fibrous Material	97%
	Mastic, Black	LAYER 2	Chrysotile	10%	Cellulose Fiber	5%
		10%			Non-Fibrous Material	85%
	Asbestos Present: Yes	**Total % Asbestos:**		**4%**		
0132357-050	1st Floor, 12" White Floor Tile/ Mastic					
WSC-105	Floor Tile, White	LAYER 1	Chrysotile	3%		
		90%			Non-Fibrous Material	97%
	Mastic, Black	LAYER 2	Chrysotile	10%	Cellulose Fiber	5%
		10%			Non-Fibrous Material	85%
	Asbestos Present: Yes	**Total % Asbestos:**		**4%**		

SAMPLING ANALYSIS, CONSULTING, WRITTEN PLANS / SPECIFICATIONS AND TRAINING CLASSES
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Credentials	Agency	Scope
Approval	DOD-US Navy	Resin
Accreditation	ABS	Hull Thickness
Accreditation	AIHA-LAP, LLC	Laboratory ID: 100551
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	EMLAP	Direct Examination: Air & Tape
	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	Laboratory Code: 200628-0
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	Laboratory No: 460257
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	License No.: 3333 000004
		Asbestos: PLM & PCM

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Plant Services - NNPS
Attn: Pennie Robbins Boyack
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MCS Report No.: 0132357
Report Date: 03/23/2021
MCS Job No.: 21-022S
Customer PO No.:

Date Sampled: 03/06/2021
Sampled By: Ryan Stanley
Job Location: Warwick Senior Center/ Gatewood Peep

Date Received: 03/08/2021
Received By: SGH
Sample Matrix: BULK
Date Analyzed: 03/18/2021

Method of Analysis: Polarized Light Microscopy (PLM) using Environmental Protection Agency (EPA) Methods: EPA - 40 CFR Appendix E to Subpart E of Part 763 and EPA 600/R93-116, July 1993.

REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132357-051	1st Floor, 12" White Floor Tile/ Mastic					
WSC-106	Floor Tile, White	LAYER 1	Chrysotile	3%		
		90%			Non-Fibrous Material	97%
	Mastic, Black	LAYER 2	Chrysotile	10%	Cellulose Fiber	5%
		10%			Non-Fibrous Material	85%
	Asbestos Present: Yes	**Total % Asbestos:**		4%		

Analyst - Mary Helen Scott

Approved Signatory - Mary Helen Scott
Laboratory Supervisor
for

Method Detection Limit: = <1%

* Fiber concentrations were determined by visually estimating the area percentage for each type.
* Asbestos fibers may not be detected by PLM in certain samples because of their size (<5um) or being bound with non-friable organic matrix. In such cases an alternative method of analysis may be necessary.
* Analyzed only readily discernable layers.
* All laboratory test results meet the applicable quality control requirements unless otherwise mentioned.
* MCS. Inc. can not attest to nor be held responsible for the proper collection of samples and/or accuracy of the sample information provided by customers for samples not collected by MCS, Inc.
* Test report relates only to the items tested.
* The samples will be stored at the MCS, Inc. laboratory for a period of thirty days after the analysis. At the end of the period, it will be our policy to dispose of the samples unless prior arrangements have been made for a longer storage period.
* This report shall not be reproduced, except in full, without the written approval of this laboratory.
* The Report must not be used by the customer to claim product certification, approval or endorsement by NVLAP, NIST or any agency of the Federal Government.
* The Report includes Chain of Custody.

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www.MarineChemist.com

Customer: NNPS
Address:
Email: Perrie.Boyock@nn.k12.va.us
Attention: Perrie Boyock
Phone: 503-1192 Fax:
MCS Job #: 21-0225 Customer PO:

BULK Chain of Custody Form

(use separate form for each matrix)

Job Location: Warwick Senior Center / Gatewood peep

- [x] Building Material
- [ ] Paint
- [ ] Soil
- [ ] Other ______

Requested Turnaround Time (markup)

- [ ] Same Day (100%)
- [ ] 1-Day (75%)
- [ ] 2-Day (50%)
- [ ] 3-Day (25%)
- [ ] 4-Day (12.5%)
- [x] 5-Day (standard)

RESULTS DUE BY: 3-15-21

ANALYSIS: PLM

MCS Use Only

Special Instructions:

MCS Project Manager:

DO NOT MAIL ☐ Give Report To:

Email: @

MCS Lab Report No. 0132357 3/8/21 SH

Samples Acceptable to Lab ☑ Yes ☐ No By

Date If "No" Reason

Field ID *example*	Sample Location *room or area*	Sample Description *size / color / material*	MCS Sample No. *lab use only*
WSC - 56	Senior Center 1st floor Hall ~~office~~	Cementitious ceiling material / mastic	0132357-001
WSC - 57	Senior Center 1st floor Hall ~~office~~	Cementitious ceiling material / mastic	0132357-002
WSC - 58	Senior Center 1st floor Hall ~~office~~	Cementitious ceiling material / mastic	0132357-003
WSC - 59	Senior Center 1st floor Hall	Brown pipe insulation	0132357-004
WSC - 60	Senior Center 1st floor Hall	Brown pipe insulation	0132357-005
WSC - 61	Senior Center 1st floor Hall	Brown pipe insulation	0132357-006
WSC - 62	Senior Center 1st floor	12" ceiling tile	0132357-007
WSC - 63	Senior Center 1st floor	12" ceiling tile	0132357-008
WSC - 64	Senior Center 1st floor	12" Ceiling tile	0132357-009
WSC - 65	Senior Center 1st floor	Heater insulation	0132357-010
WSC - 66	Senior Center 1st floor	Heater insulation	0132357-011
WSC - 67	Senior Center 1st floor	Heater insulation	0132357-012
WSC - 68	Senior Center 1st floor	2x4 wormed ceiling tile	0132357-013
WSC - 69	Senior Center 1st floor	2x4 wormed ceiling tile	0132357-014
WSC - 70	Senior Center 1st floor	2x4 wormed ceiling tile	0132357-015
WSC - 71	Senior Center 1st floor	2x4 dotted ceiling tile	0132357-016
WSC - 72	Senior Center 1st floor	2x4 dotted ceiling tile	0132357-017
WSC - 73	Senior Center 1st floor	2x4 dotted ceiling tile	0132357-018
WSC - 74	Senior Center 1st floor	2x4 pitted ceiling tile	0132357-019
WSC - 75	Senior Center 1st floor	2x4 pitted ceiling tile	0132357-020

Ryan Stanley **Sampled by (Print)**	[signature] **Signature**	3/6/21 **Date/Time**
Ryan Stanley **Transported by (Print)**	[signature] **Signature**	3/6/21 **Date/Time**
Shawn Holland **Received by (Print)**	S. Holland **Signature**	3/8/21 835 **Date/Time**

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Emailed
(date and initial above areas)

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Customer: NNPS
Address:
Email: Perrie.Boyack@nn.k12.va.us
Attention: Perrie Boyack
Phone: 503-1142 Fax:
MCS Job #: 21-0225 Customer PO:

BULK Chain of Custody Form

(use separate form for each matrix)

Job Location: Warwick Senior Center / Gatewood pegs

- [x] Building Material
- [ ] Paint
- [ ] Soil
- [ ] Other

Requested Turnaround Time (markup)

- [ ] Same Day (100%)
- [ ] 1-Day (75%)
- [ ] 2-Day (50%)
- [ ] 3-Day (25%)
- [ ] 4-Day (12.5%)
- [x] 5-Day (standard)

RESULTS DUE BY: 3-15-21

ANALYSIS: PLM

MCS Use Only

Special Instructions:

MCS Project Manager:

DO NOT MAIL ☐ Give Report To:

Email: @

MCS Lab Report No. 0132357

Samples Acceptable to Lab ☐ Yes ☐ No By

Date If "No" Reason

Field ID *example*	Sample Location *room or area*	Sample Description *size / color / material*	MCS Sample No. *lab use only*
WSC-76	Senior Center 1st floor	2x4 pitted ceiling tile	0132357-021
WSC-77	Senior Center 1st floor 303	9" ceiling tile	0132357-022
WSC-78	Senior Center 1st floor 303	9" ceiling tile	0132357-023
WSC-79	Senior Center 1st floor 303	9" ceiling tile	0132357-024
WSC-80	Senior Center 1st floor	Brick / Mortar	0132357-025
WSC-81	Senior Center 1st floor	Brick / mortar	0132357-026
WSC-82	Senior Center 1st floor	Ceramic wall tile / Blue	0132357-027
WSC-83	Senior Center 1st floor	Ceramic wall tile / Blue	0132357-028
WSC-84	Senior Center 1st floor	door caulk	0132357-029
WSC-85	Senior Center 1st floor	door caulk	0132357-030
WSC-86	Senior Center 1st floor	window caulk	0132357-031
WSC-87	Senior Center 1st floor	window caulk	0132357-032
WSC-88	Senior Center 1st floor	Drywall	0132357-033
WSC-89	Senior Center 1st floor	Drywall	0132357-034
WSC-90	Senior Center 1st floor	Drywall	0132357-035
WSC-91	Senior Center 1st floor Janitors	pipe insulation / patch	0132357-036
WSC-92	Senior Center 1st floor	6" black base cove / mastic	0132357-037
WSC-93	Senior Center 1st floor	6" black base cove / mastic	0132357-038
WSC-94	Senior Center 1st floor	4" brown base cove / mastic	0132357-039
WSC-95	Senior Center 1st floor	4" brown base cove / mastic	0132357-040

Ryan Stanley Sampled by (Print)	Ryan Stanley Signature	3/6/21 Date/Time
Ryan Stanley Transported by (Print)	Ryan Stanley Signature	3/6/21 Date/Time
Sharon Holland Received by (Print)	S. Holland Signature	3/8/21 Date/Time

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Emailed
(date and initial above areas)

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www.MarineChemist.com

Customer: NNPS
Address:
Email: Penny.Boyack@nn.k12.va.us
Attention: Penny Boyack
Phone: 503-1192 Fax:
MCS Job #: 21-022 S Customer PO:

BULK Chain of Custody Form

(use separate form for each matrix)

Job Location: Warwick Senior Center / Gateway peeps

Requested Turnaround Time (markup)

- [x] Building Material
- [ ] Paint
- [ ] Soil
- [ ] Other _____

- [ ] Same Day (100%)
- [ ] 1-Day (75%)
- [ ] 2-Day (50%)
- [ ] 3-Day (25%)
- [ ] 4-Day (12.5%)
- [x] 5-Day (standard)

RESULTS DUE BY: 3-15-21
ANALYSIS: PLM

MCS Use Only

Special Instructions:

MCS Project Manager:
DO NOT MAIL ☐ Give Report To:
Email: @
MCS Lab Report No. 0122357
Samples Acceptable to Lab ☐ Yes ☐ No By
Date If "No" Reason

Field ID	Sample Location	Sample Description	MCS Sample No.
example	*room or area*	*size / color / material*	*lab use only*
WSC - 96	Senior Center 1st floor	9" Red tile / mastic	0122357-041
WSC - 97	Senior Center 1st floor	9" Red tile / mastic	0122357-042
WSC - 98	Senior Center 1st floor	9" Red tile / mastic	0122357-043
WSC - 99	Senior Center 1st floor	white / black speckled terrazzo	0122357-044
WSC - 100	Senior Center 1st floor	white / black speckled terrazzo	0122357-045
WSC - 101	Senior Center 1st floor	12" Ivory floor tile / mastic	0122357-046
WSC - 102	Senior Center 1st floor	12" Ivory floor tile / mastic	0122357-047
WSC - 103	Senior Center 1st floor	12" Ivory floor tile / mastic	0122357-048
WSC - 104	Senior Center 1st floor	12" white floor tile / mastic	0122357-049
WSC - 105	Senior Center 1st floor	12" white floor tile / mastic	0122357-050
WSC - 106	Senior Center 1st floor	12" white floor tile / mastic	0122357-051

Ryan Stanley — Sampled by (Print) — Signature — 3/6/21 Date/Time

Ryan Stanley — Transported by (Print) — Signature — 3/6/21 Date/Time

Received by (Print) — Signature — 3/8/21 Date/Time

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Credentials	Agency	Scope
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Accreditation	ABS	Hull Thickness
Accreditation	AIHA-LAP, LLC	Laboratory ID: 100551
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	EMLAP	Direct Examination: Air & Tape
	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	Laboratory Code: 200628-0
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	Laboratory No: 460257
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	License No.: 3333 000004
		Asbestos: PLM & PCM

NOTE: Laboratory Credentials cover only to the scopes listed above.

Plant Services - NNPS
Attn: Pennie Robbins Boyack
12580 Patrick Henry Dr.
Newport News VA 23602

MCS Report No.: 0132358
Report Date: 03/19/2021
MCS Job No.: 21-022S
Customer PO No.:

Date Sampled: 03/06/2021
Sampled By: Ryan Stanley
Job Location: Warwick Senior Center/ Gatewood Peeps

Date Received: 03/08/2021
Received By: SGH
Sample Matrix: BULK
Date Analyzed: 03/17/2021

Method of Analysis: Polarized Light Microscopy (PLM) using Environmental Protection Agency (EPA) Methods: EPA - 40 CFR Appendix E to Subpart E of Part 763 and EPA 600/R93-116, July 1993.

REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132358-001	Gatewood Peeps, 12" Yellow Floor Tile/ Mastic					
GWP-1	Floor Tile, Beige	LAYER 1 90%	None Detected		Non-Fibrous Material	100%
	Mastic, Beige	LAYER 2 10%	None Detected		Cellulose Fiber	10%
					Non-Fibrous Material	90%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132358-002	Gatewood Peeps, 12" Yellow Floor Tile/ Mastic					
GWP-2	Floor Tile, Beige	LAYER 1 90%	None Detected		Non-Fibrous Material	100%
	Mastic, Beige	LAYER 2 10%	None Detected		Cellulose Fiber	5%
					Non-Fibrous Material	95%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132358-003	Gatewood Peeps, 12" Yellow Floor Tile/ Mastic					
GWP-3	Floor Tile, Beige	LAYER 1 90%	None Detected		Non-Fibrous Material	100%
	Mastic, Beige	LAYER 2 10%	None Detected		Cellulose Fiber	5%
					Non-Fibrous Material	95%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		

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Credentials	Agency	Scope
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Accreditation	AIHA-LAP, LLC	Laboratory ID: 100551
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	EMLAP	Direct Examination: Air & Tape
	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	Laboratory Code: 200628-0
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	Laboratory No: 460257
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	License No.: 3333 000004
		Asbestos: PLM & PCM

NOTE: Laboratory Credentials cover only to the scopes listed above.

Plant Services - NNPS
Attn: Pennie Robbins Boyack
12580 Patrick Henry Dr.
Newport News VA 23602

MCS Report No.: 0132358
Report Date: 03/19/2021
MCS Job No.: 21-022S
Customer PO No.:

Date Sampled: 03/06/2021
Sampled By: Ryan Stanley
Job Location: Warwick Senior Center/ Gatewood Peeps

Date Received: 03/08/2021
Received By: SGH
Sample Matrix: BULK
Date Analyzed: 03/17/2021

Method of Analysis: Polarized Light Microscopy (PLM) using Environmental Protection Agency (EPA) Methods: EPA - 40 CFR Appendix E to Subpart E of Part 763 and EPA 600/R93-116, July 1993.

REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132358-004	Gatewood Peeps, 12" Orange Floor Tile/ Mastic					
GWP-4	Floor Tile, Yellow	LAYER 1 90%	None Detected		Non-Fibrous Material	100%
	Mastic, Beige	LAYER 2 10%	None Detected		Cellulose Fiber	5%
					Non-Fibrous Material	95%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132358-005	Gatewood Peeps, 12" Orange Floor Tile/ Mastic					
GWP-5	Floor Tile, Yellow	LAYER 1 80%	None Detected		Non-Fibrous Material	100%
	Mastic, Beige	LAYER 2 10%	None Detected		Cellulose Fiber	5%
					Non-Fibrous Material	95%
	Flooring Material, Beige	LAYER 3 10%	None Detected		Non-Fibrous Material	100%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		

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		Metals: Air
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Virginia Laboratory	DGS - DPOR	License No.: 3333 000004
		Asbestos: PLM & PCM

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Plant Services - NNPS
Attn: Pennie Robbins Boyack
12580 Patrick Henry Dr.
Newport News VA 23602

MCS Report No.: 0132358
Report Date: 03/19/2021
MCS Job No.: 21-022S
Customer PO No.:

Date Sampled: 03/06/2021
Sampled By: Ryan Stanley
Job Location: Warwick Senior Center/ Gatewood Peeps

Date Received: 03/08/2021
Received By: SGH
Sample Matrix: BULK
Date Analyzed: 03/17/2021

Method of Analysis: Polarized Light Microscopy (PLM) using Environmental Protection Agency (EPA) Methods: EPA - 40 CFR Appendix E to Subpart E of Part 763 and EPA 600/R93-116, July 1993.

REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132358-006	Gatewood Peeps, 12" Orange Floor Tile/ Mastic					
GWP-6	Floor Tile, Yellow	LAYER 1 80%	None Detected		Non-Fibrous Material	100%
	Mastic, Beige	LAYER 2 10%	None Detected		Cellulose Fiber	5%
					Non-Fibrous Material	95%
	Flooring Material, Beige	LAYER 3 10%	None Detected		Cellulose Fiber	5%
					Non-Fibrous Material	95%
	Asbestos Present: No	**Total % Asbestos:**	**No Asbestos Detected**			
0132358-007	Gatewood Peeps, 12" Red Floor Tile/ Mastic					
GWP-7	Floor Tile, Red	LAYER 1 80%	None Detected		Non-Fibrous Material	100%
	Mastic, Beige	LAYER 2 10%	None Detected		Cellulose Fiber	5%
					Non-Fibrous Material	95%
	Flooring Material, Gray	LAYER 3 10%	None Detected		Cellulose Fiber	5%
					Wollastonite	5%
					Non-Fibrous Material	90%
	Asbestos Present: No	**Total % Asbestos:**	**No Asbestos Detected**			

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www.MarineChemist.com

Credentials	Agency	Scope
Approval	DOD-US Navy	Resin
Accreditation	ABS	Hull Thickness
Accreditation	AIHA-LAP, LLC	Laboratory ID: 100551
	ELLAP	Paint, Soil, Wipe & Air
	EMLAP	Direct Examination: Air & Tape
	tHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	Laboratory Code: 200628-0
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	Laboratory No: 460257
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	License No.: 3333 000004
		Asbestos: PLM & PCM

NOTE: Laboratory Credentials cover only to the scopes listed above.

Plant Services - NNPS
Attn: Pennie Robbins Boyack
12580 Patrick Henry Dr.
Newport News VA 23602

MCS Report No.: 0132358
Report Date: 03/19/2021
MCS Job No.: 21-022S
Customer PO No.:

Date Sampled: 03/06/2021
Sampled By: Ryan Stanley
Job Location: Warwick Senior Center/ Gatewood Peeps

Date Received: 03/08/2021
Received By: SGH
Sample Matrix: BULK
Date Analyzed: 03/17/2021

Method of Analysis: Polarized Light Microscopy (PLM) using Environmental Protection Agency (EPA) Methods: EPA - 40 CFR Appendix E to Subpart E of Part 763 and EPA 600/R93-116, July 1993.

REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132358-008	Gatewood Peeps, 12" Red Floor Tile/ Mastic					
GWP-8	Floor Tile, Red	LAYER 1 90%	None Detected		Non-Fibrous Material	100%
	Mastic, Beige	LAYER 2 10%	None Detected		Cellulose Fiber	5%
					Non-Fibrous Material	95%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132358-009	Gatewood Peeps, 12" Red Floor Tile/ Mastic					
GWP-9	Floor Tile, Red	LAYER 1 90%	None Detected		Non-Fibrous Material	100%
	Mastic, Beige	LAYER 2 10%	None Detected		Cellulose Fiber	10%
					Non-Fibrous Material	90%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132358-010	Gatewood Peeps Left, 2x4 Wormed Ceiling Tile					
GWP-10	Ceiling Tile, Beige	LAYER 1 100%	None Detected		Cellulose Fiber	30%
					Fibrous Glass	20%
					Non-Fibrous Material	50%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		

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Accreditation	AIHA-LAP, LLC	Laboratory ID: 100551
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	EMLAP	Direct Examination: Air & Tape
	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	Laboratory Code: 200628-0
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	Laboratory No: 460257
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	License No.: 3333 000004
		Asbestos: PLM & PCM

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Customer PO No.:

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Job Location: Warwick Senior Center/ Gatewood Peeps

Date Received: 03/08/2021
Received By: SGH
Sample Matrix: BULK
Date Analyzed: 03/17/2021

Method of Analysis: Polarized Light Microscopy (PLM) using Environmental Protection Agency (EPA) Methods: EPA - 40 CFR Appendix E to Subpart E of Part 763 and EPA 600/R93-116, July 1993.

REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132358-011	Gatewood Peeps Middle, 2x4 Wormed Ceiling Tile					
GWP-11	Ceiling Tile, Beige	LAYER 1	None Detected		Cellulose Fiber	30%
		100%			Fibrous Glass	20%
					Non-Fibrous Material	50%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132358-012	Gatewood Peeps Right, 2x4 Wormed Ceiling Tile					
GWP-12	Ceiling Tile, Beige	LAYER 1	None Detected		Cellulose Fiber	30%
		100%			Fibrous Glass	20%
					Non-Fibrous Material	50%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132358-013	Gatewood Peeps, Pipe Insulation					
GWP-13	Jacket and Paint, White	LAYER 1	None Detected		Cellulose Fiber	40%
		30%			Fibrous Glass	40%
					Non-Fibrous Material	20%
	Insulation, Yellow	LAYER 2	None Detected		Fibrous Glass	90%
		70%			Non-Fibrous Material	10%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		

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Credentials	Agency	Scope
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	EMLAP	Direct Examination: Air & Tape
	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	Laboratory Code: 200628-0
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	Laboratory No: 460257
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	License No.: 3333 000004
		Asbestos: PLM & PCM

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Report Date: 03/19/2021
MCS Job No.: 21-022S
Customer PO No.:

Date Sampled: 03/06/2021
Sampled By: Ryan Stanley
Job Location: Warwick Senior Center/ Gatewood Peeps

Date Received: 03/08/2021
Received By: SGH
Sample Matrix: BULK
Date Analyzed: 03/17/2021

Method of Analysis: Polarized Light Microscopy (PLM) using Environmental Protection Agency (EPA) Methods: EPA - 40 CFR Appendix E to Subpart E of Part 763 and EPA 600/R93-116, July 1993.

REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132358-014	Gatewood Peeps, Pipe Insulation					
GWP-14	Jacket, Beige	LAYER 1	None Detected		Cellulose Fiber	40%
		40%			Fibrous Glass	40%
					Non-Fibrous Material	20%
	Insulation, Yellow	LAYER 2	None Detected		Fibrous Glass	90%
		60%			Non-Fibrous Material	10%
	Asbestos Present: No	**Total % Asbestos:**			**No Asbestos Detected**	
0132358-015	Gatewood Peeps, Pipe Insulation					
GWP-15	Jacket, Beige	LAYER 1	None Detected		Cellulose Fiber	40%
		20%			Fibrous Glass	40%
					Non-Fibrous Material	20%
	Insulation, Yellow	LAYER 2	None Detected		Fibrous Glass	90%
		80%			Non-Fibrous Material	10%
	Asbestos Present: No	**Total % Asbestos:**			**No Asbestos Detected**	

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Credentials	Agency	Scope
Approval	DOD-US Navy	Resin
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	EMLAP	Direct Examination: Air & Tape
	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	Laboratory Code: 200628-0
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	Laboratory No: 460257
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	License No.: 3333 000004
		Asbestos: PLM & PCM

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REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132358-016	Gatewood Peeps, Multi Colored Carpet/ Mastic					
GWP-16	Carpet, Purple	LAYER 1 50%	None Detected		Synthetic Fiber	80%
					Non-Fibrous Material	20%
	Backing, Gray	LAYER 2 40%	None Detected			
					Non-Fibrous Material	100%
	Mastic, Beige	LAYER 3 10%	None Detected		Cellulose Fiber	10%
					Non-Fibrous Material	90%
	Asbestos Present: No	**Total % Asbestos:**			**No Asbestos Detected**	
0132358-017	Gatewood Peeps, Multi Colored Carpet/ Mastic					
GWP-17	Carpet, Purple	LAYER 1 50%	None Detected		Synthetic Fiber	80%
					Non-Fibrous Material	20%
	Backing, Gray	LAYER 2 40%	None Detected			
					Non-Fibrous Material	100%
	Mastic, Beige	LAYER 3 10%	None Detected		Cellulose Fiber	10%
					Non-Fibrous Material	90%
	Asbestos Present: No	**Total % Asbestos:**			**No Asbestos Detected**	

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	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	Laboratory Code: 200628-0
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	Laboratory No: 460257
	NELAC	RCRA 8 Metals: TCLP & NPW
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REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132358-018	Gatewood Peeps, Multi Colored Carpet/ Mastic					
GWP-18	Carpet, Purple	LAYER 1 50%	None Detected		Synthetic Fiber	80%
					Non-Fibrous Material	20%
	Backing, Gray	LAYER 2 40%	None Detected		Non-Fibrous Material	100%
	Mastic, Beige	LAYER 3 10%	None Detected		Cellulose Fiber	10%
					Non-Fibrous Material	90%
	Asbestos Present: No	**Total % Asbestos:**			**No Asbestos Detected**	
0132358-019	Gatewood Peeps, 4" Tan Base Cove/ Mastic					
GWP-19	Tan Cove Base, White Paint	LAYER 1 90%	None Detected		Non-Fibrous Material	100%
	Mastic, Beige	LAYER 2 10%	None Detected		Non-Fibrous Material	100%
	Asbestos Present: No	**Total % Asbestos:**			**No Asbestos Detected**	

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REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132358-020	Gatewood Peeps, 4" Tan Base Cove/ Mastic					
GWP-20	Tan Cove Base, White Paint	LAYER 1 90%	None Detected		Non-Fibrous Material	100%
	Mastic, Beige	LAYER 2 10%	None Detected		Non-Fibrous Material	100%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132358-021	Gatewood Peeps, 4" Brown Base Cove/ Mastic					
GWP-21	Cove Base, Brown	LAYER 1 80%	None Detected		Non-Fibrous Material	100%
	Beige Mastic, White Paint	LAYER 2 20%	None Detected		Cellulose Fiber Non-Fibrous Material	10% 90%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		
0132358-022	Gatewood Peeps, 4" Brown Base Cove/ Mastic					
GWP-22	Cove Base, Brown	LAYER 1 80%	None Detected		Non-Fibrous Material	100%
	Beige Mastic, White Paint	LAYER 2 20%	None Detected		Cellulose Fiber Non-Fibrous Material	20% 80%
	Asbestos Present: No	**Total % Asbestos:**		**No Asbestos Detected**		

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REPORT OF ANALYSIS

MCS Sample No. / Field Sample ID	Sample Location Description	Layer No. / Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)

Analyst - Mary Helen Scott

Approved Signatory - Mary Helen Scott
Laboratory Supervisor

Method Detection Limit: = <1%

- Fiber concentrations were determined by visually estimating the area percentage for each type.
- Asbestos fibers may not be detected by PLM in certain samples because of their size (<5um) or being bound with non-friable organic matrix. In such cases an alternative method of analysis may be necessary.
- Analyzed only readily discernable layers.
- All laboratory test results meet the applicable quality control requirements unless otherwise mentioned.
- MCS, Inc. can not attest to nor be held responsible for the proper collection of samples and/or accuracy of the sample information provided by customers for samples not collected by MCS, Inc.
- Test report relates only to the items tested.
- The samples will be stored at the MCS, Inc. laboratory for a period of thirty days after the analysis. At the end of the period, it will be our policy to dispose of the samples unless prior arrangements have been made for a longer storage period.
- This report shall not be reproduced, except in full, without the written approval of this laboratory.
- The Report must not be used by the customer to claim product certification, approval or endorsement by NVLAP, NIST or any agency of the Federal Government.
- The Report includes Chain of Custody.

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Customer: NNPS
Address:
Email: Penne.Boyack@nn.k12.va.us
Attention: Penne Boyack
Phone: 503-1192 Fax:
MCS Job #: 21-0225 Customer PO:

BULK Chain of Custody Form

(use separate form for each matrix)

Job Location: Gatewood peeps / Warwick Senior Center

- [x] Building Material
- [ ] Paint
- [ ] Soil
- [ ] Other

Requested Turnaround Time (markup)

- [ ] Same Day (100%)
- [ ] 1-Day (75%)
- [ ] 2-Day (50%)
- [ ] 3-Day (25%)
- [ ] 4-Day (12.5%)
- [x] 5-Day (standard)

RESULTS DUE BY: 3-15-21
ANALYSIS: PLM

MCS Use Only

Special Instructions:

MCS Project Manager:
DO NOT MAIL ☐ Give Report To:
Email: @
MCS Lab Report No. 0132358 3/8/21 SH
Samples Acceptable to Lab ☑ Yes ☐ No By
Date If "No" Reason

Field ID	Sample Location	Sample Description	MCS Sample No.
example	*room or area*	*size / color / material*	*lab use only*
GWP - 1	Gatewood peeps	12" yellow floor tile / mastic	0132358-001
GWP - 2	Gatewood peeps	12" yellow floor tile / mastic	0132358-002
GWP - 3	Gatewood peeps	12" yellow floor tile / mastic	0132358-003
GWP - 4	Gatewood peeps	12" orange floor tile / mastic	0132358-004
GWP - 5	Gatewood peeps	12" orange floor tile / mastic	0132358-005
GWP - 6	Gatewood peeps	12" orange floor tile / mastic	0132358-006
GWP - 7	Gatewood peeps	12" red floor tile / mastic	0132358-007
GWP - 8	Gatewood peeps	12" red floor tile / mastic	0132358-008
GWP - 9	Gatewood peeps	12" red floor tile / mastic	0132358-009
GWP - 10	Gatewood peeps (L)	2x4 worned ceiling tile	0132358-010
GWP - 11	Gatewood peeps (M)	2x4 worned ceiling tile	0132358-011
GWP - 12	Gatewood peeps (R)	2x4 worned ceiling tile	0132358-012
GWP - 13	Gatewood peeps	pipe insulation	0132358-013
GWP - 14	Gatewood peeps	pipe insulation	0132358-014
GWP - 15	Gatewood peeps	pipe insulation	0132358-015
GWP - 16	Gatewood peeps	multi colored carpet / mastic	0132358-016
GWP - 17	Gatewood peeps	multi colored carpet / mastic	0132358-017
GWP - 18	Gatewood peeps	multi colored carpet / mastic	0132358-018
GWP - 19	Gatewood peeps	4" tan basecove / mastic	0132358-019
GWP - 20	Gatewood peeps	4" tan basecove / mastic	0132358-020

Ryan Stanley	Ryan Stanley	3/6/21	OFFICE USE ONLY:
Sampled by (Print)	Signature	Date/Time	Verbal
Ryan Stanley	Ryan Stanley	3/6/21	Faxed
Transported by (Print)	Signature	Date/Time	Copied
Received by (Print)	Signature	3/8/21 849 Date/Time	Emailed (date and initial above areas)

☐ Mailed ☐ Billing

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www.MarineChemist.com

Customer: NNPS
Address:
Email: Penie.Boyack@nn.k12.va.us
Attention: Penie Boyack
Phone: 503-1192 Fax:
MCS Job #: 21-0225 Customer PO:

BULK Chain of Custody Form

(use separate form for each matrix)

Job Location: Gateward Peeps / Warwick Sewer Line

- [X] Building Material
- [ ] Paint
- [ ] Soil
- [ ] Other

Requested Turnaround Time (markup)

- [ ] Same Day (100%)
- [ ] 1-Day (75%)
- [ ] 2-Day (50%)
- [ ] 3-Day (25%)
- [ ] 4-Day (12.5%)
- [X] 5-Day (standard)

RESULTS DUE BY: 3-15-21
ANALYSIS: PLM

MCS Use Only

Special Instructions:

MCS Project Manager:
DO NOT MAIL ☐ Give Report To:
Email: @
MCS Lab Report No. 0132358
Samples Acceptable to Lab Yes ☐ No By
Date If "No" Reason

Field ID	Sample Location	Sample Description	MCS Sample No.
example	*room or area*	*size / color / material*	*lab use only*
GWP-21	Gateward peeps	4" Brown base core / mastic	0132358-021
GWP-22	Gateward peeps	4" Brown base core / mastic	0132358-022

Ryan Stanley	Ryan Stanley	3/6/21	OFFICE USE ONLY:
Sampled by (Print)	Signature	Date/Time	Verbal
Ryan Stanley	Ryan Stanley	3/6/21	Faxed
Transported by (Print)	Signature	Date/Time	Copied
S. Holland	S. Holland	3/8/21	Emailed
Received by (Print)	Signature	Date/Time	(date and initial above areas)

Mailed Billing

SECTION 7
Inspection Information

Inspection Information

The survey contractor for the inspection of Gatewood Peep / Warwick Senior Center, located in Newport News, Virginia is:

Marine Chemist Service, Inc.
11850 Tug Boat Lane
Newport News, Virginia 23606
www.MarineChemist.com

The team leader responsible for quality control coordination of inspection and adherence to inspection protocol is:

Patrick Studley - CIH
Marine Chemist Service, Inc.
11850 Tug Boat Lane
Newport News, Virginia 23606
PStudley@MarineChemist.com

The AIHA and NVLAP Accredited laboratory selected to analyze the bulk samples for asbestos content by PLM, using the "Interim Method for the Determination of Asbestos in Bulk Insulation Samples" (Appendix A to Subpart F in 40 CFR Part 763) is:

Marine Chemist Service, Inc.
Virginia Asbestos Analytical Laboratory License 3333 000004
11850 Tug Boat Lane
Newport News, Virginia 23606
(757) 873-0933

The inspectors who physically inspected the building and who have received EPA-Approved Training are:

Ryan Stanley
Virginia Asbestos Inspector License 3303 004642
RStanley@MarineChemist.com

Kallie Brown
Virginia Asbestos Inspector License 3303 004704
KBrown@MarineChemist.com

Tiffany Turner
Virginia Asbestos Inspector License 3303 004542
TTurner@MarineChemist.com

Christopher Studley
Virginia Asbestos Inspector License 3303 4660
CStudley@MarineChemist.com

The Industrial Hygiene Inspectors are employed by:

Marine Chemist Service, Inc.
11850 Tug Boat Lane
Newport News, Virginia 23606

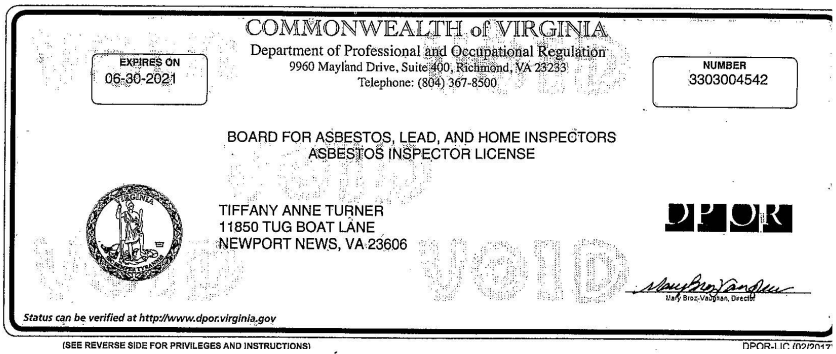
SECTION 8
Credentials

Marine Chemist Service, Inc.

Name	STANLEY, RYAN KADE
License Number	3303004642
License Description	Asbestos Inspector License
Rank	Asbestos Inspector
Address	NEWPORT NEWS, VA 23608
Initial Certification Date	2020-02-28
Expiration Date	2022-02-28

License Details

Name	BROWN, KALLIE FLAXINGTON
License Number	3303004704
License Description	Asbestos Inspector License
Rank	Asbestos Inspector
Address	NORFOLK, VA 23507
Initial Certification Date	2020-12-23
Expiration Date	2021-12-31



COMMONWEALTH of VIRGINIA
Department of Professional and Occupational Regulation
9960 Mayland Drive, Suite 400, Richmond, VA 23233
Telephone: (804) 367-8500

EXPIRES ON 06-30-2021

NUMBER 3303004542

BOARD FOR ASBESTOS, LEAD, AND HOME INSPECTORS
ASBESTOS INSPECTOR LICENSE

TIFFANY ANNE TURNER
11850 TUG BOAT LANE
NEWPORT NEWS, VA 23606

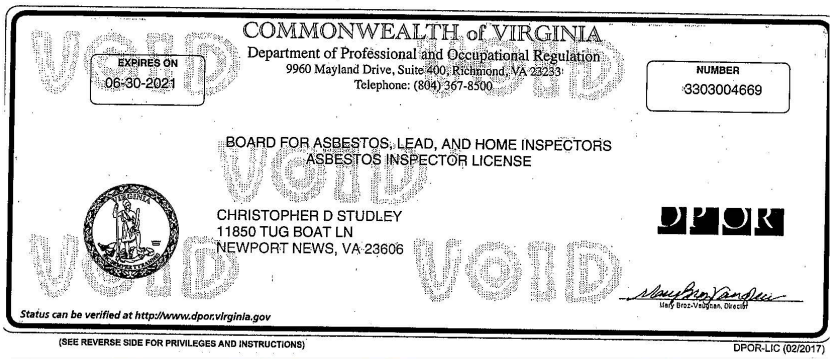
DPOR

Mary Broz-Vaughan, Director

Status can be verified at http://www.dpor.virginia.gov

(SEE REVERSE SIDE FOR PRIVILEGES AND INSTRUCTIONS)

DPOR-LIC (02/2017)



COMMONWEALTH of VIRGINIA
Department of Professional and Occupational Regulation
9960 Mayland Drive, Suite 400, Richmond, VA 23233
Telephone: (804) 367-8500

EXPIRES ON 06-30-2021

NUMBER 3303004669

BOARD FOR ASBESTOS, LEAD, AND HOME INSPECTORS
ASBESTOS INSPECTOR LICENSE

CHRISTOPHER D STUDLEY
11850 TUG BOAT LN
NEWPORT NEWS, VA 23606

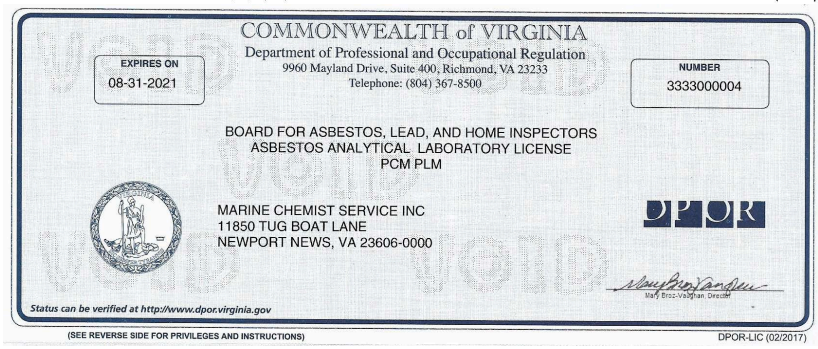
DPOR

Mary Broz-Vaughan, Director

Status can be verified at http://www.dpor.virginia.gov

(SEE REVERSE SIDE FOR PRIVILEGES AND INSTRUCTIONS)

DPOR-LIC (02/2017)



COMMONWEALTH of VIRGINIA
Department of Professional and Occupational Regulation
9960 Mayland Drive, Suite 400, Richmond, VA 23233
Telephone: (804) 367-8500

EXPIRES ON 08-31-2021

NUMBER 3333000004

BOARD FOR ASBESTOS, LEAD, AND HOME INSPECTORS
ASBESTOS ANALYTICAL LABORATORY LICENSE
PCM PLM

MARINE CHEMIST SERVICE INC
11850 TUG BOAT LANE
NEWPORT NEWS, VA 23606-0000

DPOR

Mary Broz-Vaughan, Director

Status can be verified at http://www.dpor.virginia.gov

(SEE REVERSE SIDE FOR PRIVILEGES AND INSTRUCTIONS)

DPOR-LIC (02/2017)

ABIH®

american board of industrial hygiene®

organized to improve the practice of industrial hygiene
proclaims that

Patrick Gene Studley

having met all requirements of
education, experience and examination,
is hereby certified in the

COMPREHENSIVE PRACTICE
of
INDUSTRIAL HYGIENE

and has the right to use the designations

CERTIFIED INDUSTRIAL HYGIENIST

CIH

Certificate Number	**11321 CP**
Awarded:	**May 31, 2017**
Expiration Date:	**December 1, 2022**

Chair, ABIH

Chief Executive Officer, ABIH

AIHA Laboratory Accreditation Programs, LLC

acknowledges that

Marine Chemist Service, Inc.
11850 Tug Boat Lane, Newport News, VA 23606
Laboratory ID: LAP-100551

along with all premises from which key activities are performed, as listed above, has fulfilled the requirements of the AIHA Laboratory Accreditation Programs (AIHA-LAP), LLC accreditation to the ISO/IEC 17025:2017 international standard, General Requirements for the Competence of Testing and Calibration Laboratories in the following:

LABORATORY ACCREDITATION PROGRAMS

☑	INDUSTRIAL HYGIENE	Accreditation Expires: March 01, 2023
☑	ENVIRONMENTAL LEAD	Accreditation Expires: March 01, 2023
☑	ENVIRONMENTAL MICROBIOLOGY	Accreditation Expires: March 01, 2023
☐	FOOD	Accreditation Expires:
☐	UNIQUE SCOPES	Accreditation Expires:

Specific Field(s) of Testing (FoT)/Method(s) within each Accreditation Program for which the above named laboratory maintains accreditation is outlined on the attached Scope of Accreditation. Continued accreditation is contingent upon successful on-going compliance with ISO/IEC 17025:2017 and AIHA-LAP, LLC requirements. This certificate is not valid without the attached Scope of Accreditation. Please review the AIHA-LAP, LLC website (www.aihaaccreditedlabs.org) for the most current Scope.

Cheryl O Morton
Managing Director, AIHA Laboratory Accreditation Programs, LLC

Revision19: 09/01/2020

Date Issued: 02/01/2021

United States Department of Commerce
National Institute of Standards and Technology

Certificate of Accreditation to ISO/IEC 17025:2017

NVLAP LAB CODE: 200628-0

Marine Chemist Service, Inc.
Newport News, VA

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

Asbestos Fiber Analysis

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2020-07-01 through 2021-06-30
Effective Dates

For the National Voluntary Laboratory Accreditation Program

Marine Chemist Service, Inc.

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ASBESTOS CONTAINING MATERIALS	QUANTITY	COST PER UNIT	REMOVAL COST
Mastic under 12" Pinkish-Brown w/ Dark Speckled Floor Tile (Women's Room)	500 Sq. Ft.	$4.25	$2,125.00
12" Tan w/ Dark Brown Speckled Floor Tile/ Mastic (Women's Room, Room 408, 400A)	600 Sq. Ft.	$4.25	$2,550.00
Mastic under 12" Light Gray w/ Gray Speckled Floor Tile (Room 400A)	100 Sq. Ft	$4.25	$425.00
Interior Window Glaze (Room 409A)	100 Lin Ft.	$5.50	$550.00
Sink Undercoating (Room 408)	1 Sink	$150.00	$150.00
Beige Pipe Insulation (1st Floor Senior Center Janitor's Room)	20 Lin. Ft.	$15.00	$300.00
9" Red Tile and Mastic (1st Floor Senior Center Janitor's Room)	75 Sq. Ft.	$4.25	$318.75
12" White Floor Tile and Mastic (1st Floor Senior Center Clinic Bathroom)	240 Sq. Ft.	$4.25	$1,020.00
Total	**$7,438.75**		

*The abatement contractor may require a mobilization fee of approximately $1,600.00 in addition to removal costs. Prices may vary depending on volume of abatement that needs to be accomplished, difficulty of set up requirement, work hours, work days and accessibility of materials.

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

A. Extent of selective demolition work is indicated on drawings. Work generally consists of removing existing HVAC equipment, related system components, existing suspended acoustical ceilings, and loose insulation above as shown on the drawings, and preparing openings and existing surfaces to receive new HVAC equipment and related system components. Exterior work includes removal of fencing and outdoor-mounted HVAC equipment and related system components. Several locations throughout the building require careful removal of components to be saved for reuse or reinstallation, as identified on the drawings; example includes bookcases in classrooms that must be carefully removed at one location and be reinstalled at a nearby location.

1.3 JOB CONDITIONS

A. Occupancy: Owner will be occupying the building immediately adjacent to areas of selective demolition. The project is scheduled, so that students will not be in the school during working hours. However, teachers and administrative staff will be working in the building. Conduct selective demolition work in manner that will minimize need for disruption of Owner's normal operations. Provide minimum of 72 hours advance notice to Owner of demolition activities, which will severely impact Owner's normal operations.

B. Condition of Structures: Owner assumes no responsibility for actual condition of items or structures to be demolished.

C. Protections: Provide temporary barricades and other forms of protection as required to protect Owner's personnel and general public from injury due to selective demolition work.

1. Provide protective measures as required to provide free and safe passage of Owner's personnel and the general public to and from occupied portions of building. Advise the Owner which portions of the building will be worked on the next day so that the Owner can coordinate their activities with the work in and around the building.
2. Protect from damage existing finish work that is to remain in place and becomes exposed during demolition operations. Minimize traffic on the roof and protect paths to and from equipment and the roof surrounding work areas to protect the roof to remain.
3. Protect floors with suitable coverings when necessary.

4. Provide temporary weather protection during interval between demolition and removal of existing construction on exterior surfaces, and installation of new construction to insure that no water leakage or damage occurs to structure or interior areas of existing building.
5. Remove protections at completion of work.

D. Damages: Promptly repair damages caused to adjacent facilities by demolition work at no cost to Owner.

E. Traffic: Conduct selective demolition operations and debris removal in a manner to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.

1. Do not close, block or otherwise obstruct streets, walks or other occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

F. Access to the work areas of this contract shall not include foot traffic across existing roof areas not in this Contract or completed portions of the roof.

G. Flame Cutting: Do not use cutting torches for removal until work area is cleared of flammable materials and spaces below are cleared of personnel. At concealed spaces, such as interior of ducts and pipes, verify condition of hidden space before starting flame-cutting operations. Maintain portable fire suppression devices during flame-cutting operations.

H. Do not interrupt utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction.

I. Maintain fire protection services during selective demolition operations.

J. Environmental Controls: Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rising and scattering in air to lowest practical level. Comply with governing regulations pertaining to environmental protection.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 INSPECTION

A. Prior to commencement of selective demolition work, inspect areas in which work will be performed. Photograph existing conditions to structure surfaces, equipment or to surrounding properties which could be misconstrued as damage resulting from selective demolition work; file with Owner's Representative prior to starting work.

B. Cover and protect furniture, equipment and fixtures to remain from soiling or damage when demolition work is performed in rooms or areas from which such items have not been removed.

C. Erect and maintain dust-proof partitions and closures as required to prevent spread of dust or fumes to occupied portions of the building.

D. Where selective demolition occurs immediately adjacent to occupied portions of the building, construct dust-proof partitions of minimum 3 5/8" studs, 1/2" drywall (joints taped) on occupied side, 1/2" fire-retardant plywood on demolition side, and fill partition cavity with sound-deadening insulation.

E. Provide weatherproof closures for exterior openings resulting from demolition work, but do not remove more than can be protected that same day.

F. Identify all load-bearing walls at commencement of project. Do not cut openings in existing load-bearing walls without determining need for shoring and/or temporary bracing. Place all temporary shoring and lateral bracing to support roof and/or floor loads prior to cutting of openings. Leave shoring in place until opening(s) and adjacent construction are completed in its intended final structural condition. Patch all opening edges and ensure proper support of new lintels or existing lintels to remain that are adjacent to new openings.

3.2 DEMOLITION

A. Perform selective demolition work in a systematic manner. Use such methods as required to complete work indicated on Drawings in accordance with demolition schedule and governing regulations.

B. Provide services for effective air and water pollution controls as required by local authorities having jurisdiction.

C. Do not overload the roof structure when moving rooftop equipment and during demolition operations. If necessary, obtain structural engineering services to assure that the work can be accomplished without danger to structural components.

D. If unanticipated mechanical, electrical or structural elements which conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to Owner's Representative in written, accurate detail. Pending receipt of directive from Owner's Representative rearrange selective demolition schedule as necessary to continue overall job progress without delay.

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.

1. Comply with requirements for existing services/systems interruptions specified in Section 011000 "Summary of Work" and Section 015000 “Temporary Facilities.”

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated 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 indicated 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 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.
    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.

C. Refrigerant: Remove refrigerant from mechanical and refrigeration equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.4 MATERIALS TO BE REMOVED AND REINSTALLED

A. Carefully remove and store rooftop equipment for reinstallation where identified on the drawings unless indicated to be eliminated.

B. Carefully remove interior components, casework, exterior storefront window panels and mullions, and other features of work as shown on the drawings in order to save for reuse, reinstallation, or to avoid damaging adjacent sensitive existing construction, such as glazing.

C. The Contractor shall be responsible to replace with similar new construction <u>any</u> item removed and intended for reuse that is damaged by removal operations.

D. The Contractor shall be responsible to patch or replace with similar new construction <u>any</u> item, feature or surface intended to remain that is damaged by removed operations.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

A. All debris from roof demolition operations shall be removed from the roof immediately and deposited into trucks or dumpsters and hauled away from the site and properly recycled or disposed of at the Contractor's expense.

B. Dumpsters or trucks shall be removed from the premises when they are full.

C. Contractor shall periodically clean up the site, building and roof and be generally responsible for keeping the site, building and roof in a safe, neat and orderly condition.

D. If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution.

1. Existing lighting throughout many areas to be removed contains fluorescent tube lamps. These tubes shall be assumed to contain mercury vapor. Other lighting fixtures to be removed may be equipped with lamps containing halogens or other harmful compounds. All existing lighting fixture lamps shall be removed, handled and disposed of in a lawful manner preventing breakage and release of vapors on school property.

E. Burning of removed materials is not permitted on project site.

F. Recycling: The Contractor shall segregate all waste prior to disposal, and is encouraged to recycle demolished materials to the greatest practical extent.

3.6 CLEANUP AND REPAIR

A. General: Upon completion of demolition work, remove tools, equipment, and demolished materials from site. Remove protection and leave interior areas vacuum-clean from any dust or debris that may have entered the building as a result of roofing operations, in time for school the next day.

B. Repair demolition performed in excess of that required. Return elements of construction (and surfaces to remain) to condition existing prior to start operations. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.

END OF SECTION 024119

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

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

1. Patching of holes in slabs-on-grade and elevated concrete floor slabs.
2. Concrete used in pre-fabrication of masonry lintels.
3. Equipment Pads
4. Repair of exterior sidewalks, curbs and miscellaneous concrete paving.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 SUBMITTALS

A. 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.

E. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Aggregates.

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. Curing compounds.
6. Floor and slab treatments.
7. Bonding agents.
8. Adhesives.
9. Vapor retarders.
10. Semirigid joint filler.

G. Field quality-control test and inspection reports.

1.5 QUALITY ASSURANCE

A. 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."

B. 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.

C. 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.

D. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

E. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Plain-Steel Welded Wire Reinforcement: ASTM A 1064, plain, fabricated from as-drawn steel wire into flat sheets.

2.2 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut bars true to length with ends square and free of burrs.

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.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I or II:

a. Fly Ash: ASTM C 618, Class F.
b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33, Class 3S.

1. Maximum Coarse-Aggregate Size: 1 inch (25 mm) nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M and potable.

2.4 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. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.5 VAPOR RETARDERS

A. Plastic Vapor Retarder: ASTM E 1745, Class C, or polyethylene sheet, ASTM D 4397, not less than 10 mils (0.25 mm) thick. Include manufacturer's recommended adhesive or pressure-sensitive joint tape.

2.6 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.7 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. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

C. 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.

2.8 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.

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.
2. Combined Fly Ash and Pozzolan: 25 percent.
3. Ground Granulated Blast-Furnace Slag: 50 percent.
4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent Portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use high-range water-reducing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, and concrete with a water-cementitious materials ratio below 0.50.

2.9 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3,000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 5 inches, plus or minus 1 inch.

B. Slabs-on-Grade and Equipment Pads: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4,000 psi at 28 days.
2. Minimum Cementitious Materials Content: 520 lb./cu. yd.
3. Slump Limit: 4 inches, plus or minus 1 inch.

4. Air Content for Exterior Concrete: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.
5. Air Content for Interior Slabs: Do not allow air content of trowel-finished floors to exceed 3 percent.

C. Concrete Piers and Other Concrete: Normal-weight concrete.

1. Minimum Compressive Strength: 3000 psi at 28 days.
2. Maximum W/C Ratio: 0.45.
3. Minimum Cementitious Materials Content: 470 lb./cu. yd.
4. Slump Limit: 4 inches, plus or minus 1 inch (25 mm).

2.10 FABRICATING REINFORCEMENT

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

2.11 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 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 (3.2 mm) for smooth-formed finished surfaces.
2. Class C, 1/2 inch (13 mm)] 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. 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, keyways, 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.

3.2 EMBEDDED ITEMS

A. 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. Wet setting dowels and anchor rods is not allowed.

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."

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, piers, 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

(10 deg C) 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.

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.

3.4 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 (150 mm) and seal with manufacturers recommended tape.

3.5 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.

3.6 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.

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 (38 mm) into concrete.

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 as follows:

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks. Saw joints shall be made within 4 to 12 hours after placement of the concrete.

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. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 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. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

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 (150 mm) 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 (4.4 deg C) 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 (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.8 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. 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.

C. Related Unformed Surfaces: At tops of piers, 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.

3.9 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. 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 to receive trowel finish.

C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.

D. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces 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.

E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, equipment pads, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.10 MISCELLANEOUS CONCRETE ITEMS

A. 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.

B. 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.

C. 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.

3.11 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. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb./sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. 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.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

    a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
    b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
    c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

    a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.12 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 one months. 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 (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.13 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect'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 (1.18-mm) 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 (13 mm) in any dimension in solid concrete, but not less than 1 inch (25 mm) 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.

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 (0.25 mm) 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. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) 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 (19-mm) 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.
7. Repair random cracks and single holes 1 inch (25 mm) 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. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.14 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Steel reinforcement placement.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.

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 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mixture placed each 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; 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 (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.

5. Compression Test Specimens: ASTM C 31/C 31M.

    a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.

6. 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 and one set of two specimens 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.

7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
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 (3.4 MPa).
9. Test results shall be reported in writing to Architect, 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 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. 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.

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 do not comply with the Contract Documents.

END OF SECTION 033000

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes unit masonry assemblies consisting of the following for repair of interior and exterior wall openings:

1. Concrete masonry units (CMUs, Concrete Block or Block).
2. Reinforced masonry lintels
3. Face brick.
4. Mortar and grout.
5. Reinforcing steel.
6. Masonry joint reinforcement.
7. Ties and anchors.
8. Embedded flashing.
9. Miscellaneous masonry accessories.
10. Cavity-wall insulation.

B. Related Sections include the following:

1. Division 07 Section 072100, “Thermal Insulation” for rigid cavity-wall insulation.
2. Division 07 Section 076200, "Flashing and Sheet Metal" for exposed sheet metal flashing.
3. Division 07 Section 079200, "Joint Sealants" for sealing control and expansion joints in unit masonry.

C. Products installed, but not furnished, under this Section include the following:

1. Steel lintels for unit masonry, furnished under Division 05 Section "Metal Fabrications."

1.3 DEFINITIONS

A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths (f'_m) at 28 days.

B. Determine net-area compressive strength (f'_m) of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.

C. Samples for Initial Selection: For the following:

1. Colored mortar.

D. Samples for Verification: For each type and color of the following:

1. Face brick, in the form of straps of five or more bricks.
2. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project.
3. Accessories embedded in masonry.

E. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

F. Qualification Data: For testing agency.

G. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:

1. Masonry units.

a. Include material test reports substantiating compliance with requirements.
b. For bricks, include size-variation data verifying that actual range of sizes falls within specified tolerances.
c. For exposed brick, include material test report for efflorescence according to ASTM C 67.

d. For surface-coated brick, include material test report for durability of surface appearance after 50-cycles of freezing and thawing per ASTM C 67.
e. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.

2. Cementitious materials. Include brand, type, and name of manufacturer.
3. Pre-blended, dry mortar mixes. Include description of type and proportions of ingredients.
4. Grout mixes. Include description of type and proportions of ingredients.
5. Reinforcing bars.
6. Joint reinforcement.
7. Anchors, ties, and metal accessories.

H. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports, per ASTM C 780, for mortar mixes required to comply with property specification.
2. Include test reports, per ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

I. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

J. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1093 for testing indicated, as documented according to ASTM E 548.

B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.

D. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver pre-blended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store pre-blended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
2. Where 1 wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/ TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

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, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

2.3 CONCRETE MASONRY UNITS (BLOCK)

A. Shapes: Provide shapes indicated and as follows:

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide bull nose units with 1-inch radius for all exposed, outside corners unless otherwise indicated.

B. Concrete Masonry Units: ASTM C 90.

1. Weight Classification: Lightweight.
2. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

2.4 REINFORCED MASONRY LINTELS

A. General: Provide one of the following:

B. Concrete Lintels: ASTM C1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated. Provide lintels with net-area compressive strength not less than that of CMUs, but in no case, not less than 2,500 PSI.

C. Concrete Lintels: Precast or formed-in-place concrete lintels complying with requirements in Section 033000 "Cast-in-Place Concrete," and with reinforcing bars indicated.

D. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.5 BRICK

A. General: Provide shapes indicated and as follows:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Face Brick: ASTM C 216, Grade SW, Type FBS, 4-inch nominal width.

1. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested per ASTM C 67.
2. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
3. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet or shall have a history of successful use in Project's area.
4. Size (Actual Dimensions): 3-1/2 inches wide by 2-1/4 inches high by 7-1/2 inches long or 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.
5. Color and Texture: Match existing facebrick adjacent to openings as closely as possible. Submitted samples shall be used to determine match of color and texture.

2.6 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar that matches the mortar used on the existing building.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of Portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S.

D. Masonry Cement: ASTM C 91.

1. Available Products:

a. Capital Materials Corporation; Flamingo Color Masonry Cement.
b. Essroc, Italcementi Group; Brixment or Velvet.
c. Holcim (US) Inc.; Mortamix Masonry Cement.
d. Lafarge North America Inc.; Magnolia Masonry Cement.
e. Lehigh Cement Company; Lehigh Masonry Cement.
f. National Cement Company, Inc.; Coosa Masonry Cement.

E. Mortar Cement: ASTM C 1329.

1. Available Products:

a. Lafarge North America Inc.; Lafarge Mortar Cement or Magnolia Superbond Mortar Cement.

F. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.

G. Colored Cement Product: Packaged blend made from masonry cement or mortar cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard “Buff” colors to match Flamingo C-320.
2. Pigments shall not exceed 10 percent of Portland cement by weight.
3. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
4. Available Products:

a. Colored Portland Cement-Lime Mix:

1) Capital Materials Corporation; Riverton Portland Cement Lime Custom Color.
2) Holcim (US) Inc.; Rainbow Mortamix Custom Color Cement/Lime.
3) Lafarge North America Inc.; Eaglebond.
4) Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.

b. Colored Masonry Cement:

1) Capital Materials Corporation; Flamingo Color Masonry Cement.
2) Essroc, Italcementi Group; Brixment-in-Color.
3) Holcim (US) Inc.; Rainbow Mortamix Custom Color Masonry Cement.
4) Lafarge North America Inc.; Magnolia Masonry Cement.
5) Lehigh Cement Company; Lehigh Custom Color Masonry Cement.

6) National Cement Company, Inc.; Coosa Masonry Cement.

c. Colored Mortar Cement:

1) Lafarge North America Inc.; Magnolia Superbond Mortar Cement.

H. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.

I. Aggregate for Grout: ASTM C 404.

J. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. Available Products:

a. Addiment Incorporated; Mortar Kick.
b. Euclid Chemical Company (The); Accelguard 80.
c. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Morset.
d. Sonneborn, Div. of ChemRex; Trimix-NCA.

K. Water: Potable.

2.7 REINFORCEMENT

A. Masonry Joint Reinforcement, General: ASTM A 951.

1. Exterior Walls: Hot-dip galvanized, carbon steel.
2. Wire Size for Side Rods: W2.8 or 0.188-inch diameter.
3. Wire Size for Cross Rods: W2.8 or 0.188-inch diameter.
4. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
5. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

B. Masonry Joint Reinforcement for Multi-wythe Masonry:

1. Ladder type with 1 side rod at each face shell of hollow masonry units more than 4 inches in width, plus 1 side rod at each wythe of masonry 4 inches or less in width.

2.8 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with eight subparagraphs below, unless otherwise indicated.

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153/ A 153M, Class B-2 coating.

B. Corrugated Metal Ties: Metal strips not less than 7/8 inch wide with corrugations having a wavelength of 0.3 to 0.5 inch and an amplitude of 0.06 to 0.10 inch made from steel sheet, galvanized after fabrication not less than 0.053 inch thick. Ties made from galvanized steel sheet may be used in interior walls, unless otherwise indicated.

2.9 MISCELLANEOUS ANCHORS

A. Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM A 307, Grade A ; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

B. Post-installed Anchors: Provide chemical or torque-controlled expansion anchors, with capability to sustain, without failure, a load equal to six times the load imposed when installed in solid or grouted unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

1. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 microns) for Class SC 1 service condition (mild).
2. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or 316, for anchors.

2.10 EMBEDDED FLASHING MATERIALS

A. Flexible Flashing: For flashing not exposed to the exterior, use one of the following, unless otherwise indicated:

1. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a polyester-reinforced ethylene interpolymer alloy as follows:

a. Monolithic Sheet: Elastomeric thermoplastic flashing, 0.040 inch thick.
b. Self-Adhesive Sheet: Elastomeric thermoplastic flashing, 0.025 inch thick, with a 0.015-inch-thick coating of rubberized-asphalt adhesive.

c. Self-Adhesive Sheet with Drip Edge: Elastomeric thermoplastic flashing, 0.025 inch thick, with a 0.015-inch- thick coating of rubberized-asphalt adhesive. Where flashing extends to face of masonry, rubberized-asphalt coating is held back approximately 1-1/2 inches from edge.

1) Color: Black.

d. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.

e. Available Products:

1) Hyload, Inc.; Hyload Cloaked Flashing System.
2) Henry Company, Blueskin TWF.
3) W.R. Meadows Inc., Sealtight Air-Shield Thru-Wall Flashing.

B. Solder and Sealants for Sheet Metal Flashings: As specified in Division 07 Section "Sheet Metal Flashing and Trim."

C. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.11 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Pre-molded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene urethane or PVC.

2.12 CAVITY-WALL INSULATION

A. As specified under Division 07 Section 072100, “Thermal Insulation.”

2.13 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Available Manufacturers:

a. Diedrich Technologies, Inc.
b. EaCo Chem, Inc.
c. ProSoCo, Inc.

2.14 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Limit cementitious materials in mortar for exterior and reinforced masonry to Portland cement and lime.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Pre-blended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270 & BIA Technical Notes 8A, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. For masonry below grade or in contact with earth, use Type M.
2. For reinforced masonry, use Type S.
3. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
4. For interior non-load-bearing partitions, Type O may be used instead of Type N.

D. Pigmented Mortar: Use colored cement product.

E. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

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

F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

H. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:

1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8-inch in 10 feet, 1/4-inch in 20 feet, or 1/2-inch maximum.
2. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4-inch in 10 feet, or 1/2-inch maximum.
3. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8-inch in 10 feet, 1/4-inch in 20 feet, or 1/2-inch maximum.
4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8-inch, with a maximum thickness limited to 1/2-inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8-inch.
5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8-inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8-inch.
6. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16-inch except due to warpage of masonry units within tolerances specified for warpage of units.
7. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16-inch from one masonry unit to the next.

3.3 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

H. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

A. Lay hollow concrete masonry units as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

3.5 CAVITY WALLS

A. Bond wythes of cavity walls together using one of the following methods:

1. Individual Metal Ties: Provide ties installed in horizontal joints, but not less than one metal tie for 4.5 sq. ft. of wall area spaced not to exceed 24 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.

    a. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type ties to allow for differential movement regardless of whether bed joints align.

2. Masonry Joint Reinforcement: Installed in horizontal mortar joints.

    a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes tab-type reinforcement.
    b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties.
    c. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties to allow for differential movement regardless of whether bed joints align.

B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

C. Coat cavity face of backup wythe to comply with Division 07 Section "Bituminous Dampproofing."

D. Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.

1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.6 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.
2. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.

a. Reinforcement above is in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

3.7 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry as follows:

1. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

C. Form expansion joints in brick made from clay or shale as follows:

1. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Division 07 Section "Joint Sealants."

D. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 07 Section "Joint Sealants," but not less than 3/8 inch.

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.8 LINTELS

A. Install steel lintels where indicated.

B. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.9 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install flashing as follows, unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At multi-wythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches, and 1-1/2 inches into the inner wythe. Form 1/4-inch hook in edge of flashing embedded in inner wythe.
3. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
4. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

C. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:

1. Use full raked head joints to form weep holes.

3.10 REINFORCED UNIT MASONRY INSTALLATION

A. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

B. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches.

3.11 FIELD QUALITY CONTROL

A. Inspectors: Owner will engage qualified independent inspectors to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.

1. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.

3.12 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.13 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Steel angle frames around roof openings.
2. Loose steel masonry lintels.
3. Roof access ladder and platform.
4. Miscellaneous lintels at ductwork openings.

B. Related Sections include the following:

1. Division 04 Section "Unit Masonry" for installing loose lintels, anchor bolts, and other items indicated to be built into unit masonry.
2. Division 07 Section “Joint Sealants” for sealants to be used at all penetrations of metal fabrications through existing or new exterior wall construction.

1.3 SUBMITTALS

A. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
2. Provide templates for anchors and bolts specified for installation under other Sections.

B. Welding certificates.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
2. Provide allowance for trimming and fitting at site.

1.6 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Sheet: ASTM A 1003/A, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: As required by structural performance.
2. Coating: G90 or equivalent.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1.

D. Anchor Bolts: ASTM F 1554, Grade 36.

1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.

E. Eyebolts: ASTM A 489.

F. Machine Screws: ASME B18.6.3.

G. Lag Bolts: ASME B18.2.1.

H. Wood Screws: Flat head, ASME B18.6.1.

I. Plain Washers: Round, ASME B18.22.1.

J. Lock Washers: Helical, spring type, ASME B18.21.1.

K. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

L. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material for Anchors in Exterior Locations: Alloy Group 1 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.

1. Use primer with a VOC content of 420 g/L (3.5 lb./gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.

1. Use primer with a VOC content of 420 g/L (3.5 lb./gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Galvanizing Repair Paint: High-zinc-dust-content paint for re-galvanizing welds in steel, complying with SSPC-Paint 20.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

F. Concrete Materials and Properties: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

2.6 METAL LADDERS AND PLATFORMS

A. General:

1. Comply with ANSI A14.3.

B. Galvanized Steel Ladders:

1. Shop fabricate ladders from ASTM A 36 steel plate, structural shapes and/or members as indicated on the drawings.
2. Space siderails 24 inches (457 mm) apart unless otherwise indicated.
3. Siderails: Continuous formed-steel channels, angles or plate, not less than 2-1/2 inches (64 mm) deep, 1/2 inch (13 mm) thick.
4. Rungs: From deformed, round steel bar (such as rebar), not less than 1-inch (26 mm) diameter), with ribbed or figured-traction tread surfaces.

5. Fit rungs in centerline of siderails; fasten by welding or with stainless-steel fasteners or brackets and aluminum rivets.

    a. Acceptable alternative rung products include providing conventional 1-inch diameter round pipe or bar rungs fitted with a non-slip aluminum ladder rung covers such as “SlipNOT” with medium abrasive finish as manufactured by W.S. Molnar Company, or punched aluminum “Traction Tread” as manufactured by the McNichols Company, Inc.

6. Provide platforms as indicated fabricated from pressure-locked galvanized bar grating or extruded-aluminum plank grating, supported by welded steel framing. Limit openings in gratings to no more than 1/2 inch (12 mm) in least dimension.
7. Galvanize each entire ladder assembly by hot-dip method, ASTM A 153.
8. Support each ladder at top and bottom and not more than 60 inches (1500 mm) o.c. with welded or bolted galvanized steel brackets.
9. Secure ladders to adjacent construction with stainless steel anchor bolts of not less than 1/2-inch diameter.

2.7 MISCELLANEOUS FRAMING, LINTELS AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

C. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.8 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

C. Steel and Iron Finishes: Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123/A 123M, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

D. Aluminum Finishes: Manufacturer's standard powder coat finish in color, to be selected by the Architect from standard available colors.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 METAL LADDER INSTALLATION

A. General: Fabricate and install galvanized steel ladders in accordance with the drawings and approved shop drawings. Field verify heights and clearances around edges of roofs and gutters. Position ladders so that top rung is at or very near the top edge of roof and bottommost rung is no higher than 12 inches above grade or roof surface below.

B. Fasteners: Provide 5-inch minimum-length by 1/2-inch diameter galvanized steel wedge-type expansion bolts with washers to anchor ladders directly and securely to exterior brick veneer joints.

C. Touch-up any damage to galvanized surfaces prior to final acceptance. Patch and thoroughly seal all adjacent wall panel surfaces that are cut or penetrated to secure anchors to substrate CMU in accordance with the drawings. Seal penetration at all edges of ladder brackets.

3.3 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings. Anchor securely in accordance with ASTM E 894 and ASTM E 935 so resist vertical and horizontal loads

3.4 ADJUSTING AND CLEANING

A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 painting Sections.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Types of work in this section include rough carpentry for:

1. Gypsum sheathing.
2. Plywood.
3. Framing with Dimensional Lumber.

B. SUBMITTALS: Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

C. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

1. Wood-preservative-treated wood and plywood.
2. Fire-retardant-treated wood and plywood.

1.3 PRODUCT HANDLING

A. Delivery and Storage: Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber as well as plywood and other panels; provide for air circulation within and around stacks and under temporary coverings including polyethylene and similar materials.

B. For lumber and plywood pressure treated with waterborne chemicals, sticker between each course to provide air circulation.

1.4 PROJECT CONDITIONS

A. Coordination: Fit carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow attachment of other work.

PART 2 - PRODUCTS

2.1 LUMBER, GENERAL

A. Lumber Standards: Manufacture lumber to comply with PS 20 "American Softwood Lumber Standard" and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.

B. For exposed lumber apply grade stamps to ends or back of each piece, or omit grade stamps entirely and issue certificate of grade compliance from inspection agency in lieu of grade stamp.

1. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20, for moisture content specified for each use.
2. Provide dressed lumber, S4S, unless otherwise indicated standard grade southern yellow pine.
3. Provide seasoned lumber with 19 percent maximum moisture content (S-Dry) after preservative treatment.

2.2 MISCELLANEOUS MATERIALS

A. Fasteners and Anchorages: Provide size, type, material and finish as indicated and as recommended by applicable standards, complying with applicable Federal Specifications for nails, staples, screws, bolts, nuts, washers and anchoring devices. Provide metal hangers and framing anchors of the size and type recommended by the manufacturer for each use including recommended nails.

B. Where rough carpentry work is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners and anchorages with a hot-dip zinc coating (ASTM A 153).

2.3 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA C2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat all rough carpentry, unless otherwise indicated.

1. Wood nailers, curbs, equipment support bases, expansion joint framing, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

2.4 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 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. Treatment shall not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and 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 at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841.

C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

E. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat all concealed rough carpentry unless otherwise indicated.

1. Framing for raised platforms.
2. Framing for stages.

3. Concealed blocking.
4. Framing for non-load-bearing partitions.
5. Framing for non-load-bearing exterior walls.
6. Roof construction.
7. Plywood backing panels.

2.5 DIMENSION LUMBER FRAMING

A. Preservative Treatment: Comply with applicable requirements of AWPA Standards C2 (Lumber) and of AWPB Standards listed below. Mark each treated item with the AWPB Quality Mark Requirements.

B. Plywood Blocking: APA rated sheathing, treated.

C. Inspect each piece of treated lumber or plywood after drying and discard damaged or defective pieces.

2.6 GYPSUM SHEATHING

A. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M, with fiberglass mat laminated to both sides and with manufacturer's standard edges.

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. American Gypsum.
    b. G-P Gypsum Corporation.
    c. LaFarge North America Inc.
    d. National Gypsum Company.
    e. Temple-Inland Inc.
    f. United States Gypsum Co.

2. Type and Thickness: Regular 1/2 inch (15.9 mm) thick.
3. Edge and End Configuration: Square
4. Size: 24 by 96 inches

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Discard units of material with defects, which might impair quality of work, and units, which are too small to use in fabricating work with minimum joints or optimum joint arrangement.

B. Set carpentry work to required levels and lines, with members plumb and true to line and cut and fitted.

C. Securely attach carpentry work to substrate by anchoring and fastening as shown and as

required by recognized standards.

D. Countersink nail heads on exposed carpentry work and fill holes.

E. Use common wire nails, hot-dip galvanized where anchoring into other wood. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; predrill as required.

F. Use expansion on anchors when attaching to masonry or concrete and bolts or self-tapping screws where attaching to steel framing members.

3.2 WOOD NAILERS AND BLOCKING FOR CURBS:

A. For curbs and equipment bases, provide wood blocking under the base flange and anchor to the roof deck in thicknesses to allow base flashings at the curb to extend a minimum of 10" above the finished roof surface.

3.3 WOOD NAILERS AND BLOCKING

A. Provide wherever shown and where required to attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved. Where blocking abuts roof insulation, it shall match thickness of insulation. Provide treated plywood and treated shims where required to bring blocking to proper level.

B. Attach to substrates as required to support applied loading and hold work securely in place. Countersink bolts and nuts flush with surfaces, unless otherwise indicated. When tying work into adjacent existing blocking to remain, overlap wood members to integrate with existing work.

END OF SECTION 061000

SECTION 066400 - FIBERGLASS-REINFORCED PLASTIC (FRP) 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:

1. Seamless plastic sheet paneling for use at exterior storefront infill panels where indicated on the drawings. Construction with integral-factory-laminated or separately-furnished plywood to yield a composite panel nominal thickness of 1-inch.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for substrate construction and plywood for installing plastic face panels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For plastic paneling and trim accessories, in manufacturer's standard sizes.

1.4 QUALITY ASSURANCE

A. Testing Agency: FM Approvals, non-combustibility.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

B. Manufacturers: Provide FRP panels from one of the following manufacturers, or equal products submitted to and approved by the Architect/Engineer:

1. Fiber-Tech Industries
2. U.S. FRP
3. Crane Composites

C. Basis of Design shall be “CladTuff” sandwich panels manufactured by Fiber-Tech Industries.

2.2 PLASTIC SHEET PANELING

A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D5319.

1. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E84. Identify products with appropriate markings of applicable testing agency.

   a. Flame-Spread Index: 25 or less.
   b. Smoke-Developed Index: 450 or less.

2. Nominal Thickness: Not less than 0.25 inch (6.0 mm).
3. Surface Finish: Smooth, Class ‘C.’.
4. Color: To match closely the reddish brown color of existing exterior window wall panels. As an alternate, the Owner will accept a light gray or titanium color that matches the clear anodized aluminum storefront system and exterior wall louvers.

2.3 ACCESSORIES

A. Plywood Sandwich Panels: These shall be provided generally as specified herein and under Section 061000 "Rough Carpentry." Provide A-C or B-C finish plywood manufactured with exterior waterproof glue, or smooth-faced, A-D grade salt-treated plywood, 3/4-inch thickness. When laminated to the 1/4-inch thick FRP panels, the composite panel thickness shall be nominally 1-inch thick, to be used for glazing into a storefront window system designed to receive 1-inch thick panels or insulating glass.

B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.

C. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.

D. Adhesive: As recommended by plastic paneling manufacturer for exterior wall panel application.

E. Sealant: Mildew-resistant, single-component, neutral-curing or acid-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, 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 PREPARATION

A. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.

B. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.

C. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

D. Lay out paneling and cutouts for louver inserts before installing. Locate panel joints where indicated to minimize conflict of seams with installed toilet accessories. Maximize efficient use of material to avoid excess seams; however, avoid panels less than 6 inches in width.

1. Mark plumb lines on substrate at trim accessory and panel joint locations for accurate installation.
2. Locate trim accessories and panel joints to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

A. Install plastic composite paneling according to manufacturer's written instructions.

B. Install panels in a full spread of adhesive.

C. Install panels with fasteners. Layout fastener locations and mark on face of panels so that fasteners are accurately aligned.

1. Drill oversized fastener holes in panels and center fasteners in holes.
2. Apply sealant to fastener holes before installing fasteners.

D. Install factory-laminated panels using concealed mounting splines in panel joints.

E. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 066400

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. (Rigid) extruded polystyrene foam-plastic board.
2. Glass-fiber blanket batt insulation (encapsulated).

B. Related Sections include the following:

1. Division 06 Section “Rough Framing” for insulation installed in conjunction with roofing and roof repair.

1.3 DEFINITIONS

A. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers; produced in boards and blanket with latter formed into batts (flat-cut lengths) or rolls.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for insulation products.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Surface-Burning Characteristics: ASTM E 84.
2. Fire-Resistance Ratings: ASTM E 119.
3. Combustion Characteristics: ASTM E 136.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam insulating materials to Project site before installation time.
3. Complete installation and concealment of foam materials as rapidly as possible in each area of construction.

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 Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD

A. Extruded Polystyrene Board, Type IV: ASTM C 578, Type IV, 25-psi (173-kPa) minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84. Provide in thickness(es) indicated on the drawings, but in no case less than 1-1/2 inches thick or R6 minimum insulating value. NOTE: Foam plastic products may not be left exposed to the building or attic interior without satisfactory gypsum board fire barrier. Do not use foam plastic insulation in any instance where it will be left unencapsulated by new construction.

1. Available Manufacturers:

a. DiversiFoam Products.
b. Dow Chemical Company (Thermax is the basis of design).
c. Owens Corning.

d. Pactiv Building Products Division.

2.3 GLASS-FIBER BLANKET INSULATION

A. FSK-faced, Encapsulated Glass-Fiber Blanket Insulation: ASTM C 665, Type II (blankets with a thin, permeable polyethylene sheeting), Class A (membrane-faced surface with a flame-spread index of 25 or less); U.L.-listed and labeled. Category 2 fully-encapsulated batts. Unfaced fiberglass batts are not permitted for exposure to interior attic areas.

B. Where glass-fiber blanket insulation is indicated by the following thicknesses, provide blankets in batt or roll form with thermal resistances indicated:

1. 3-5/8 inches thick with a minimum thermal resistance of R13.
2. 5-1/2 or 6 inches thick with a thermal resistance of R19.
3. 9 inches thick with a thermal resistance of R30.

C. Available Manufacturers:

1. CertainTeed Corporation.
2. Guardian Fiberglass, Inc.
3. Johns Manville.
4. Knauf Fiber Glass.
5. Owens Corning.

D. Alternative Insulating Products: In lieu of fiberglass insulation, faced or unfaced rock-mineral wool batts, block or board-type insulation may be substituted; it may be left unfaced where labeled by U.L. for such use. Interior vapor barrier faces shall be U.L.-listed for interior attic use, and may be integral with insulation, or applied over framing after installation of unfaced insulation. Acceptable products include those by Rockwool, Johns Manville “MinWool,” Knauf Insulation “Mineral Plus,” and Owens Corning “Thermafiber.”

2.4 AUXILIARY INSULATING MATERIALS

A. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

a. Gemco; Tuff Bond Hanger Adhesive.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. For preformed insulating units, provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF CAVITY-WALL INSULATION

A. On units of foam-plastic board insulation, install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face, and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates indicated.

1. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Division 04 Section "Unit Masonry."

3.5 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Seal joints between rigid board insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. Install glass-fiber insulation 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 cavity, 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.

    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.

3.6 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 075200 - PATCHING & REPAIR OF MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 SCOPE

A. This Section shall apply to roofing work at existing low-slope roofing of the Building. Patching and repairs are required in conjunction with removal of existing HVAC system components and/or placement of new HVAC system components, equipment, structural supports, curbs, utility distribution and related accessories. Existing low-slope roof at all areas of the building was installed in 2019 and is under warranty. It is the intent under this contract for all patching materials to be compatible with existing modified bituminous roof membrane. It is also the intent to install new roof curbs, utility penetration housing(s), equipment and appurtenances in such a way that is certified by the roof system manufacturer/warrantor NOT to void or affect the current roof warranty. The Owner shall verify details of the current roof system's manufacturer and warranty. Interior of the building shall be kept watertight at the end of each day's work under this Contract.

This Section includes the following:

1. Roof membrane application:

    a. 2-ply Modified Bitumen roof, cold adhesive applied for slope equal or lesser than 1/4- inch/foot

        1) NRCA #MBS-2-I-L-M (SBS)

2. Roof flashing application.
3. Incorporation of sheet metal flashing components and roofing accessories into the roof system.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 6 Section "Rough Carpentry" for sheathing, composite insulated sheathing, wood nailers, curbs, and wood cants.

1.3 REFERENCE STANDARDS

A. References in these specifications to standards, test methods, codes etc., are implied to mean the latest edition of each such standard adopted. The following is an abbreviated list of associations, institutions, and societies which may be used as references throughout these specifications.

1. ASTM: American Society for Testing and Materials
2. FM: Factory Mutual Engineering and Research
3. NRCA: National Roofing Contractors Association
4. OSHA: Occupational Safety and Health Administrations
5. SMACNA: Sheet Metal and Air Conditioning Contractors National Association
6. UL: Underwriters Laboratories

1.4 DESCRIPTION OF WORK

A. The basic work descriptions (components, layering and attachment methods) required in this specification are referenced below. See also Parts 2 and 3 for specific products, preparation, application and details.

1. Project Type: Roof Patching and repairs
2. Roof Deck: Metal, above Two-Story Wing, Gypsum above the One-Story Wing.
3. Insulation: Minimum 2 layers of Polyisocyanurate: Mechanically attach first layer of insulation; secure subsequent layers of insulation and cover board with cold-applied adhesive in a thickness to match adjacent top of membrane.
4. Tapered Insulation: As required to provide positive drainage.

5. Cover Board: ASTM C 1177/C 1177M, glass-mat, 100% inorganic, water-resistant gypsum substrate, 5/8-inch (16 mm) thick.

    a. Georgia-Pacific: DensDeck™ Glass Mat-faced Gypsum Roof Board (and as branded by others)
    b. CertainTeed Corp.: GlasRoc™ Roof Board
    c. Rockwool: TOPROCK™ DD Plus (2 inches thick, may be used as upper layer of insulation in lieu of conventional 1/2-inch or 5/8-inch thickness coverboard).

6. Insulation - Acoustic Steel for Deck: Sound absorbing strip of glass or mineral fiber for depth of deck, in Division 5 Section “Steel Deck.”
7. MB Roof System (Primary) : NRCA #MBS-2-I-L-M
8. Existing Warranty: A 20-year roof warranty for roof membrane, insulation, flashings, roof edge and fascia is in effect, issued in 2019. All work on the roof under this project must be accepted by the roofing system warrantor as having no-impact upon the roofing warranty

9. Existing Roof System Manufacturer: The following manufacturer’s products were installed in 2019, and is warranting the existing roof installation under an existing 20 year warranty which expires in 2039:

    a. _____ (to be verified by NNPS).
    b. Only installers certified by this manufacturer will be allowed to bid on this project and perform roofing-related work under this Contract.
    c. Contractor shall submit evidence that that the roofing installer is authorized by the roofing manufacturer to perform work on its warranted roof system.

d. Contractor shall submit the roofing system manufacturer's letter of final inspection attesting to the Owner that the existing roof warranty remains in force and full effect, including all new work performed under this Contract.

1.5 PERFORMANCE REQUIREMENTS

A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

1.6 SUBMITTALS

A. Submit concurrently with Division 7 Section "Sheet Metal Flashing and Trim" for roofing system components included under total system warranty.

B. Product Data, including manufacturer's technical product data, installation instructions, and recommendations for each type of roofing product required. Include data substantiating that materials comply with requirements.

C. Samples of the following:

1. Roofing membrane base sheet.
2. Membrane granular-surfaced cap sheet.
3. Aluminum-foil surfaced flashing sheet.
4. Liquid-applied roofing membrane for low-slope (positive drainage) applications.
5. Roof insulation.
6. Six insulation fasteners of each type, length, and finish.

D. Provide evidence and description of manufacturer's quality control/quality assurance program for the primary roofing products supplied. The quality assurance program description shall include all methods of testing for physical and mechanical property values. Provide confirmation of manufacturer's certificate of analysis for reporting the tested values of the actual material being supplied for the project prior to issuance of the specified guarantee.

E. Descriptive list of the materials proposed for use.

F. Evidence of Underwriters' Laboratories Class A acceptance of the roofing system. No other testing agency approvals will be accepted.

G. Letter from the primary roofing manufacturer that the repair made will meet the requirement for continued warranty.

H. Complete list of material physical and mechanical properties for each sheet including: weights and thicknesses; low temperature flexibility; breaking load; ultimate elongation; dimensional stability; compound stability; granule embedment and resistance to thermal shock (foil faced products).

I. Letter from the primary roofing manufacturer confirming that the installer is an acceptable Contractor authorized to install the proposed system and was an acceptable authorized contractor at date of bid.

J. Submittals Prior to Project Close-Out:

1. Provide a Certificate of Analysis from the testing laboratory of the primary roofing materials manufacturer, confirming the physical and mechanical properties of the roofing membrane components. Testing shall be performed in accordance with the parameters published in ASTM D 5147 and will indicate Quality Assurance/Quality Control data as required to meet the specified properties. A separate Certificate of Analysis is required for each production run of material and shall indicate the following information:

a. Material type
b. Lot number
c. Production date

d. Dimensions and Mass (indicate the lowest values recorded during the production run);

1) Roll length
2) Roll width
3) Selvage width
4) Total thickness
5) Thickness at selvage
6) Weight

e. Physical and Mechanical Properties:

1) Low temperature flexibility
2) Breaking load
3) Ultimate elongation
4) Dimensional stability
5) Compound stability
6) Granule embedment
7) Resistance to thermal shock (foil faced products)

1.7 QUALITY ASSURANCE

A. Acceptable Products: Provide primary roofing products, including each type of sheet, all manufactured in the United States, supplied by a single manufacturer which has been successfully producing the specified types of primary products for not less than ten (10) years. Provide

secondary or accessory products which are acceptable to the manufacturer of the primary roofing products.

B. Product Quality Assurance Program: Provide primary roofing materials manufactured under a quality control/quality assurance program. A certificate of analysis for reporting/confirming the tested values of the actual material being supplied for the project will be required prior to project close-out.

C. Agency Approvals: The proposed roof system shall conform to the following requirements. No other testing agency approvals will be accepted.

1. Underwriters Laboratories Class A acceptance of the proposed roofing system .

D. Acceptable Contractor: Have a minimum of five (5) years' experience in successfully installing the proposed roofing materials and be certified in writing by the roofing materials manufacturer to install the primary roofing products.

E. Project Acceptance: Submit a completed manufacturer's application for roof guarantee form along with shop drawings of the roofs showing all dimensions, penetrations, and details. The form shall contain all the technical information applicable to the project including deck types, roof slopes, base sheet and/or insulation assemblies (with method of attachment, and fastener type), and manufacturer's membrane assembly proposed for installation. The form shall also contain accurate and complete information requested including proper names, addresses, zip codes and telephone numbers. The project must receive approval, through this process, prior to shipment of materials to the project site.

1. The Manufacturer shall provide on-the-job inspections at a frequency of every other week and provide technical assistance, and application guidance as necessary.

F. Manufacturer Requirements: The roofing materials manufacturer shall provide direct trained company personnel to attend necessary job meetings, perform periodic inspections as necessary, and conduct a final inspection upon successful completion of the project.

G. Recommended Maintenance: In addition to the guarantee, furnish to the Owner the manufacturer's printed recommendations of proper maintenance of the specified roof system including inspection frequencies, penetration addition policies, temporary repairs, and leak call procedures.

1.8 PRODUCT DELIVERY STORAGE AND HANDLING

A. Delivery: Deliver materials in the manufacturer's original sealed and labeled containers and in quantities required to allow continuity of application.

B. Storage: Store materials out of direct exposure to the elements. Store roll goods on a clean, flat and dry surface. All material stored on the roof overnight shall be stored on pallets. Rolls of roofing must be stored on ends. Store materials on the roof in a manner so as to preclude overloading of deck and building structure. Store materials such as solvents, adhesives and asphalt cutback products away from open flames, sparks or excessive heat. Cover all material

using a breathable cover such as a canvas. Polyethylene or other non-breathable plastic coverings are not acceptable.

C. Handling: Handle all materials in such a manner as to preclude damage and contamination with moisture or foreign matter. Handle rolled goods to prevent damage to edges or ends.

D. Damaged Material: Any materials that are found to be damaged or stored in any manner other than stated above will be automatically rejected, removed and replaced at the Contractor's expense.

1.9 PROJECT/SITE CONDITIONS

A. Requirements Prior to Job Start

1. Preliminary Roofing Conference: As soon as possible after award of modified bitumen roofing work, meet with Installer (Roofer), installers of substrate construction (decks) and other work adjoining roof system including penetrating work and rooftop units, Architect, Owner, and representatives of other entities directly concerned with performance of roofing system including (as applicable) Owner's insurers and test agencies. Provide a minimum of 72 hours advanced notice to participants prior to convening pre-roofing conference.
2. Review requirements for tear-off of existing membrane roofing and phasing requirements of project.
3. Review requirements of Contract Documents, submittals, status of coordinating work, availability of materials, and installation facilities and establish preliminary installation schedule. Review requirements for inspections, testing, certifications, forecasted weather conditions, governing regulations, insurance requirements, and proposed installation procedures.
4. Discuss roofing system protection requirements for construction period extending beyond roofing installation.
5. Record discussion, including agreement or disagreement on matters of significance; furnish copy of recorded discussions to each participant within 7 days following the meeting. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.
6. Notification: Give a minimum of five (5) days' notice to the Owner and manufacturer prior to commencing any work and notify both parties on a daily basis of any change in work schedule.
7. Safety: Familiarize every member of the application crew with all fire and safety regulations recommended by OSHA, NRCA and other industry or local governmental groups.

B. Environmental Requirements

1. Precipitation: Do not apply roofing materials during precipitation or in the event there is a probability of precipitation during application. Take adequate precautions to ensure that materials, applied roofing, and building interiors are protected from possible moisture damage or contamination.

C. Protection Requirements

1. Membrane Protection: Provide protection against staining and mechanical damage for newly applied roofing and adjacent surfaces throughout this project.
2. Limited Access: Prevent access by the public to materials, tools and equipment during the course of the project.
3. Debris Removal: Remove all debris daily from the project site and take to a legal dumping area authorized to receive such materials.
4. Site Condition: Complete, to the owner's satisfaction, all job site clean-up including building interior, exterior and landscaping where affected by the construction.

1.10 GUARANTEE/WARRANTY

A. Contractor's guarantees-Roofing Installer shall guarantee materials and workmanship of the finished installation to the full extent as that of the manufacturer's guarantee as outlined in this "Guarantee/Warranty" article.

1. Installer warranty shall be two (2) years from date of Final Acceptance.

a. Warranty shall be signed by the installer and the General Contractor.

PART 2 - PRODUCTS

2.1 ROOFING SYSTEM ASSEMBLY

A. Existing Roofing Membrane Assembly: A roof membrane assembly consisting of two (2) plies of a prefabricated, polyester-reinforced, homogeneous Styrene-Butadiene-Styrene (SBS) copolymer modified asphalt membrane secured to a prepared substrate. The modified bitumen base ply shall be fully adhered to the prepared substrate as specified herein, and shall possess waterproofing capability such that a phased roof application with only the modified bitumen base ply in place can be achieved for prolonged periods of time without detriment to the watertight integrity of the entire roof system, but shall not exceed the manufacturer's recommendations or a maximum of ninety (90) days extra. Provide roof system components meeting the following physical and mechanical requirements:

B. Styrene-Butadiene-Styrene (SBS) Modified Bitumen Roof System, Cold-Applied:

1. Modified Bitumen Base Ply: ASTM D6164/D6164M, Type II, Grade S, SBS-modified asphalt sheet, reinforced with polyester fabric, or ASTM D6162/D6162M, Type III, Grade S, hybrid polyester/fiberglass scrim/mat-reinforced; smooth surfaced; suitable for application method specified. Minimum 114 mil thickness.
2. Modified Bitumen Cap Sheet: ASTM D6164/D6164M, Type I, Grade G, SBS-modified asphalt sheet reinforced with polyester fabric, or ASTM D6162/D6162M, Type I, Grade G, SBS-modified asphalt sheet, hybrid polyester/fiberglass scrim/mat-reinforced; white ceramic-coated granular surfaced; suitable for application method specified. Minimum 130 mil thickness.

3. Stripping Ply: (Same as roof system base ply unless noted).
4. Flashing Membrane Assembly: ASTM D 6298, aluminum-foil-faced SBS-modified asphalt sheet (reinforced with fiberglass scrim/mat), equal to "Veral" Aluminum; suitable for application method specified. Flashings are to be installed in cold adhesive. No torching of base flashings is allowed.
5. Reinforcing Ply: Same as roof system base ply.

2.2 AUXILIARY ROOFING MEMBRANE MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing membrane.

B. Cold-Applied Adhesive: Roofing system manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive specially formulated for compatibility and use with roofing membrane and base flashings.

1. Adhesive for Roof Membrane: A cold-applied solvent based asphaltic adhesive meeting ASTM 4479 Type II. Typical coverage rate ranges from 1.5-2.5 gallons per square.
2. Adhesive for Aluminum Faced Base Flashing Membrane: A single component cold-applied solvent free flashing adhesive. Typical coverage rate ranges from 2.0-2.5 gallons per square.

C. Roofing Cement: Provide ASTM D 4586 asphalt roofing cement or roofing system manufacturer's modified asphalt roofing cement, asbestos free, of consistency required by roofing system manufacturer for application.

D. Mastic Sealant: Polyisobutylene, plain or modified bitumen; non-hardening, non-migrating, non-skinning, and nondrying.

E. Metal Flashing Sheet: Refer to Division 07 Section "Sheet Metal, Flashing and Trim."

F. Roofing Granules: Ceramic-coated roofing granules, No. 11 screen size with 100 percent passing No. 8 sieve and 98 percent of mass retained on No. 40 sieve, color to match roofing membrane.

G. Miscellaneous Accessories: Provide those recommended by roofing system manufacturer.

2.3 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.

1. Refer to Division 6 Section "Rough Carpentry" for composite nail base insulated sheathing for roof-side or parapet applications indicated.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.

C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches unless otherwise indicated.

2.4 INSULATION ACCESSORIES

A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing membrane components to substrate; tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer.

1. Metal Decks: Provide insulation mechanical fasteners and metal plates for metal decks that have been factory coated for corrosion resistance, and when subjected to 30 Kesternich cycles, must show less than 10 percent red rust, conforming to Factory Mutual 4470. Acceptable insulation fastener types for metal decks are listed below:

   a. Dekfast #12 + Dekfast Steel Hexagonal Plates, by Construction Fasteners, Inc.
   b. #12 Standard Roofing Fastener by Olympic Fasteners.

C. Insulation Adhesive: Provide the following.

1. Bead-Applied Insulation Adhesive: Insulation manufacturer's recommended bead-applied, low-rise, one-component or multi-component urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.

D. Cover Board: ASTM C 1177/C 1177M, glass-mat, 100% inorganic, water-resistant gypsum substrate, 5/8-inch (16 mm) thick.

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. Georgia-Pacific Corporation; DensDeck™ Roof Board.
   b. National Gypsum Company; DEXcell™ FA Glass Mat Roof Board
   c. CertainTeed Corp.: GlasRoc™ Roof Board

E. Substrate Joint Tape: 6- or 8-inch- wide, coated, glass-fiber joint tape.

F. Insulation – Acoustic Steel for Deck: Sound absorbing strip of glass or mineral fiber for depth of deck, is specified in Division 5 Section “Steel Deck.”

2.5 ROOF ACCESSORIES

A. General: Provide the following roof accessories for managing roof penetrations and supporting rooftop-mounted mechanical equipment.

B. Metal Materials:

1. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coated.
2. Aluminum Extrusions and Tubes: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for type of use, mill finished.
3. Stainless-Steel Shapes or Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304 or Type 316, No. 2D finish.
4. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized to comply with ASTM A 123/A 123M, unless otherwise indicated.
5. Galvanized Steel Tube: ASTM A 500, round tube, hot-dip galvanized to comply with ASTM A 123/A 123M.
6. Galvanized Steel Pipe: ASTM A 53/A 53M.

C. Miscellaneous Materials:

1. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by roof accessory manufacturer. Match finish of exposed fasteners with finish of material being fastened. Provide non-removable fastener heads to exterior exposed fasteners.
2. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.
3. Elastomeric Sealant: ASTM C 920, polyurethane sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
4. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene, plasticized, and heavy bodied for hooked-type expansion joints with limited movement.

D. Prefabricated Roof Equipment Curbs: Provide metal roof curbs, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported on roof curbs. Fabricate with welded or sealed mechanical corner joints, with integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1. Available Manufacturers:

a. Colony Custom Curbs.
b. Commodity Products Company, Inc.
c. Conn-Fab Sales, Inc.
d. Curbs Plus Inc.
e. Custom Curb, Inc.
f. LM Curbs.
g. Loren Cook Company.
h. Metallic Products Corporation.
i. Pate Company (The).
j. Roof Products & Systems Corporation.
k. Roof Products, Inc.
l. ThyCurb; Div. of Thybar Corporation.
m. Uni-Curb, Inc.
n. Vent Products Company, Inc.

2. Material: Galvanized steel sheet, 0.079 inch (2.0 mm) thick.
3. Liner: Same material as curb, of manufacturer's standard thickness and finish.
4. Factory install wood nailers at tops of curbs.
5. Factory insulate curbs with 1-1/2-inch- (38-mm-) thick, glass-fiber board insulation.
6. Curb height may be determined by adding thickness of roof insulation and minimum base flashing height recommended by roofing membrane manufacturer. Fabricate units to minimum height of 12 inches (300 mm), unless otherwise indicated.

E. Prefabricated Pipe Supports: Provide adjustable piping support products as manufactured by Roof Top Blox, 500 Distribution Parkway, Collierville, TN 38017, Model RTB-01, or equal product(s) as submitted to, and approved by, the Architect. Salient features include:

1. Materials: Support base shall be manufactured from 25 PSI plastic with a base not less than 9 inches by 9 inches by 1-inch thickness (nominal). Plastic may be from recycled products. Supports shall be manufactured to permit secure insertion of an elevated, vertical, galvanized steel post or threaded rod. Post or rod shall be vertically-adjustable to permit alignment of supported element.
2. Pipe Clamps for Natural Gas Piping and Refrigerant Line Piping: Provide single post or rod shall fitted with a circular, galvanized steel split-ring clamp to support and secure the pipe. For multiple pipes, two posts or rods may be fitted with a horizontal support bar with pre-drilled holes allowing for securing of pipes with inverted, threaded, galvanized steel U-clamps and nuts. Provide clamping assemblies that do not crush pipe insulation.
3. Pipe Clamps for Condensate Piping: Provide single-pipe galvanized steel U-clamp assembly for secure attachment of PVC piping directly to the equipment support base.
4. Provide manufacturer’s standard roof adhesive for attaching the support base to the roof membrane. In lieu of an adhesive product by the pipe support manufacturer, substitute an adhesive approved for use by the roof membrane manufacturer.

F. Pre-Fabricated Utility Penetration (Chase) Housing: Provide “Vault” products as manufactured by Roof Penetration Housings, LLC, P.O. Box 461024, San Antonio, TX 78246 (Ph 800-994-0945) or provide equal products by another manufacturer approved in advance by the Architect, based upon Medium” Vault Chase Housing,” Model No. AWI/AW-201412.

1. Housing size: 21 ½ inches long by 14 ½ inches wide.
2. Housing height (above curb): 14 inches.
3. Curb height (without housing): 8 inches.
4. Material: Welded powder coated aluminum.
5. Seals: Provide manufacturer’s pre-fabricated seals for power, controls and refrigerant lines as required at each location. Coordinate with mechanical and electrical requirements.
6. Location: As shown on the Contract Drawings.

PART 3 – EXECUTION

3.1 PREPARATION

A. Provide roof for limited removal of roof membrane and substrate in accordance with the drawings and requirements of Section 024119, “Selective Demolition.” Coordinate removal of roofing membrane and substrate carefully with provision and layout of new rooftop-mounted mechanical equipment and associated electrical utilities. Identify all existing roof structural members below prior to locating and laying out roof penetrations.

B. General: Sweep or vacuum all surfaces, removing all loose aggregate and foreign substances prior to commencement of roofing. Coordinate disconnection removal reinstallation and reconnection of all roof top plumbing, mechanical, and electrical items that may have been connected or installed prior to roofing that requires roofing to be properly installed or flashed.

3.2 SUBSTRATE PREPARATION AND INSULATION INSTALLATION

A. Insulation: Comply with insulation manufacturer's instructions and recommendations for the handling, installation, and bonding or anchorage of insulation to substrate. Examine substrate before starting work. Surfaces to receive insulation shall be clean, smooth, and dry. Verify that wood blocking has been installed at edges, walls, and other openings. Install insulation panels with end joints offset; edges of the panels shall be in moderate contact without forcing applied in strict accordance with the insulation manufacturer's requirements and the following instructions.

1. Acoustical Steel Deck Sound-Absorbing Insulation: Install manufacturer's standard pre-molded roll or strip of mineral fiber into topside of deck prior to installation of base layer and tapered layers of roofing insulation.

B. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.

1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

C. Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2 inches or greater, install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 12 inches in each direction.

1. At sloping deck, provide two layers of 2 inch thickness polyisocyanurate. Install coverboard over this insulation. Crickets, cants, and tapered edge strips are also in addition to the polyisocyanurate insulation board thickness.
2. At level decks, provide polyisocyanurate insulation thickness indicated, in two layers unless noted otherwise. Install coverboard over this insulation. Crickets, cants, and tapered edge strips are also in addition to the polyisocyanurate insulation board thickness for the primary roof planes.

D. Mechanically Fastened and Adhered Insulation: Install first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten first layer of insulation over entire area of roofing at spacing as required by FM for Windstorm Resistance Classification I-90. Run long joints for insulation in continuous straight lines, perpendicular to roof slope with end joints staggered between rows.
2. Set each subsequent layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place. Provide adhesive bead spacing as required for uplift requirements at roof field, perimeter and corner applications. Stagger joints of second layer a minimum of 12 inches each direction from joints of first layer.

E. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows, set in adhesive for full bond. Offset joints a minimum of 6 inches in each direction from joints of insulation below. Loosely butt cover boards together. Tape joints if required by roofing system manufacturer.

1. Cricket Areas: Construct crickets of tapered polyisocyanurate panels between the roof drains. Install each cricket directly over the surface of the top layer of insulation to facilitate prompt and complete removal of water to each roof drain.
2. Trim surface of insulation where necessary at roof drains so completed surface is flush with ring of drain.

3.3 ROOF MEMBRANE INSTALLATION

A. Prime all lap areas prior to installation for the base sheet.

B. Install roofing membrane system according to roofing system manufacturer's written instructions and applicable recommendations in ARMA/NRCA's “Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing.”

1. Install roofing system MBS-2-I-L-M, according to roof assembly identification matrix and roof assembly layout illustrations in “The NRCA Roofing and Waterproofing Manual” and to requirements in this Section.

C. Coordinate installation of roofing system so insulation and other components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.

1. At end of each day's work, provide tie-offs to cover exposed roofing membrane sheets and insulation with a course of coated felt set in roofing cement, with joints and edges sealed.
2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
3. Remove and discard temporary seals before beginning work on adjoining roofing.

D. Substrate-Joint Penetrations: Prevent adhesives from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

E. Aesthetic Considerations: The overall appearance of the finished roof application is a standard requirement for this project. The Contractor shall make necessary preparations, utilize recommended application techniques, apply the specified materials (i.e., granules, metallic

powder, etc.), and exercise care in ensuring that the finished application is acceptable to the Owner.

F. The Manufacturer's Quality Control Representative shall visit the site every other week, and at conclusion of the project. Representative shall provide 24 hour notice to the Owner of all visits made to the site and shall submit to the Architect/Engineer, within 3 days following site visits, written reports of findings from their field visits. Failure to provide visits and reports shall be cause for withholding pay application for roofing materials and labor and shall be cause of removal of roofing contractor from project without further notice.

G. Priming: Prime metal flanges (all jacks, edge metal, lead drain flashings, etc.) and concrete and masonry surfaces with a uniform coating of asphalt primer ASTM D 41.

H. Adhesive Consistency: Cutting or alterations of adhesives, primer, and sealants will not be permitted.

I. Roofing Application: Apply all layers of roofing free of wrinkles, creases or fishmouths. Exert sufficient pressure on the roll during application to ensure prevention of air pockets. Lap seams in the base ply layer should not coincide with the lap seams of the finish ply layer. Heat-weld lap seams in accordance with membrane manufacturer's recommendations. The courses should be staggered to ensure this.

1. Apply all layers of roofing perpendicular to the slope of the deck.
2. Fully bond the base ply to the prepared substrate, having a minimum of three (3) inch side and end laps. Each sheet shall be applied directly in cold-applied adhesive.
3. Fully bond the finish ply to the base ply, having a minimum of three (3) inch side and end laps. Each sheet shall be applied directly in cold-applied adhesive.
4. Maximum sheet lengths and special fastening of the specified roof membrane system may be required at various slope increments where the roof deck slope exceeds one-half (1/2) inch per foot. The manufacturer shall provide acceptable sheet lengths and the required fastening schedule for all roofing sheet applications to applicable roof slopes.

J. Liquid-Applied Roofing and Flashing Application: At low slope areas and membrane penetration flashing applications install in accordance with manufacturer's instructions. Provide primer or SBS membrane base-ply to the secured top surface of the completed modified bitumen roofing system as required by fluid-applied roofing system for warranted application. The polyester-reinforced liquid-applied roof membrane will be installed to the top surface of the prepared substrate.

1. Flash standard base flashings: Install polyester-reinforced liquid-applied flashings in areas shown on the details. Bond the flashings directly to the surface of the modified bitumen roofing system completed cap sheet.
2. Flash with Polyester-Reinforced Liquid-Applied Flashings: Install the catalyzed flashing resin on the surface of the modified bitumen roofing system completed cap sheet and the vertical primed surface of the walls and penetrations. Place flashing resin on the back of the reinforcing fleece and install in place at the flashing. Coat the top layer of the fleece with an additional layer of flashing resin.
3. Install Polyester-Reinforced Liquid-Applied Roof Membrane: When the flashing has set up, install the polyester-reinforced liquid-applied roof membrane resin directly to the top

surface of the prepared substrate. Imbed the fleece in the resin, and topcoat with another layer of resin in accordance with manufacturer's instructions.

K. Flashing Application: Use only cold applied adhesive. Flash curbs using the modified bitumen reinforcing sheet and the metal foil flashing membrane. The reinforcing sheet shall have minimum three (3) inch laps, extending a minimum of three (3) inches onto the base ply surface and on vertical wood or masonry substrate as indicated. After the finish ply has been applied to the top of the cant, prepare the surface area that is to receive flashing coverage by application of asphalt primer to foil surfaces; allowing primer to dry thoroughly. Adhesive apply the metal foil flashing into place using three foot lengths (cut from the end of roll) and using the factory selvage edge for laps, extending a minimum of four (4) inches beyond the toe of the cant onto the prepared surface of the finished roof. Exert pressure on the flashing sheet during application to ensure complete contact with the wall/roof surfaces, preventing air pockets; this can be accomplished by using a damp sponge or shop rag. Check and seal all loose laps and edges. Nail the top edge of the flashing on nine (9) inch centers. (See manufacturer's schematic for visual interpretation).

1. Heat-Welded Seams: Do not apply adhesive within two inches of edges of cap sheets. Heat weld underside of the exposed edge seam to substrate sheet below using a hand-held hot-knife or other appropriate heated tool as recommended by the roofing manufacturer.

L. Water Cut-Off: At end of day's work, or when precipitation is imminent, construct water cut-off at all open edges. Cut-offs can be built using asphalt or plastic cement and roofing felts, constructed to withstand protracted periods of service. Cut-offs must be completely removed prior to the resumption of roofing.

3.4 ROOF SYSTEM INTERFACE WITH RELATED COMPONENTS

A. The following is a list of verbal descriptions for correct installation of components integrated into the roof membrane assembly. In all cases, unless otherwise approved, incorporate flanged components into the system between the application of the base ply and the finish ply. The flange must be primed with a uniform coating of approved ASTM D 41 asphalt primer and allowed to dry thoroughly; all flanges must be set in approved mastic.

1. Metal flashings: Completely prime metal flanges and allow to dry prior to installation. After the base ply and continuous cleat (if applicable) have been installed, set the flange in mastic and stagger nail every three (3) inches on center. Strip-in the flange using the cap ply material, extending a minimum of four (4) inches beyond the edge of the flange.
2. Sealant: Caulk all exposed finish ply edges at all flashings, with a smooth continuous bead of approved sealant.

3.5 INSTALLATION OF ROOF ACCESSORIES

A. General: Install roof accessories according to manufacturer's written instructions. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessory installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Install roof accessories to fit substrates and to result in watertight performance.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Bed flanges in thick coat of asphalt roofing cement where required by roof accessory manufacturers for waterproof performance.

D. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks. Level all equipment supports and rails as required for proper installation and operation of mechanical or electrical equipment placed thereupon.

E. Seal joints with elastomeric sealant as required by manufacturer of roof accessories. Apply sealants in strict accordance with manufacturer's installation instructions.

3.6 FIELD QUALITY CONTROL AND INSPECTIONS

A. Site Condition: All areas around job site shall be free of debris, roofing materials, equipment and related items after completion of job.

B. Notification of Completion: Contractor shall notify manufacturer by means of manufacturer's printed Notification of Completion form of job completion in order to schedule a final inspection date.

C. Final Inspection

1. Post-Installation Meeting: Hold a meeting at the completion of the project, attended by all parties that were present at the pre-job conference. A punch list of items required for completion shall be compiled by the Contractor and the manufacturer's representative. Complete, sign, and mail the punch list form to the manufacturer's headquarters.
2. Drain Verification: At final inspection of all work, verify that all drains, scuppers, etc., are functioning properly. Drains shall have adequate strainers.

D. Issuance of the Guarantee: Complete all post installation procedures and meet the manufacturer's final endorsement for issuance of the specified guarantee.

E. Within thirty (30) days of Substantial Completion roofing contractor shall perform an infrared survey to ascertain the presence of moisture in the roof system and submit copies to Contractor, Owner and Architect. Any finding of moisture shall be remedied and necessary repairs made in compliance with manufacturer's warranty requirements.

F. Two-Year Inspection: Contact the manufacturer during the ninety (90) day period immediately preceding the two (2) year anniversary of the guarantee date to arrange for a mandatory two-year inspection. The inspection shall be attended by the Owner, Architect-Engineer, and Contractor

and the manufacturer's representative. A two-year inspection punch list shall be compiled by the manufacturer and submitted to the Contractor for his completion. Upon completion, sign and mail the punch list form to the manufacturer's headquarters, verifying that all items are in accordance with the manufacturer's recommendations.

END OF SECTION 075200

SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes through-penetration firestopping systems for penetrations through fire-resistance-rated constructions, including openings containing penetrating items that are installed as part of the work of this Contract.

B. Related Sections include the following:

1. Division 22 and 23 Sections specifying duct and piping penetrations.
2. Division 26 Sections specifying cable and conduit penetrations.

1.3 PERFORMANCE REQUIREMENTS

A. General: For penetrations through the following fire-resistance-rated constructions, including openings containing penetrating items installed as part of this Contract, provide through-penetration firestopping systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

1. Fire-resistance-rated walls including fire walls, fire partitions and fire barriers.

B. Rated Systems: Provide through-penetration firestopping systems with the following ratings determined per ASTM E 814 or UL 1479:

1. F-Rated Systems: Provide through-penetration firestopping systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.

2. T-Rated Systems: For the following conditions, provide through-penetration firestopping systems with T-ratings indicated, as well as F-ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:

a. Penetrations located outside wall cavities.
b. Penetrations located outside fire-resistance-rated shaft enclosures.

3. L-Rated Systems: Where through-penetration firestopping systems are required in smoke barriers, provide through-penetration firestopping systems with L-ratings of not more than 3.0 cfm/sq. ft (0.01524cu. m/s x sq. m) at both ambient temperatures and 400 deg F (204 deg C).

C. For through-penetration firestopping systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For each through-penetration firestopping system, show each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item. Include firestopping design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestopping system configuration for construction and penetrating items.
2. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular through-penetration firestopping condition, submit illustration, with modifications marked, approved by through-penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

C. Through-Penetration Firestopping System Schedule: Indicate locations of each through-penetration firestopping system, along with the following information:

1. Types of penetrating items.
2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
3. Through-penetration firestopping systems for each location identified by firestopping design designation of qualified testing and inspecting agency.

D. Qualification Data: For Installer.

E. Product Certificates: For through-penetration firestopping system products, signed by product manufacturer.

F. Product Test Reports: From a qualified testing agency indicating through-penetration firestopping system complies with requirements, based on comprehensive testing of current products.

1.5 QUALITY ASSURANCE

A. Installation Responsibility: Assign installation of through-penetration firestopping systems to the subcontractor responsible for making the penetration.

B. Source Limitations: Obtain through-penetration firestopping systems, for each kind of penetration and construction condition indicated, through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide through-penetration firestopping systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:

1. Through-penetration firestopping systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems complying with the following requirements:

a. Through-penetration firestopping system products bear classification marking of qualified testing and inspecting agency.

b. Through-penetration firestopping systems correspond to those indicated by reference to through-penetration firestopping system designations listed by the following:

1) UL in its "Fire Resistance Directory."
2) OPL in its "Directory of Listed Building Products, Materials, & Assemblies."
3) ITS in its "Directory of Listed Products."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver through-penetration firestopping system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multi-component materials.

B. Store and handle materials for through-penetration firestopping systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install through-penetration firestopping systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate through-penetration firestopping systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

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

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestopping systems.

C. Do not cover up through-penetration firestopping system installations that will become concealed behind other construction until each installation has been examined by Owner's representative and the building inspector.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the through-penetration firestopping systems indicated for each application that are produced by one of the following manufacturers:

1. A/D Fire Protection Systems Inc.
2. Grace, W. R. & Co. - Conn.
3. Hilti, Inc.
4. Johns Manville.
5. Nelson Firestopping Products.
6. NUCO Inc.
7. RectorSeal Corporation (The).
8. Specified Technologies Inc.
9. 3M; Fire Protection Products Division.
10. Tremco; Sealant/Weatherproofing Division.
11. USG Corporation.

2.2 FIRESTOPPING, GENERAL

A. Compatibility: Provide through-penetration firestopping systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestopping systems, under conditions of service and application, as demonstrated by through-penetration firestopping system manufacturer based on testing and field experience.

B. Accessories: Provide components for each through-penetration firestopping system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for firestopping systems indicated. Accessories include, but are not limited to, the following items:

1. Permanent forming/damming/backing materials, including the following:

a. Slag-/rock-wool-fiber insulation.
b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
c. Fire-rated form board.
d. Fillers for sealants.

2. Temporary forming materials.
3. Substrate primers.
4. Collars.
5. Steel sleeves.

2.3 FILL MATERIALS

A. General: Provide through-penetration firestopping systems containing the types of fill materials indicated in the Through-Penetration Firestopping System Schedule at the end of Part 3 by referencing the types of materials described in this Article. Fill materials are those referred to in directories of referenced testing and inspecting agencies as "fill," "void," or "cavity" materials.

B. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.

C. Firestopping Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.

E. Intumescent Putties: Non-hardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a non-shrinking, homogeneous mortar.

H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives.

I. Silicone Foams: Multi-component, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.

J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:

1. Grade for Vertical Surfaces: Non-sag formulation for openings in vertical and other surfaces.

2.4 MIXING

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestopping systems to comply with firestopping system manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestopping systems.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestopping systems. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by through-penetration firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent through-penetration firestopping systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping system materials. Remove tape as soon as possible without disturbing firestopping system's seal with substrates.

3.3 THROUGH-PENETRATION FIRESTOPPING SYSTEM INSTALLATION

A. General: Install through-penetration firestopping systems to comply with Part 1 "Performance Requirements" Article and with firestopping system manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming/damming/backing 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 indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping systems.

C. Install fill materials for firestopping systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestopping system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestopping systems immediately and install new materials to produce systems complying with specified requirements.

END OF SECTION 078413

SECTION 079200 - JOINT SEALANTS

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. Urethane joint sealants.
2. Silicone joint sealants.

B. Related Sections:

1. Division 04 Section "Unit Masonry" for sealing perimeter joints at HVAC grilles on the exterior of the building.

1.3 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

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. Qualification Data: For qualified Installer.

D. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

E. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.

F. Warranties: Sample of special warranties.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

1.5 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.6 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which 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: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: 5 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 structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from natural 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.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. 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.

B. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.

C. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

D. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

E. Colors of Exposed Joint Sealants: To match adjacent finish color.

2.2 URETHANE JOINT SEALANTS

A. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.

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. Sika Corporation, Construction Products Division; Sikaflex - 15LM.
b. Tremco Incorporated; Vulkem 921.

B. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.

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. Pacific Polymers International, Inc.; Elasto-Thane 230 LM Type II.
b. Polymeric Systems, Inc.; PSI-901.

2.3 SILICONE JOINT SEALANTS

A. Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

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. Tremco; Spectrem 2.

b. Pecora Corporation; 864NST or PCS.

2.4 JOINT SEALANT BACKING

A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

2.5 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, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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 all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean 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. Masonry.
    c. Unglazed surfaces of ceramic tile.

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

4. 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 of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Glazed surfaces of ceramic 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. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with 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 C 1193 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.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.

5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.

    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 FIELD QUALITY CONTROL

A. 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.

3.5 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.

3.6 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 and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Control and expansion joints in unit masonry.
b. Joints between different materials listed above.
c. Perimeter joints between concrete or masonry and frames of doors windows and louvers.

2. Urethane Joint Sealant: Single component, nonsag, Class 100/50.
3. Joint-Sealant Color: As selected by the Owner's Representative from manufacturer's full range of colors.

B. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.

1. Joint Locations:

a. Control and expansion joints in tile flooring.

2. Urethane Joint Sealant: Multicomponent, nonsag, traffic grade.
3. Joint-Sealant Color: As selected by the Owner's Representative from manufacturer's full range of colors.

C. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Perimeter joints of wall repair panels between ceramic tile and impact resistant wall repair panels.
b. Perimeter joints of exterior openings where indicated.
c. Vertical joints on exposed surfaces of interior unit masonry walls and partitions.

2. Joint-Sealant Color: As selected by the Owner's Representative from manufacturer's full range of colors.

D. 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, 50, NT.

3. Joint-Sealant Color: As selected by the Owner's Representative from manufacturer's full range of colors.

E. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

    a. Joints in metal-to-metal or metal-to glass window and door systems, or where metal flashing meets adjacent metal surfaces.
    b. Joints around metal louvers or metal panels where in contact with metal sleeves, frames or other metal surfaces.
    c. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 50, NT.

3. Joint-Sealant Color: As selected by the Owner’s Representative from manufacturer's full range of colors.

END OF SECTION 079200

SECTION 084113 - ALTERATION OF ALUMINUM-FRAMED STOREFRONT WINDOWS

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. Modification of exterior storefront windows, including removal of glazed panels and individual horizontal mullion members.
2. Accessories for glazing in replacement glass and specialty exterior wall/louver panels.

B. Related Sections:

1. Division 06 Section 066400, “Fiberglass-Reinforced Plastic (FRP) Wall Panels.”
2. Division 07 Section 079200, "Joint Sealants.”
3. Division 08 Section 088000, "Glazing.”

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum-framed systems.

B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.

1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
2. For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for field-modifying aluminum storefront windows and installation of units required for this Project.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Manufacturer of the existing window wall systems is not known. These are common, 2-inch wide by 4-1/2 inches deep, thermally-broken-frame, center-glazed storefront systems similar to Kawneer 451T or one of similar systems manufactured by EFCO. Tubelite or YKK AP America. Existing window framing has removable stops on the exterior side; therefore, modifications to these windows must be undertaken from the exterior side, including at elevated second floor windows.

B. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

C. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts, complying with ASTM A 123/A 123M or ASTM A 153/A 153M.

D. Concealed Flashing: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding flashing compatible with adjacent materials.

E. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for frame and joint type.

2.2 GLAZING SYSTEMS

A. Glazing: As specified in Division 08 Section "Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

2.3 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 07 Section "Joint Sealants."

B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil (0.762-mm) thickness per coat.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, 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. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure non-movement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
6. Seal joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

F. Install glazing and FRP/Plywood Panels with fixed louvers as specified in Division 08 Section 088000, "Glazing."

G. Install perimeter joint sealants as specified in Division 07 Section 079200, "Joint Sealants" to produce weathertight installation.

3.3 ERECTION TOLERANCES

A. Install aluminum-framed systems to comply with the following maximum erection tolerances:

1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/4 inch (6 mm) over total length.

2. Alignment:

a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm).
b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch (3 mm).

3.4 FIELD QUALITY CONTROL

A. Repair or remove work if test results and inspections indicate that it does not comply with specified requirements.

B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

C. Aluminum-framed assemblies will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 084113

SECTION 088000 - GLAZING

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 glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Existing, fixed aluminum storefront-framed exterior windows, including replacement of 1-inch insulating glass, specified herein; and,

2. Placement of 1-inch thick, composite FRP/plywood panels at openings intended to receive exterior wall louvers.

B. Related Sections:

1. Division 06 Section 066400, “Fiberglass-Reinforced Plastic (FRP) Wall Panels.”
2. Division 08 Section 084113, “Alteration of Aluminum Framed Storefront Windows.”

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit.

D. Hermetic Seal: The edge seal of insulating glass units consisting of pre-formed metal spacer with integral dessicant material and high-adhesive glazing compounds to adhere the glass to the spacer.

1.4 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Delegated Design: Design glass, including comprehensive engineering analysis according to ASTM E 1300 & ICC's 2009 International Building Code by a qualified professional engineer, using the following design criteria:

1. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.

a. Basic Wind Speed (ASCE 7-10, 3-sec peak gust): 115 mph.
b. Risk Category: II
c. Importance Factor: 1.
d. Exposure Category: B.

2. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.
3. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch (25 mm), whichever is less.
4. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
5. Thickness of Patterned Glass: Base design of patterned glass on thickness at thinnest part of the glass.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.5 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Glass Samples: For each type of the following products; 12 inches (300 mm) square.

1. Insulating glass.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

D. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Qualification Data: For installers and manufacturers of insulating-glass units with sputter-coated, low-e coatings.

F. Product Certificates: For glass and glazing products, from manufacturer.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for coated glass and insulating glass.

H. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved by coated-glass manufacturer.

B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

D. 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. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

E. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or [the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

F. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F (4.4 deg C).

1.9 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

1. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.

B. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
2. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
3. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
4. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

A. Heat-Treated Float Glass, including Tempered: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
2. For uncoated glass, comply with requirements for Condition A.
3. For coated vision glass, comply with requirements for Condition C (other coated glass).

2.3 INSULATING GLASS

A. Manufacturers: Provide material produced by an approve Manufacturer, subject to compliance with the specified requirements,

B. Insulating Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace filled with argon gas, qualified according to ASTM E 2190, and complying with other requirements specified.

1. Sealing System: Manufacturer's standard Dual seal.
2. Desiccant: Molecular sieve or silica gel, or blend of both.

C. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Insulating-Glass Types" Article and in "Insulating-Laminated-Glass Types" Article.

2.4 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:

1. Neoprene complying with ASTM C 864.
2. EPDM complying with ASTM C 864.
3. Silicone complying with ASTM C 1115.
4. Thermoplastic polyolefin rubber complying with ASTM C 1115.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene, EPDM, silicone or thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.

1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

2.5 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 Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.6 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit 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 publications, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

2.7 INSULATING-GLASS TYPES

A. Glass Type GL-1: Tempered insulating glass, for use in exterior aluminum windows, storefront, entrance frames, transoms, at locations indicated due to proximity to floor and swinging doors:

1. Overall Unit Thickness: 1 inch (25 mm).
2. Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: Clear tempered float glass.
4. Interspace Content: Argon.
5. Indoor Lite: Clear tempered float glass.
6. Low-E Coating: Pyrolytic or sputtered on second or third surface.

B. Glass Type GL-2: Heat-Strengthened, insulating glass, for use aluminum-framed windows at exterior walls of classrooms and other exterior storefront window locations not otherwise required to be tempered:

1. Overall Unit Thickness: 1 inch (25 mm).
2. Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: Clear heat-Strengthened float glass.
4. Interspace Content: Argon.
5. Indoor Lite: Clear heat-Strengthened float glass.
6. Low-E Coating: Pyrolytic or sputtered on second or third surface.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 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. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass and , minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass and panel edges from damage during handling and installation. Remove damaged glass and panels 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 primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction 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.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites and panels where length plus width is larger than 50 inches (1270 mm).

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites and panels in each series with uniform pattern, draw, bow, and similar characteristics.

J. Set glass lites with proper orientation so that coatings face exterior or interior as specified. FRP/plywood composite panels are to be set with FRP surface facing the exterior.

K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints with sealant recommended by gasket manufacturer.

3.4 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: 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 weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.5 LOCK-STRIP GASKET GLAZING

A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system unless otherwise indicated.

3.6 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. 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 in writing by glass manufacturer.

F. Protect FRP composite panels from damage after setting in place. Seal openings in panels as necessary to form temporary weathertight assembly until permanent louvers are installed.

END OF SECTION 088000

SECTION 089119 - FIXED-BLADE LOUVERS

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. Stationary, extruded-aluminum louvers.
2. Blank-off panels for louvers.

B. Related Requirements:

1. Section 07920 "Joint Sealants" for sealing edges of louver frames in openings.

1.3 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Horizontal Louver: Louver with horizontal blades (i.e., the axis of the blades are horizontal).

C. Vertical Louver: Louver with vertical blades (i.e., the axis of the blades are vertical).

D. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

E. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven-rain performance, as determined by testing according to AMCA 500-L.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

1. Show weep paths, gaskets, flashings, sealants, and other means of preventing water intrusion.
2. Show mullion profiles and locations.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

B. Sample Warranties: For manufacturer's special warranties.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
2. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.8 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. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fixed and hinged louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

B. Basis of Design: Provide hinged and fixed louvers as manufactured by Ruskin, Inc., 3900 Dr. Greaves Road, Grandview, MO 64030, (816) 761-7476. Similar products of other manufacturers may be accepted subject to review and approval by the Architect/Engineer.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

1. Wind Loads: Determine loads based on pressures as indicated on Drawings.
2. Wind Loads: Determine loads based on a uniform pressure of 30 lbf/sq. ft. (1436 Pa), acting inward or outward.

3. Wind Loads: Determine loads based on pressures indicated below:

    a. Corner Zone: Within five (5) feet of building corners, uniform pressure of 30 PSF, acting inward, and 20 PSF, acting outward.
    b. Other Than Corner Zone: Uniform pressure of 25 PSF, acting inward, and 20 PSF, acting 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. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

D. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.3 FIXED EXTRUDED-ALUMINUM LOUVERS

A. Horizontal Drainable-Blade Louver:

1. Louver Depth: 4 inches (100 mm).
2. Frame and Blade Nominal Thickness: Not less than 0.080 inch (1.52 mm) for blades and 0.080 inch (2.03 mm) for frame.
3. Mullion Type: Exposed.

4. Louver Performance Ratings:

    a. Free Area: Not less than 50 percent of nominal overall area.
    b. Point of Beginning Water Penetration: Not less than 900 fpm (4.6 m/s).
    c. Air Performance: Not less than free-area and volume intake velocity indicated on the mechanical drawings.

5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.4 LOUVER SCREENS

A. General: Provide screen at each exterior louver.

1. Screen Location for Fixed Louvers: Interior face.
2. Screening Type: Insect screening.

B. Secure screen frames to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches (150 mm) from each corner and at 12 inches (300 mm) o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.

1. Metal: Same type and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
2. Finish: Same finish as louver frames to which louver screens are attached.
3. Type: Rewireable frames with a driven spline or insert.

D. Louver Screening for Aluminum Louvers:

1. Insect Screening: Aluminum, 18-by-16 (1.4-by-1.6-mm) mesh, 0.012-inch (0.30-mm) wire.
2. Insect Screening: Stainless steel, 18-by-18 (1.4-by-1.4-mm) mesh, 0.009-inch (0.23-mm) wire.

2.5 BLANK-OFF PANELS

A. Uninsulated Blank-Off Panels: Metal sheet attached to back of louver.

1. Aluminum sheet for aluminum louvers, not less than 0.050-inch (1.27-mm) nominal thickness.
2. Panel Finish: Same finish applied to louvers.
3. Attach blank-off panels with clips or sheet metal screws.
4. Size and Profile: As required to blank off louver areas not required for outdoor air intake or exhaust, based on sizes indicated on the mechanical drawings.

2.6 MATERIALS

A. Aluminum Extrusions: ASTM B221 (ASTM B221M), Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B209 (ASTM B209M), 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 hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.
2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
3. For fastening galvanized steel, use hot-dip-galvanized-steel or 300 series stainless-steel fasteners.
4. For fastening stainless steel, use 300 series stainless-steel fasteners.
5. 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 E488/E488M conducted by a qualified testing agency.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.7 FABRICATION

A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.

C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

D. Subframes of hinged louvers shall fit snugly into head, jamb and sill frames, but shall swing/operate freely without binding on fixed perimeter frames.

E. Provide continuous, integral weatherstripping of neoprene or other flexible plastic around fixed frame so that louver subframes shall be weathertight when in closed position.

F. Provide fixed, overlapping, vertical astragal with weatherstripping at exterior or interior face of louver (whichever is manufacturer's standard method) on one side where frames meet at center of double louvers.

G. Provide hinges and latch mechanisms that are standard, with the manufacturer fabricated from aluminum or stainless steel. Latches shall be operable from the exterior side, and shall be concealed to the maximum greatest extent.

H. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

1. Frame Type: Channel or Exterior flange, whatever is manufacturer's standard, unless otherwise indicated.

I. Include supports, anchorages, and accessories required for complete assembly.

J. Provide vertical mullions of type and at spacings indicated, but not more than is recommended by manufacturer, or 72 inches (1830 mm) o.c., whichever is less.

1. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.
2. Exterior Corners: Prefabricated corner units with mitered blades with concealed close-fitting splices.

K. Provide subsills made of same material as louvers or extended sills for recessed louvers.

L. Join frame members to each other and to fixed louver blades with fillet welds concealed from view, or threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.8 ALUMINUM FINISHES

A. Finish louvers after assembly.

B. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: White, satin finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. 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.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 089119

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. This Section includes non-load-bearing steel framing members for the following applications:

1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
2. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).

B. Related Sections include the following:

1. Division 09 Section 092900, "Gypsum Board" for wall finish over non-load bearing wall and soffit framing.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
2. Protective Coating: the manufacturer's standard rust-inhibiting coating or hot-dip galvanized, unless otherwise indicated.

2.2 STEEL FRAMING FOR FRAMED ASSEMBLIES

A. Steel Studs and Runners: ASTM C 645.

1. Minimum Base-Metal Thickness: 0.033 inch (0.84 mm).
2. Depth: As indicated on Drawings.

B. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: 0.0312 inch (0.79 mm).

C. Cold-Rolled Channel Bridging: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges.

1. Depth: 1-1/2 inches (38.1 mm).
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38.1 by 38.1 mm), 0.068-inch- (1.73-mm-) thick, galvanized steel.

D. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base Metal Thickness: 0.0312 inch (0.79 mm)
2. 7/8 inch (22.2 mm).

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

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.

1. 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.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. 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. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

B. Install studs so flanges within framing system point in same direction.

1. Space studs as follows:

a. Single-Layer Application: 16 inches (406 mm) o.c., unless otherwise indicated.

C. Install tracks (runners) 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 penetrating partitions above ceiling.

D. Direct Furring:

1. Screw to substrate as shown on the drawings.

E. 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.

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. This Section includes the following:

1. Interior gypsum board.

B. Related Sections include the following:

1. Division 07 Section "Thermal Insulation" for insulation and vapor retarders installed in assemblies that incorporate gypsum board.
2. Division 09 Section "Non-Structural Metal Framing" for metal stud framing and furring that supports gypsum board.
3. Division 09 painting Sections for primers applied to gypsum board surfaces.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are 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 PANELS, GENERAL

A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.2 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. American Gypsum Co.
b. G-P Gypsum.
c. National Gypsum Company.
d. USG Corporation.

B. Gypsum Wallboard: ASTM C 1396/C 1396M; for use at all locations except where specified otherwise.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

C. Gypsum Board, Type X: ASTM C 1396/C 1396M; for use at or with any fire-rated wall or ceiling assemblies. This includes all applications under this Contract.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

2.3 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.

2. Shapes:

a. Cornerbead.
b. L-Bead: L-shaped; exposed long flange receives joint compound.
c. J-Trim: J-shaped with ½" exposed flange that does not receive joint compound.
d. Expansion (control) joint.

2.4 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or 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 drying-type, all-purpose compound.

a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.

2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.

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 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

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 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. 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- wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- 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. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members, or provide control joints to counteract wood shrinkage.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Regular Type: Vertical surfaces, unless otherwise indicated.
2. Type X Fire Resistant Type: at fire barriers and firewalls as shown on the construction drawings.
3. Water Resistant Type: Toilet vertical walls

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), unless 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.
   b. At high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.

3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 INSTALLING 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 C 840 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. L-Bead: Use 200B

3.5 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 and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Walls: Level 3, unless otherwise noted.
2. Ceilings: Level 4, unless otherwise noted.

3.6 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. 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 093000 - 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. Ceramic tile for repair of existing wall finishes where damaged, or where required to infill wall surfaces left unfinished after removal or relocation of existing wall-mounted equipment or features, as needed to match adjacent visible, tiled wall surface(s).

B. Related Sections:

1. Section 079200, "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

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. Module Size: Actual tile size plus joint width indicated.

C. Face Size: Actual tile size, excluding spacer lugs.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

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 each type of tile and grout indicated. Include Samples of 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.
3. Metal edge strips in 6-inch (150-mm) lengths.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified 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, signed by product manufacturer.

D. Material Test Reports: For each tile-setting and -grouting product.

1.6 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.

1.7 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain tile of each color or finish from one 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 one manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:

1. Joint sealants.
2. Metal edge strips.

1.8 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.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.9 PROJECT 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 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 A108.5, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA 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.

2.2 TILE PRODUCTS

A. Wall Tile Type: Glazed Ceramic Tile.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Dal-Tile; Division of Dal-Tile International Inc. Basis of Design: "Natural Hues" Series.
b. American Marazzi Tile, Inc.
c. American Olean; Division of Dal-Tile International Inc.
d. Crossville, Inc.
e. Florida Tile Industries, Inc.

2. Composition: Ceramic clay/silica, surface-colored, glazed.
3. Face Size: 4-1/4 inches by 4-1/4 inches nominal.
4. Thickness: 1/4 inch
5. Grout Joint Width: 1/16-inch, minimum; 1/8-inch maximum.
6. Face: Plain with square or cushion edges.
7. Finish: Gloss, polished, clear glaze.
8. Tile Color and Pattern: Colors and patterns to match closely the existing adjacent tiled wall surface(s). Tile colors will be selected from manufacturer's range of samples. Tile colors may consist of multiple colors for this project, including consist of at least two (2) primary field colors.
9. Grout Color: Standard light gray; specific color as selected by Architect from manufacturer's full range of submitted samples.

10. 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:

a. External Corners for Thin-Set Mortar Installations: Surface bullnose, module size same as adjoining wall tile.
b. Internal Corners: Square.

2.3 SETTING MATERIALS

A. Dry-Set Portland cement Mortar (Thin Set): ANSI A118.1; for use at concrete and masonry wall surfaces.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Bonsal American; an Oldcastle company.
b. Laticrete International, Inc.
c. MAPEI Corporation.
d. Summitville Tiles, Inc.

B. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4; for use at plaster, gypsum wallboard and other smooth surfaces.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Bonsal American; an Oldcastle company.
b. Laticrete International, Inc.
c. MAPEI Corporation.
d. Summitville Tiles, Inc.

2. Provide prepackaged, dry-mortar mix containing dry, re-dispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.

2.4 GROUT MATERIALS

A. Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.

B. Standard Cement Grout: ANSI A118.6.

1. Basis-of-Design Product: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Bonsal American; an Oldcastle company.
b. Laticrete International, Inc.
c. MAPEI Corporation.
d. Summitville Tiles, Inc.

2.5 ELASTOMERIC SEALANTS

A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Section 079200 "Joint Sealants."

1. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
2. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.

C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.

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. DAP Inc.; 100 percent Silicone Kitchen and Bath Sealant.
b. Dow Corning Corporation; Dow Corning 786.

c. GE Silicones; a division of GE Specialty Materials; Sanitary 1700.
d. Laticrete International, Inc.; Latasil Tile & Stone Sealant.
e. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
f. Tremco Incorporated; Tremsil 600 White.

2.6 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, Portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

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. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints and that does not change color or appearance of grout.

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. Bonsal American; an Oldcastle company; Grout Sealer.
b. MAPEI Corporation; KER 004, Keraseal Penetrating Sealer for Unglazed Grout and Tile.
c. Summitville Tiles, Inc.; SL-15, Invisible Seal Penetrating Grout and Tile Sealer.

2.7 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 installed tile.

1. Verify that substrates for setting tile are firm, dry, clean, and 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 bonded mortar bed] comply with surface finish requirements in ANSI A108.5 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 thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. 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 TILE INSTALLATION

A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA 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 TCA 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 composed of tiles 6 by 6 inches.

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. 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. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
2. 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.

F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Ceramic tile: 1/16-inch minimum, 3/32-inch max.

3.4 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove Latex-Portland cement 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. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

B. 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.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.5 INTERIOR TILE INSTALLATION SCHEDULE

A. Interior Wall Installations, Concrete Masonry and Cementitious Tile Backer Board substrates:

1. Tile Installation W243/244: Thin-set mortar over gypsum board; TCNA W243; or over cementitious backer units or fiber cement underlayment, TCA W244.

a. Thin-Set Mortar: Latex-Portland cement mortar.
b. Grout: Polymer-modified sanded grout.

2. Tile Installation W202: Thin-set mortar on concrete masonry; TCA W202.

a. Thin-Set Mortar: Dry-set Portland cement mortar.
b. Grout: Sand-Portland cement or Standard sanded cement grout.

END OF SECTION 093000

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes acoustical panel ceilings installed with exposed suspension systems.

B. Related Sections: The following sections contain requirements that relate to this section:

1. Division 09 Section “Non-Structural Metal Framing” for metal stud framing at soffits adjacent to suspended acoustical ceilings.
2. Division 09 Section 092900 “Gypsum Board” for gypsum board to be applied over metal stud-framed soffits.
3. Division 26 Section “Interior Lighting Fixtures” for lighting fixtures in acoustical ceilings.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

1. Product data for each type of product specified.

2. Samples for verification purposes of each type of exposed finish required, prepared on samples of size indicated below and of same thickness and material indicated for final unit of Work. Where finishes involve normal color and texture variations, include sample sets showing full range of variations expected.

    a. 6-inch-square samples of each acoustical panel type, pattern, and color.
    b. Set of 12-inch-long samples of exposed suspension system members, including moldings, for each color and system type required.

3. Qualification data for firms and persons specified in “Quality Assurance” article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Architects (or Engineers) and Owners, and other information specified.

4. Product test reports from qualified independent testing laboratory that are based on its testing of current products for compliance of acoustical ceiling systems and components with requirements.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has successfully completed acoustical ceilings similar in material, design, and extent to those indicated for Project.

B. Single-Source Responsibility for Ceiling Units: Obtain each type of acoustical ceiling unit from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

C. Single-Source Responsibility for Suspension System: Obtain each type of suspension system from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

D. Coordination of Work: Coordinate layout and installation of acoustical ceiling units and suspension system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system components (if any), and operable partition system.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical ceiling units carefully to avoid chipping edges or damaging units in any way.

1.6 PROJECT CONDITIONS

A. Space Enclosure: Do not install interior acoustical ceilings until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:

B. Products: Subject to compliance with requirements, provide one of the following:

1. Acoustical Panel (APC-1): Mineral Base Panels – 24" by 24" by 5/8-inch thickness, square-edged; water-felted, with white painted finish and perforated and fissured Pattern, ASTM E 84, Class A fire-resistance:

    a. "Fissured" #560, USG Interiors, Inc.
    b. "Fine Fissured" #1728, Armstrong Ceilings.
    c. "Directional Fissured," #FH-157, CertainTeed/Saint Gobain

C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Non-Fire-Resistance-Rated Single-Web Steel Suspension Systems:

    a. Chicago Metallic Corporation.
    b. Armstrong World Industries, Inc.
    c. National Rolling Mills, Inc.
    d. USG Interiors, Inc.

2. Edge Moldings:

    a. Armstrong World Industries, Inc.
    b. Chicago Metallic Corporation.
    c. National Rolling Mills, Inc.
    d. USG Interiors, Inc.

2.2 ACOUSTICAL CEILING UNITS, GENERAL

A. Standard for Acoustical Ceiling Units: Provide manufacturers' standard units of configuration indicated that comply with ASTM E 1264 classifications as designated by reference to types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400 (plenum mounting in which face of test specimen is 15-3/4 inches 400 mm away from the test surface) per ASTM E 795.

B. Colors and Patterns: Provide products to match appearance characteristics indicated under each product type.

1. For acoustical ceiling units whose appearance characteristics are indicated by reference to ASTM E 1264 designations for pattern and not by limiting to the naming of one or more products or manufacturers, provide Engineer's selections from each named manufacturer's full range of standard products of type, color, pattern, and light reflectance indicated.

2.3 NON-FIRE-RESISTANCE-RATED DIRECT-HUNG SUSPENSION SYSTEMS

A. Wide-Face Single-Web Steel Suspension System: Main and cross-runners roll-formed from prepainted or electrolytic zinc-coated cold-rolled steel sheet, with pre-painted 15/16-inch-wide

flanges; other characteristics as follows:

1. Structural Classification: Intermediate-Duty System.
2. Finish: Painted, white.

2.4 MISCELLANEOUS MATERIALS

A. Concealed Acoustical Sealant: Nondrying, non-hardening, non-skinning, non-staining, non-bleeding, gunnable sealant complying with requirement specified in Division 7 Section "Joint Sealers."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and structural framing to which ceiling system attaches or abuts, with Installer present, for compliance with requirements specified in this and other sections that affect installation and anchorage of ceiling system. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.

1. Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work.

B. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less-than-half-width units at borders and comply with reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical ceiling systems to comply with installation standard referenced below, per manufacturer's instructions and CISCA "Ceiling Systems Handbook."

1. Standard for Installation of Ceiling Suspension Systems: Comply with ASTM C 636.
2. Standards for Installation of Ceiling Suspension Systems: Comply with ASTM C 636 and ASTM E 580.

B. Arrange acoustical units and orient directionally patterned units in a manner shown by reflected ceiling plans.

C. Suspend ceiling hangers from building structural members and 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 ceiling suspension system. 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 the location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
4. Do not support ceilings directly from permanent metal forms; furnish cast-in-place hanger inserts that extend through forms.
5. Do not attach hangers to steel deck tabs.
6. Do not attach hangers to steel roof deck. Attach hangers to structural members.
7. Space hangers not more than 4'-0" o.c. along each member supported directly from hangers, unless otherwise shown, and provide hangers not more than 8 inches from ends of each member.

D. Install edge moldings of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical units.

1. Sealant Bed: Apply continuous ribbon of acoustical sealant, concealed on back of vertical leg before installing moldings.
2. Screw-attach moldings to substrate at intervals not over 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to tolerance of 1/8 inch in 12'-0". Miter corners accurately and connect securely.

E. Install acoustical panels in coordination with suspension system, with edges concealed by support of suspension members. Scribe and cut panels to fit accurately at borders and at penetrations.

1. Install hold-down clips in areas indicated and in areas where required by governing regulations or for fire-resistance ratings; space as recommended by panel manufacturer, unless otherwise indicated or required.

3.4 CLEANING

A. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with manufacturer’s instructions for cleaning and touch-up of minor finish damage. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

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. Resilient base, to be applied where demolition or relocation of wall-mounted items or features has left gaps in the existing wall base.

2. Resilient molding accessories.

B. Related Sections:

1. Division 09 Section "Resilient Tile Flooring" for resilient floor tile.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

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 or more than 90 deg F.

1.6 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 RESILIENT BASE

A. Resilient Base:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Armstrong World Industries, Inc.
b. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
c. Flexco, Inc.
d. Johnsonite.
e. Roppe Corporation, USA.

B. Resilient Base Standard: ASTM F 1861.

1. Material Requirement: Type TV (vinyl, thermoplastic).
2. Manufacturing Method: Group I (solid, homogeneous).
3. Style: Cove (base with toe) for resilient flooring and Straight (flat or toeless) for carpeted areas.

C. Minimum Thickness: 0.125 inch.

D. Height: 6 inches.

E. Lengths: Cut lengths 48 inches long or coils in manufacturer's standard length.

F. Outside Corners: Job formed or preformed.

G. Inside Corners: Job formed or preformed.

H. Finish: As selected by Architect from manufacturer's full range.

I. Colors and Patterns: As selected from manufacturer's full range to match closely the color(s) of existing adjacent wall base.

2.2 RESILIENT MOLDING ACCESSORY

A. Resilient Molding Accessory:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
b. Flexco, Inc.
c. Johnsonite.
d. Roppe Corporation, USA.

B. Description: Carpet edge for glue-down applications, Nosing for resilient floor covering, Reducer strip for resilient floor covering, Joiner for tile and carpet Transition strips.

C. Material: Vinyl.

D. Colors and Patterns: As selected by Architect from full range of industry colors.

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 manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

C. Stair-Tread-Nose Filler: Two-part epoxy compound recommended by resilient tread manufacturer to fill nosing substrates that do not conform to tread contours.

D. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

E. Floor Polish: Provide protective liquid floor polish products as recommended by resilient stair tread 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.

B. 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.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Treads and Accessories: Prepare according to ASTM F 710.

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.

4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.

    a. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate. Leveling amounts in the contract are those needed to properly install products listed. There will be no increase to the contract for additional leveling agents.

D. Do not install resilient products until they are same temperature as the space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

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 practicable 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:

1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.
2. Inside Corners: Use straight pieces of maximum lengths possible.

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 carpet and resilient floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Perform the following operations immediately after completing resilient product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop 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. Floor Polish: Remove soil, visible adhesive, and surface blemishes from resilient stair treads before applying liquid floor polish.

1. Apply two coat(s).

E. Cover resilient products until Substantial Completion.

END OF SECTION 096513

SECTION 096520 - 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. Vinyl composition floor tile.

B. Related Sections:

1. Division 09 Section "Resilient Base and Accessories" for resilient base, reducer strips, and other accessories installed with resilient floor coverings.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

1. Show details of special patterns.

C. Samples for Initial Selection: For each type of floor tile indicated.

D. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.5 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 or more than 90 deg F. Store floor tiles on flat surfaces.

1.6 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

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.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

PART 2 - PRODUCTS

2.1 VINYL COMPOSITION FLOOR TILE

A. Products: Subject to compliance with requirements:

1. Armstrong World Industries, Inc.; Imperial Texture Standard Excelon
2. Congoleum Corporation; Alternatives
3. Johnsonite; Azrock

B. Tile Standard: ASTM F 1066, Class 2, through-pattern tile.

C. Wearing Surface: Smooth.

D. Thickness: 0.125 inch.

E. Size: 12 by 12 inches.

F. Colors and Patterns: As selected from manufacturer's full range of samples to match closely the adjacent resilient floor tile color and pattern. It is anticipated that multiple colors may be required on this project.

2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit floor tile and substrate conditions indicated.

C. Floor Polish: Provide protective liquid floor polish products as recommended by 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.

B. 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.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

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 substrates pass testing.

4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.

a. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75% relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate. Leveling amounts in the contract are those needed to properly install products listed. There will be no increase to the Contract for additional leveling agents and related labor.

D. Do not install floor tiles until they are same temperature as space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

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 in pattern indicated.

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 direction alternating in adjacent tiles (basket-weave pattern).

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, non-staining marking device.

G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor 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 flooring 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 protection of floor tile.

B. Perform the following operations immediately after completing floor tile installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor tile surfaces before applying liquid floor polish.

1. Apply two coat(s).

E. Cover floor tile until Substantial Completion.

END OF SECTION 096520

SECTION 096813 - TILE CARPETING

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 modular, tufted carpet tile. A small area of carpet tile is required under this project in order to patch a floor surface affected by the work. It is the Owner's desire to remove all existing carpet from the space identified in the drawings and replace the carpet throughout that space with a simple, attractive tile carpet product that is readily available from current local suppliers.

B. Related Requirements:

1. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include installation recommendations for each type of substrate.

B. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

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. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m).

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

B. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI's "CRI Carpet Installation Standard."

1.8 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.9 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, excess static discharge, loss of tuft bind strength, loss of face fiber, and delamination.
3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1. Mannington
2. Interface
3. Mohawk Industries

B. Color: As selected by Architect from available range of products; preferably in a medium to darkish gray with textured pattern. Depending on products that the supplier can furnish readily, some variations in the following criteria may be allowed:

C. Fiber Content: 100 percent nylon Type 6.

D. Fiber Type: Nylon

E. Pile Characteristic: Textured patterned loop.

F. Yarn Ply: Minimum 2

G. Density: 5,538.

H. Pile Thickness: 0.091 inches for finished carpet tile.

I. Stitches: 9.16 per inch (mm).

J. Gage: 5/64 per inch (mm).

K. Dye Method: 100% solution Dyed.

L. Primary Backing/Backcoating: Non-Woven Synthetic

M. Secondary Backing: Manufacturer's standard material.

N. Size: 18 inches by 36 inches (457 by 914 mm).

O. Applied Soil-Resistance Treatment: Manufacturer's standard material.

P. Performance Characteristics: As follows:

1. Appearance Retention Rating: Heavy traffic, 3.0 minimum according to ASTM D 7330.
2. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm.
3. Dry Breaking Strength: Not less than 100 lbf (445 N) according to ASTM D 2646.
4. Tuft Bind: Not less than 10 lbf (45 N) according to ASTM D 1335.

5. Delamination: Not less than 4 lbf/in. (18 N/mm) according to ASTM D 3936.
6. Dimensional Tolerance: Within 1/32 inch (0.8 mm) of specified size dimensions, as determined by physical measurement.
7. Dimensional Stability: 0.2 percent or less according to ISO 2551 (Aachen Test).
8. Resistance to Insects: Comply with AATCC 24.
9. Noise Reduction Coefficient (NRC): according to ASTM C 423.
10. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.
11. Colorfastness to Light: Not less than 4 after 40 AFU (AATCC fading units) according to AATCC 16, Option E.
12. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.
13. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.
14. Emissions: Provide carpet tile that complies with testing and product requirements of CRI's "Green Label Plus" program.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, non-staining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.

2. Subfloor finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" for slabs receiving carpet tile.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
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.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104, Section 7.0, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider and protrusions more than 1/32 inch (0.8 mm) unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 10, "Carpet tile Installation," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.

C. Maintain dye lot integrity. Do not mix dye lots in same area.

D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, non-staining marking device.

G. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI 104, Section 13.7 - “Post Installation.”

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

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: Galvanized metal, wood and PVC/plastic.

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 D 523.

B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. MPI 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. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

E. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

F. MPI 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.

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 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. 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 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 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 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

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.

1.7 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 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 one of the following:

1. Benjamin Moore & Co.
2. PPG Architectural Finishes, Inc.
3. Pratt & Lambert.
4. Sherwin-Williams Company (The).

B. Products: Subject to compliance with requirements, provide one of the products listed in the Exterior Painting Schedule for the paint category indicated.

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 selected by Architect from manufacturer's full range.

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. Wood: 15 percent.

C. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

D. 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.

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. 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.

E. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification 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. Paint entire exposed surface of window frames and sashes.
5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint undercoats 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.

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 EXTERIOR PAINTING SCHEDULE

A. Wood Substrates: Wood trim previously painted.

1. Latex over Latex Primer System MPI EXT 6.3L:

a. Prime Coat: Primer, latex for exterior wood, MPI #6.

1) Benjamin Moore – Insul X-Blockout Acrylic House Paint Primer
2) PPG Architectural – Killstain - WB Int/Ext Latex Primer
3) Pratt & Lambert – ProHide Gold - Exterior Latex Primer
4) Sherwin-Williams – PrepRite ProBlock - Interior/Exterior Latex Primer/Sealer

b. Intermediate Coat: Latex, exterior, matching topcoat.

c. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.

1) Benjamin Moore – Ben - 100% Acrylic Exterior Semi-Gloss Finish
2) PPG Architectural – Fortis 450 Exterior Premium 100% Acrylic Semi-Gloss
3) Pratt & Lambert – ProHide Gold - Exterior Latex Semi-Gloss
4) Sherwin-Williams – Solo - Interior/Exterior 100% Acrylic Semi-Gloss

B. PVC/Plastic Sheet and Trim Fabrication Substrates:

1. Latex System MPI EXT 6.8A:

a. Prime Coat: Primer, bonding, water based, MPI #17.

1) Benjamin Moore – Fresh Start Multi-Purpose Latex Primer
2) PPG Architectural – Gripper Interior/Exterior Primer and Sealer
3) Pratt & Lambert – ProHide Gold - Exterior Latex Primer
4) Sherwin-Williams – PrepRite ProBlock - Interior/Exterior Latex Primer/Sealer

b. Intermediate Coat: Latex, exterior, matching topcoat.

c. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.

1) Benjamin Moore – Ben - 100% Acrylic Exterior Semi-Gloss Finish
2) PPG Architectural – Fortis 450 Exterior Premium 100% Acrylic Semi-Gloss
3) Pratt & Lambert – ProHide Gold - Exterior Latex Semi-Gloss
4) Sherwin-Williams – Solo - Interior/Exterior 100% Acrylic Semi-Gloss.

C. Galvanized (Ferrous) Metal Substrates:

1. Water-based/Latex Acrylic System MPI EXT 5.3A, Semi-Gloss Finish:

a. Prime Coat: Primer, galvanized, water based, MPI #134.

1) Benjamin Moore – Ultra Spec HP Acrylic Metal Primer
2) PPG Architectural – Corrostop Ultra Metal Primer
3) Pratt & Lambert – Iron Guard White Primer
4) Sherwin-Williams – Pro-Cryl Universal Primer

b. Intermediate Coat: Latex, exterior acrylic, matching topcoat.

c. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), High-performance, MPI #311.

1) Kelly-Moore – 1298 ENVY Exterior Semi-Gloss Enamel
2) PPG Architectural – Diamond Exterior 100% Acrylic Semi-Gloss
3) Behr Paint – Premium Plus - Exterior Semi-Gloss Enamel
4) Sherwin-Williams – Duration Exterior Acrylic Coating, Semi-Gloss.

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. This Section includes surface preparation and the application of paint systems at new surfaces and features installed under this Contract, as well as touch-up at all existing surfaces impacted by construction under this Contract, on the following interior substrates:

1. Concrete masonry units (CMU).
2. Gypsum board at walls and ceiling soffits.
3. Exposed steel structure (roof deck, joists, steel beams, etc.) where exposed to view.
4. Exposed ferrous metal and insulated ductwork.

B. Related Sections include the following:

1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.
2. Division 06 Sections for shop priming and finishing carpentry specified in this Section.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: For each type of topcoat product indicated.

C. 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 in Part 2, with the proposed product highlighted.

1.4 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."

2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

1.5 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.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.6 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 percent, but not less than 1 gallon of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Sherwin-Williams Company (The).
2. Benjamin Moore & Co.
3. Bennette Paint Mfg. Co., Inc.
4. Duron, Inc.
5. ICI Paints.
6. PPG Architectural Finishes, Inc.

2.2 PAINT, GENERAL

A. 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.

B. Colors: As selected by Architect from manufacturer's full range.

2.3 BLOCK FILLERS

A. Interior/Exterior Latex Block Filler: MPI #4.

2.4 PRIMERS/SEALERS

A. Interior Latex Primer/Sealer: MPI #50.

2.5 METAL PRIMERS

A. Quick-Drying Alkyd Metal Primer: MPI #76.

B. Cementitious Galvanized-Metal Primer: MPI #26.

2.6 WOOD PRIMERS

A. Interior Latex-Based Wood Primer: MPI #39.

2.7 ALKYD PAINTS

A. Interior Alkyd (Flat): MPI #49 (Gloss Level 1).

B. Interior Alkyd (Semigloss): MPI #47 (Gloss Level 5).

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 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. Gypsum Board: 12 percent.
5. Plaster: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Beginning coating 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 plates, machined surfaces, and similar items already in place that 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.
2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and re-prime substrate with compatible primers as required to produce paint systems indicated.

D. Concrete Masonry Substrates: Remove 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. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.

F. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions.

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, removable or hinged covers, and similar hinged items to match exposed surfaces.

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.

3.4 FIELD QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:

1. Owner will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
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.

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. CMU Substrates:

1. Alkyd over Latex Sealer System: MPI INT 4.2N.

a. Prime Coat: Interior/exterior latex block filler (unless previously painted).
b. Sealer Coat: Interior latex primer/sealer.
c. Intermediate Coat: Interior alkyd matching topcoat.
d. Topcoat: Interior alkyd (semigloss).

B. Steel Substrates:

1. Alkyd System: MPI INT 5.1E.

a. Prime Coat: Alkyd anticorrosive metal primer (unless materials is supplied with a factory applied primer).
b. Intermediate Coat: Interior alkyd matching topcoat.
c. Topcoat: Interior alkyd (semigloss).

C. Galvanized-Metal Substrates:

1. Alkyd System: MPI INT 5.3C.

a. Prime Coat: Cementitious galvanized-metal primer.
b. Intermediate Coat: Interior alkyd matching topcoat.
c. Topcoat: Interior alkyd (flat).

D. Gypsum Board Substrates:

1. Alkyd over Latex Primer System: MPI INT 9.2C.

a. Prime Coat: Interior latex primer/sealer.
b. Intermediate Coat: Interior alkyd matching topcoat.
c. Topcoat: Interior alkyd (semigloss).

END OF SECTION 099123

SECTION 230100 - MECHANICAL GENERAL PROVISIONS

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. This Section forms a part of all Division(s) 21, 22 and 23 Sections.

1.2 APPLICABLE SPECIFICATIONS, CODES AND STANDARDS

A. Latest effective publications of following Specifications, regulations, standards, codes, etc., as applicable, form a part of these Specifications the same as if written fully herein and shall be followed as minimum requirements.

Codes and ordinances of local governing agencies:

AGA	American Gas Association
AHRI	Air Conditioning, Heating and Refrigeration Institute
AMCA	Air Moving and Conditioning Association
ANSI	American National Standard Institute
ASHRAE	American Society of Heating, Refrigerating and Air-conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
Hartford	Boiler Insurance Company Regulations
IEEE	Institute of Electrical and Electronics Engineers
NAFM	National Association of Fan Manufacturers
NEC 2014	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Administration
SMACNA	Sheet Metal and Air-conditioning Contractors National Association
UFAS	Uniform Federal Accessibility Standards
UL	Underwriters Laboratories, Inc.
VFSR	Virginia Fire Safety Regulations
VUSBC	Virginia Uniform Statewide Building Code, 2015 Edition

1.3 DRAWINGS

A. General arrangements of indicated piping, ductwork and equipment are diagrammatic only, do not scale. Where rearrangement is necessary, submit drawings of proposed changes for approval. Due to scale of drawings, offsets, fittings and accessories may not be indicated. Work indicated, but having details omitted, shall be provided complete to perform function intended

without extra cost. Investigate existing structural and finish conditions in building affecting plumbing, heating, ventilating and air-conditioning work, etc., and arrange work accordingly. Furnish fittings, traps, offsets, vents, valves and accessories required. Install equipment in accordance with manufacturer's recommendations and clearance requirements.

1.4 COORDINATION

A. Coordinate piping, ducts and equipment with electrical, structural and architectural plans and work in order to avoid omissions and to eliminate any interference. Report in writing discrepancies, if found, to the Engineer as soon as possible after discovery.

1.5 WORKMANSHIP

A. Workmanship shall be first class and of best quality in accordance with approved contemporary construction practices. Defective equipment and materials, or material damaged in the course of installation and tests shall be replaced or repaired in an approved manner.

1.6 CUTTING

A. Cutting shall be carefully done. Repair damage to the building, piping, wiring, or equipment as a result of cutting for installation, using skilled mechanics of trade involved.

1.7 APPROVAL OF MATERIALS, FIXTURES AND EQUIPMENT

A. See Specification Section 013300 "Submittals", for shop drawing submittal procedures. Within 30 days after award of the Contract and before any purchases are made, submit for approval a complete list of materials, fixtures and equipment proposed, together with names of manufacturers and catalog numbers for each Specification Section. Furnish other detailed information where directed. No consideration will be given to partial lists submitted from time to time. Approval of materials shall be based on manufacturer's published ratings. Materials, fixtures and equipment listed which are not in accordance with specified requirements shall be rejected. Contractor shall make resubmission of items not approved within 30 days from date of rejections. Submission shall be complete with description, ratings, dimensions and related items and any additional information required by the Owner.

B. Materials and equipment shall be new, conforming to these Specifications.

C. Two or more units of same class of equipment shall be product of single manufacturer; however, component parts of system need not be product of same manufacturer.

D. Mechanical design has given full consideration to space requirements for equipment specified. Contractor is responsible for selecting equipment that will be accommodated by this space. Equipment not conforming to space allotted shall be rejected.

E. Mechanical design has given full consideration for electrical requirements for equipment. Contractor is responsible for selecting equipment that will be accommodated by the electrical design indicated. Equipment not conforming to the electrical design provided under Division 26 is the Contractor's responsibility. All electrical changes required to accommodate the equipment provided shall be furnished and installed by the Contractor without change in Contract price or time of completion. This shall include but not be limited to wiring, conduit, circuit breakers, disconnect switches, starters and controllers.

F. Submit one copy of equipment installation manuals to the Engineer for his use.

1.8 EQUIPMENT DESIGN

A. Equipment and accessories not specifically described or identified by manufacturer's catalog numbers shall be designed in conformity with ASME, ANSI, IEEE, or other applicable technical standards, suitable for maximum working pressure and shall have neat and finished appearance.

1.9 SUPERVISION

A. The Contractor for each Section under this Division shall maintain a competent foreman on the job at all times to supervise the work and coordinate with other trades for the installation of the system. Submit foreman's qualifications, including master's trade license, to the Engineer for approval.

1.10 NOTICES AND FEES

A. Give all required notices, obtain all necessary permits (including a separate permit for the installation of refrigerant lines if required by the local "Authority Having Jurisdiction") and pay all required fees.

1.11 RECORD DRAWINGS

A. Refer to Specification Section 017839 "Project Record Documents"

1.12 OPERATION AND MAINTENANCE MANUALS

A. Refer to Specification Section 017823 "Operation and Maintenance Data"

1.13 OWNER'S TRAINING

A. Upon completion of work and at a time designated by the Owner, the services of competent persons shall be provided as required to instruct Owner's representative in operation and maintenance of systems. Training sessions shall be a combination of on-site and in-classroom

training and shall be a minimum of two 8-hour sessions. All training shall be video recorded by the Contractor and provided in DVD format. Two copies of the DVD shall be submitted to the Owner.

1.14 WARRANTY-GUARANTEE

A. Contractor shall furnish written warranty, countersigned and guaranteed by the General Contractor, stating that work executed under this Section of the Specifications shall be free from defects of materials and workmanship for a period of 12 months from date of Final Acceptance.

B. Contractor shall service the systems for 12 months from date of Substantial Completion. Such service shall include all emergency services and adjustments, except cleaning/changing of filters. Adjustments and repairs to equipment shall be made by the original equipment manufacturer (OEM). Third party service agencies are not acceptable for making repairs or adjustments to equipment during the warranty period.

C. The equipment manufacturer and Contractor shall provide a one-year material, labor and refrigerant warranty on all compressors. In addition, the manufacturer shall provide a material only warranty on all compressors for a period of 5 years total, beginning at the date of start-up of the compressor.

D. Contractor shall be responsible for all maintenance, repair and servicing of mechanical equipment during the construction period as required by the equipment manufacturers and identified in the Operation and Maintenance Manuals. This shall include all routine maintenance, such as greasing of bearings, adjustment/replacement of belts, cleaning of coils, cleaning of strainers, water treatment adjustments, calibration of controls and other routine maintenance items that may be unique to each piece of equipment. This shall also include repair and replacement of any malfunctioning or damaged parts. In addition, this shall include changing filters on a bi-weekly basis through award of Substantial Completion. Contractor shall respond within 24-hour notification by Owner or General Contract.

1.15 WELDER'S CERTIFICATIONS

A. Submit welder's certifications to the Engineer/Architect for approval.

PART 2 - PRODUCTS

2.1 STEEL PIPE FITTINGS

A. Welding fittings shall be carbon-steel buttwelding type, conforming to ASME B16.9 and B16.28. Flanges shall be carbon steel, conforming to ANSI B16.5.

B. In lieu of welding fittings, BONNEY FORGE “Weldolets”, “Sockolets” and “Threadolets” may be used for branch connections when the diameter of the branch connection does not exceed 50% of the diameter of the main.

2.2 PIPE SLEEVES, PIPE HANGERS, PIPE SUPPORTS, DUCT SUPPORTS AND FIXTURE SUPPORTS

A. Provide pipe sleeves, hangers, supports, duct supports and fixture supports. Contractor shall be responsible for proper and permanent location. Pipe and duct shall not be permitted to pass through footings, beams, or ribs, unless indicated and/or approved. All piping passing through masonry or concrete walls shall be sleeved and insulation shall run continuously through sleeve.

B. Install pipe sleeves and properly secure in place with grout where pipes pass through masonry or concrete and at all fire-rated assemblies. Pipe sleeves, except in footings, shall be sufficient diameter to provide approximately 1/4" clearance around insulation or pipe. Fill void between insulation or pipe and sleeve with mineral wool to prevent sound transmission. Pipe sleeves in footings or foundation walls shall be cast iron, 4" larger in diameter than pipe installed. Pipe sleeves in walls, floors and partitions shall be Schedule 40 steel pipe. Extend sleeves above floor at least 1", pack space around pipe with fireproof material and make watertight. Pipe penetration through below grade walls shall be sealed with modular seals selected for the type of pipe and wall penetration, “LINK SEAL” or approved equal. Where pipes pass through waterproofing membranes, provide flashing sleeves with integral flashing flanges or clamping device of 16-ounce soft-sheet copper; extend at least 8" from sleeve. Thoroughly mop flashing flanges and shields into membrane.

C. Hang horizontal overhead runs of pipe with adjustable clevis-type hangers spaced not over 10 feet apart, except space soil pipe hangers not over 6 feet apart. Provide hangers other than aforementioned, if pipe size or other features make spacing at shorter intervals necessary. Pipe hangers shall be provided within 4 feet of all changes in direction of pipe. Pipe hangers shall not be installed on pipe fittings where fitting could bear the weight of connected pipe but instead shall be installed on pipe at intervals previously specified. Chain, strap, perforated bar, or wire hanger will not be permitted. Hangers shall have short turnbuckles or approved means of adjustment, except turnbuckles may be omitted on hangers for soil or waste pipe from individual toilet rooms to main stack when space does not permit their use. Use spring-type hangers where required. Use trapeze hangers on pipes running parallel and close together. Inserts shall be cast iron or cast steel, of type to receive machine bolt in one horizontal direction and shall be installed before concrete is poured. Support vertical runs of pipe by clamps or collars spaced not over 20 feet apart or as required, except cast-iron soil pipe shall be supported at every floor. Support chromium-plated pipe where required by cast-brass supports finished to match pipe. Hangers for copper tubing shall be copper plated where in contact with tubing. Hangers, including rods and clamps, shall be hot dipped galvanized exterior to the building and in all mechanical spaces, zinc plated in all interior spaces, except as otherwise specified.

D. Hang all horizontal overhead runs of pre-insulated refrigerant pipe with a pipe shield as manufactured by EATON B-LINE, series SNAP’N SHIELD or approved equal. Hang all horizontal overhead runs of field insulated refrigerant piping with a clamp assembly attached to strut as manufactured by EATON B-LINE, series B-LINE ARMAFIX CLAMPS or approved

equal. Refrigerant pipe insulation shall be continuous through the clamp assembly. All refrigerant pipe supports shall be spaced not over 6 feet apart.

E. Refrigeration piping on roof shall be supported by support blocks manufactured by ROOF TOP BLOX model RTB-01, or approved equal. The support blocks must be designed to eliminate roof penetrations, flashings or damage to roofing membrane. Support body shall be made of recycled UV-resistant Polypropylene Copolymer. Base platform material shall be 1" thick, 25psi, type 4 closed cell structural foam to distribute and evenly cushion loads. Support top surface shall have molded in pipe organizing saddles and strut mounting cradle. The top surface shall also have screw guide indents and engineered internal screw thread gripping feature. Block must accept up to 1/2" threaded rod using side entry nut slots to allow fast top side assembly and piping height adjustments or attachment of galvanized slotted steel strut channel. For roof mounted piping provide approved pipe supports every four feet for Polyvinyl Chloride (PVC) and every six feet for Copper. Provide polycarbonate securing brackets model SCB07. Brackets shall secure support directly to the roof membrane with M-1 structural adhesive.

F. Supports for piping, ductwork and equipment shall be attached to a structural member, not bridging. Piping, ductwork and equipment shall not be attached to structural joist bridging or metal roof or floor decking. Provide additional steel supports spanning between joists or beams for hanger attachments. Additional steel supports shall be approved by the Structural Engineer.

G. In areas supported by steel beams, secure hanger rods directly to beams.

H. Support vertical lines from lowest story with base fittings set on concrete or brick pier or by hangers and supports where directed.

I. Provide galvanized steel shields or protection saddles to protect insulation at area of contact with hangers and supports. Where shields are used on pipes 1-1/2" and larger, provide insulation inserts at points of hangers and supports. Refer to Specification Section 230700 "Mechanical Insulation", for details.

J. Support and fasten fixtures and equipment in an approved manner.

K. Ductwork shall be supported in accordance with SMACNA, HVAC Duct Construction Standards, unless otherwise noted or indicated. Ductwork shall be supported using threaded rod or solid metal strap as required by SMACNA. No other materials, such as perforated metal strap, or cloth strap, are acceptable. Wire may be used to hang round duct smaller than 10"; however, solid metal strap shall be used to wrap around duct. Wire shall not be used for rectangular duct or round duct larger than 10".

2.3 PIPE PENETRATIONS THROUGH FLOORS, WALLS AND CEILINGS

A. Fit exposed pipes passing through floors, finished walls, or finished ceilings with escutcheon of chromium-plated cast-brass plates on chromium-plated pipe, nickel-plated steel plates on ferrous pipe, or copper tubing. Plates shall be large enough to completely close hole around pipes and conceal pipe sleeves and shall be round, with least dimension at least 1/2" larger than diameter of pipe and insulation. Secure plates in an approved manner.

2.4 UNIONS

A. Unions shall be installed on each side of all control valves, regulators and similar items and one side of all pieces of equipment, such as pumps, tanks, etc., so that such equipment shall be readily disconnected and removed if necessary.

2.5 DIELECTRIC CONNECTIONS

A. Dielectric connections shall be provided at all connections between ferrous and nonferrous piping or metals, except drain piping connections at drain pans for cooling coils and valves having cast-bronze adapters.

2.6 ELECTRICAL WORK FOR EQUIPMENT UNDER MECHANICAL SYSTEMS

A. All non-integrated motor controllers and starters serving equipment installed under Division 23 Sections shall be furnished under those Sections and shall be turned over to Electrical Contractor, for installation by Electrical Contractor. Controllers shall be equipped with all auxiliary contacts, poles, or devices necessary to permit interlocking and control required.

B. Fractional horsepower motors 1/2 HP and below shall be single-phase, 60 cycles, 120V; motors larger than 1/2 HP shall be 3-phase, 60 cycles, of voltages indicated on the electrical drawings and conforming to the electrical service, except where indicated otherwise. Motors shall conform to latest NEMA requirements.

C. All electrical power wiring required for equipment installed under Division 23 Sections shall be provided under Division 26 Sections with all necessary approved wiring diagrams and guidance provided under Division 23 Sections, with the exception of power wiring to Automatic Temperature Control panels which shall be provided by the Automatic Temperature Control Contractor.

D. Raceways shall be 1/2" minimum. All wiring in rooms with exposed structure or in inaccessible ceiling and walls shall be installed in conduit. Label the front face of the cover on each junction box with indelible black marker indicating the number of each circuit contained in or running through the box. In areas where exposed construction is the final finished condition and conduit and junction boxes are called out to be painted, label the inside face of the covers.

E. All control and power wiring required for temperature control system and all interlocking and accessory control wiring required for equipment installed under Division 23 Sections shall be installed by the Plumbing, Mechanical and Temperature Control Contractors. All power wiring for the temperature control system shall be fed from an emergency panel served by the emergency generator where emergency power is available on site. Accessory control wiring including, but not limited to interlock wiring for electric damper actuators (separate from DDC systems), equipment accessories for cooling towers, closed circuit coolers and remote equipment sensors shall be provided and installed by the Plumbing, Mechanical and Automatic Temperature Control Contractors.

F. Three-phase motors shall have magnetic across-the-line starters unless hereinafter indicated or required by Power Company to be otherwise. Provide overload relay in each phase or motor lead. Operation of any overload relay shall simultaneously open all phases.

G. Manual starters shall be manual single-, double-, or three-pole type designed for flush or surface mounting, with overload protection in each phase.

H. Starters for motors under automatic control shall have built-in "hand-off-auto" selector switch.

I. All starters and controls shall be NEMA rated and NEMA I enclosed where mounted inside building, except in kitchens which shall be NEMA 4X-SS. Starters and controls mounted outside or where specifically called for shall be NEMA 3R. Explosion-proof enclosures shall be used in hazardous areas and where specifically called for. Combination switch and magnetic starters shall be provided where indicated.

J. Auxiliary 120-Volt contacts shall be provided to give control and interlocking as required or as indicated.

K. Where control voltages are different from motor voltages, a control-voltage transformer shall be provided as a part of the starter.

L. The Contractor shall be responsible for coordinating with the Division 26 Contractor for providing properly sized circuit breakers to serve equipment and motors furnished which differ from that specified or indicated. This shall be further understood to include branch circuit wiring, conduit, disconnect switches, etc., in accordance with the appropriate codes and specifications. The cost of providing this increased electrical service and related work shall be included under the applicable section under which the equipment and motors are being furnished, at no additional cost to Owner.

M. The Automatic Temperature Controls Contractor shall be responsible for providing circuit breakers and power wiring and conduit from electrical panels installed under Division 26 to Automatic Temperature Controls panels. All electrical work shall be in accordance with appropriate codes and Division 26 specifications.

N. The Mechanical Contractor shall be responsible for the installation and mounting of all duct smoke detectors in new and existing ductwork. The duct smoke detector shall be furnished and provided with all fire alarm wiring under Division 28. Any and all Temperature Control wiring shall be provided under Division 23. Refer to the mechanical drawings for locations in new ductwork. Refer to the electrical drawings for locations of existing detectors to be replaced. Coordinate the installation of the detectors with the Electrical and Automatic Temperature Control Contractors.

2.7 MACHINERY ACCESSORIES

A. Provide oil-level gages, grease cups and grease-gun fittings for machinery bearings as recommended by machinery manufacturer; where these lubricating means are not easily accessible, extend to locations as directed. Furnish all grease-gun fittings of uniform type.

2.8 WALL, PARTITIONS AND CEILING ACCESS DOORS

A. The Contractor shall furnish and the General Contractor shall install prime coated steel (type 304 stainless steel, #4 satin polish finish) access doors with lock where required, style necessary for surface in which placed, sizes as indicated or required for access to equipment, valves, dampers, filters, duct smoke detectors and all other devices requiring access ACUDOR PRODUCTS, INC. model UF-5000 SCPS –prime coated (SCSS –stainless) or approved equal.

B. Access doors shall have same fire rating as ceiling, floors, walls and partitions in which installed.

2.9 AIR BALANCING DEVICES

A. Furnish any additional material or equipment, such as sheaves, belts, motors and balancing devices, required to complete and/or adjust and balance the systems as recommended by the TAB Agency at no additional cost to the Owner. Failure to provide additional means of adjusting and balancing will not relieve the Contractor of responsibility for properly adjusting and balancing the various systems as intended.

2.10 DUCT SEALANT

A. Where duct is indicated to be sealed, utilize a fire resistive, water based, indoor/outdoor, U.V. resistant, non-fibrated duct sealant, DUCTMATE EverSeal, FOSTER DUCT-FAS 32-19 or approved equal.

B. Sealant shall have a volatile organic compound (VOC) rating of 24 g/L, less water.

C. Sealant shall meet all SMACNA pressure classes up to 10” w.g. and SMACNA seal classes A, B and C.

D. Apply sealant with brush working sealant into all joints. For spiral duct, apply sealant to male end of coupling prior to fitting straight run of duct to coupling. Follow manufacturer’s instructions for all application requirements.

E. The use of duct sealing tape of any kind is unacceptable.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

A. Pipe systems shall be complete. Pipe shall be of size indicated or, where not indicated, shall be of size required to produce capacities of the equipment specified. No pipe shall be buried in floors, unless specifically indicated or approved.

B. Install runs of piping as indicated. Cut pipe accurately to measurements established at the building by the Contractor and work into place without springing or forcing. Do not cut or move any structural portions of the building without approval. Run piping above ground, parallel with lines of buildings, unless otherwise shown or specified.

C. Install piping to allow for expansion and contraction, using offsets, swing joints, expansion joints, anchors and related items as may be necessary. Make connections to coils, pumps and other equipment in such manner as to eliminate undue strains in piping and equipment and to prevent noise transmission. Provide necessary fittings and bends to avoid springing of pipes during assembly. Weld expansion loops using long-radius ells. Make changes in pipe sizes with reducing fittings.

D. Pipe outlets of vent valves, safety valves, drip pans, overflow drains, condensate drains, backflow preventers and other drain points to floor drain unless otherwise indicated. Gages, thermometers and related items shall be carefully leveled. Thoroughly clean and flush piping in presence of the Owner, as installed and before automatic vents are installed.

E. Unless otherwise indicated, connections to equipment shall be as shown by manufacturer's data. Make piping connections to equipment with unions or flanged connections arranged so that equipment can be dismantled without disturbing the piping installation. Unions shall be accessible after building is complete. Provide valves to isolate equipment for service or removal.

F. Run horizontal water piping with pitch of at least 1" in 40'-0" and arrange to drain to minimum number of low points. Equip low points with drain valves and hose nipples not smaller than 3/4". Eccentric reducing fittings or eccentric reducing couplings must be installed where indicated or as required to bring bottoms of mains in line and prevent pockets. Pitch closed loop water piping to vent at high points. Provide a manual air vent ball valve at all high points in the piping system.

G. Close pipe openings with caps or plugs during installation. Cover fixtures and equipment tightly and protect against dirt, water and chemical or mechanical injury. Carefully free interior of pipe of superfluous material as work progresses. Upon completion of work, thoroughly clean fixtures, materials and equipment and deliver in approved unblemished condition.

H. Lay pipe true to line and grade with bells up-grade so pipe will have smooth and uniform invert. Keep pipe thoroughly clean so jointing compounds will adhere. Inspect each pipe section for defects before lowering into trenches. Allow no water in trenches during pipe laying or around joints until compound has set.

I. Ream pipe after cutting and before threading and remove burrs. Make screwed joints with graphite and oil or approved graphite compound applied to threads only. Cut threads full and not more than three threads on pipe shall remain exposed. Caulking of threaded joints to stop or prevent leaks will not be permitted. Provide unions where required for disconnection. Use swing joints for branch connections to risers and mains.

J. Make copper tubing sweat joints with noncorrosive flux and lead-free solder recommended for service encountered or as indicated.

K. No joint shall be made under water. Secure watertightness and prevent damage or disturbing of joints during refilling process, or at other times after pipes have been laid and joints made. Do not walk or work over pipes except as necessary in tamping until at least 2" of covering has been placed over pipe. Uncover joints showing leaks; remake joint at Contractor's expense.

L. The Contractor may, except at unions, weld pipe 2-1/2" and larger, using welding fittings. Welding material and labor shall be in accordance with an approved procedure conforming to ASME B31.9 Building Services code. Welders shall be fully qualified by an approved Welding Bureau or locally recognized testing authority. Welding shall be electric arc welding method. Welding of pipe inside the building shall not be permitted without approved ventilation. Galvanized pipe shall have the galvanizing ground from the heat affected zone.

M. All copper pipe joints shall be made with fittings. Formed bell & spigot couplings and mechanical "T" formed joints are not acceptable.

3.2 GROUTING

A. Grout heavy equipment with Embeco pre-mixed grout. MASTER BUILDERS COMPANY. Follow manufacturer's instructions on container. Use Mix No. 1 where clearance between bedplate and foundation is 1" or less; for other clearances, use Mix No. 2. Use only where grout is confined or held under restraint.

3.3 EQUIPMENT INSTALLATION

A. Erect equipment in neat and workmanlike manner. Align, level and adjust for satisfactory operation. Install so that connecting of piping and accessories can be made readily and so that parts are easily accessible for inspection, operation, maintenance and repair. Minor deviation from indicated arrangements may be made as approved by Owner.

3.4 EQUIPMENT SUPPORTS AND FOUNDATIONS

A. Design and construct supporting structures of strength to safely withstand stresses to which they may be subjected and to distribute properly the load and impact over building areas. Conform to applicable technical societies' standards, also to codes and regulations of agencies having jurisdiction. Obtain approval before fabrication.

B. Locate supports for tanks so as to avoid undue strain on shell and interference with pipe connections to tank outlets.

C. For tanks containing tubes, check support locations for clearance to pull tubes.

D. Where saddles are indicated or specified for tank supports, use cast-iron or welded-steel saddles of curvature to fit tank.

E. Fasten wall-mounted or ceiling-hung equipment to building structures or inserts as approved.

F. Where concrete foundations or pedestals are indicated or required, use concrete mix, reinforcement where required and methods as specified under Section 033000 “Cast-In-Place Concrete”.

G. Where floor is waterproofed, construct foundation so that anchor bolts will not pierce waterproofing.

H. Finish exposed parts of concrete foundation with cement mortar. Fill voids, trowel smooth, bevel edges and corners to make neat appearance.

3.5 NOISE AND VIBRATION

A. Mechanical and electrical equipment shall operate without objectionable noise or vibration as determined by the Owner.

B. If such objectionable noise or vibration should be produced and transmitted to occupied portions of building by apparatus, piping, ducts, or other parts of mechanical and electrical work, make necessary changes and additions as approved, without extra cost to the Owner.

C. Isolators shall prevent, as far as practicable, the transmission of vibration, noise, or hum to any part of building.

D. Isolators shall suit vibration frequency to be absorbed. Provide isolator units of area and distribution to obtain proper resiliency under load and impact.

3.6 CONCRETE PADS

A. Provide at least 24" x 24" x 6" concrete pad flush with grade around fuel-oil fill and vent pipe, storm and sanitary sewer cleanouts and other pipe projections above grade.

B. Concrete shall conform to requirements of Section 033000 “Cast-In-Place Concrete”.

3.7 FLASHING

A. Provide cap flashing for roof-mounted fans, goosenecks, air intakes, vents and the like.

3.8 PROTECTION OF EQUIPMENT AND MATERIALS

A. Responsibility for care and protection of mechanical equipment rests with Contractor until Substantial Completion of the work.

B. After delivery, before and after installation, protect equipment and materials against theft, injury, the environment, or damages from all causes.

C. Protect plumbing fixtures and other equipment with enamel or glaze surfaces from damage by covering and/or coating as approved.

D. Protect equipment outlets and pipe openings with temporary plugs or caps.

E. During construction, seal off all openings into interior of equipment and ductwork with sheet metal or taped polyethylene sheathing to prevent infiltration of dust.

F. Temporary (MERV 8) filters shall be provided a minimum of every 14 days for all fans that are operated during construction and new (MERV 8 or MERV 13) filters shall be installed after all construction dirt has been removed from the building just prior to testing and balancing. Following the testing and balancing, (MERV 8 or MERV 13) filters shall be provided a minimum of every 14 days for all fans that are operated during construction. Just prior to Final Completion, all filters shall be replaced with the final (MERV 8 or MERV 13) filters. Ducts shall be inspected for dust and dirt. Contractor shall provide a signed statement to indicate that new filters for each piece of equipment were installed just before Final Completion. Construction filters shall be removed and not be used as the final set of filters. The contractor shall keep a filter replacement log that includes equipment identifications and dates of filter installation. Log shall be provided to the Engineer and Owner for review on a monthly cycle. Should the Contractor fail to comply with the filter changes as specified, the Owner may, at his discretion, hire through a separate contract the specified filter changes and withhold the cost for this work from the construction contract amount as a back charge to the Contractor.

G. Provide a spare filter (or sets of filters for equipment that require multiples) for each piece of equipment. Turn filters over to Owner with proper transmittal prior to Final Completion.

H. Equipment not designed for exterior installation (i.e., cabinet unit heaters, classroom vertical unit ventilators, duct heating coils, air handling units, boilers, pumps, etc.) shall not be delivered to the job site until a location protected from the environment is provided. Location must be approved by the Architect and Engineer prior to delivery.

I. Equipment suitable for exterior installation (i.e., condensing units, etc.) shall not be delivered to the job site until it is ready to be installed in its permanent location.

3.9 CONTRACTOR'S RESPONSIBILITY FOR MANUFACTURER'S AUTHORIZED FIELD START UP

A. The equipment manufacturer shall furnish a factory-trained and certified service technician without additional charge to start the HVAC equipment. This individual's certifications shall be submitted as a shop drawing along with the equipment and shall be reviewed and approved by the Engineer. Unit manufacturers shall maintain service capabilities no more than 100 miles from the job site.

B. The HVAC equipment to be started by the manufacturer's certified technician shall include:

1. Boilers
2. Pump packages

3. Air handling units
4. Split system air conditioning units
5. Unit Ventilators

C. The manufacturer shall furnish complete submittal wiring diagrams of the HVAC equipment as applicable for field maintenance and service.

D. Start-up sheets on all equipment shall be submitted and reviewed by the engineer. An approved copy shall be included in the final TAB report. If required, this same representative shall be made available to review the startup sheets onsite with the Engineer and Owner.

3.10 CONTRACTOR'S RESPONSIBILITY FOR TESTING, ADJUSTING AND BALANCING (TAB)

A. Provide the TAB Agency a full set of Contract Documents (drawings and technical specifications), all manufacturers' approved submittal data and copies of revised data as soon as possible.

B. Ensure that a current TAB Engineer's certification certificate is kept on file.

C. Ensure all systems have been installed and are in 100% working order before the TAB Engineer is called to the job site, including but not limited to ductwork, piping, terminals, electrical and ATC. The Contractor shall verify that each item of the Pre-TAB Checklist (see Appendix A) has been completed and shall deliver a signed copy of the Pre-TAB Checklist to the Owner's Representative and the TAB Agency attesting that the project is complete and ready for TAB work to begin.

D. Ensure that all ductwork requiring SMACNA – ADLTM duct leakage testing has been tested in the presence of the TAB Engineer and Owner's Representative and has met the referenced requirements.

E. Provide adequate access to all points of measurement and adjustment and ensure that all dampers operate freely.

F. Provide a factory representative for all major pieces of equipment as requested by the TAB Agency to assist in operation and performance verification of equipment.

G. Cooperate with the TAB Agency to help operate and adjust the control systems directly related to TAB work and provide any specialties required to make such adjustments.

H. Carefully review the drawings and Specifications for the various systems noting all facilities incorporated in the design for purposes of adjusting and balancing. Should it be deemed necessary to provide additional dampers, baffles, valves, or other devices which would aid in the required adjusting and balancing, same shall be provided by the installing contractor.

3.11 CLEANING, PAINTING AND IDENTIFICATION

A. Remove from site excess material, equipment protection, etc. Thoroughly clean piping, hangers, equipment, fixtures and trimmings and leave every part in perfect condition ready for use, painting, or insulation as required.

B. Paint exterior surfaces of equipment supports and other ferrous metal work, except that which is galvanized, with one coat of RUSTOLEUM damp-proof red primer, or approved equal.

C. Exposed piping and equipment in mechanical equipment rooms and mechanical mezzanines shall be completely color code painted under this Section. Insulated piping shall be color coded under Section 230700 "Mechanical Insulation" using colored PVC jackets matching the colors listed in this Section. Finish painting shall conform to requirements of Section 099900 "Painting". Color code shall be as follows (SHERWIN-WILLIAMS names and numbers are given for reference of colors):

Gas	Safety Yellow (SW-4084)
Heating Hot Water Supply and Return	Safety Orange (SW-4083)
Ductwork, O.A.	White (Extra White)

D. Finish painting of exposed piping, ductwork, equipment and insulation in finished spaces shall be done under Section 099900 "Painting".

E. Water piping service and flow direction shall be indicated with outdoor grade 3.2 mil thick high gloss adhesive backed vinyl labels which identify the service by name (not initials) and the flow direction by arrows. Provide labels similar to Brimar, EZ Pipe Markers with arrow banding tape wrapping the pipe 360°. Labels shall be used wherever piping is exposed, except in finished spaces, at all unit connections and at 25-foot intervals for concealed piping located above accessible ceilings. Label and arrow heights shall be proportional to pipe sizes as follows:

Insulated and Un-Insulated Pipe Size	Label Heights
Up to 1"	1"
1-1/4" to 2"	2"
2-1/2" to 4"	3"
4" and above	4"

F. In addition, all non-potable water systems shall be identified with outdoor grade 3.2 mil thick high gloss adhesive backed vinyl labels with the words, "Nonpotable- not safe for drinking". All nonpotable water outlets, such as hose bibbs at low point drains, shall be identified with 1-1/2" diameter, permanently stamped, brass tags with the words, "Nonpotable- not safe for drinking".

G. Refrigerant piping service shall be indicated with outdoor grade 3.2 mil thick high gloss adhesive backed vinyl labels which identify the service by name (not initials). Provide labels similar to Brimar, EZ Pipe Markers. Labels shall be used wherever piping is exposed, at all unit connections and at 25-foot intervals for concealed piping located above accessible ceilings. Label and arrow heights shall be 1".

H. All valves in equipment room(s) shall be identified with 1-1/2" diameter, permanently stamped, brass tags. Secure tags to valve item or wheel with brass jack chain or copper meter seals. Provide framed and mounted, under clear plastic, valve chart (8-1/2 x 11 min.), identifying valve number by system served and function.

I. Provide seals, signs and tags on fire protection equipment at designated locations per NFPA.

J. Provide color-coded identification dots affixed to the ceiling grid for equipment, access doors, terminal equipment controllers, smoke detectors, filters and valves concealed above ceilings. Provide a color-coded chart identifying type of equipment or valve. Chart shall be framed and mounted, under clear plastic and located as directed by Owner.

3.12 EQUIPMENT MARKING

A. Label all mechanical equipment, including starters, control panels, boilers, chillers, fans, VAV boxes, pumps, and air-handling units.

B. Labels shall be machine engraved, laminated, 1/8” thick, Bakelite, nameplate type. Labels shall be black faces with white letters.

C. Labels shall have 1/4" high letters.

D. Labels shall be rigidly attached using rivets or screws. Adhesive backing is not acceptable.

3.13 EQUIPMENT INVENTORY

A. Provide a complete equipment inventory for all Mechanical, Plumbing and Fire Protection equipment included in the project scope of work. Refer to Appendix B of this section for the required template. A separate form shall be provided for each new piece of equipment provided.

B. Prior to substantial completion, submit the equipment inventory forms for review. Once approved, include the forms in the operation and maintenance manual.

APPENDIX A

PRE-TAB CHECKLIST

A. GENERAL

1. All components of the HVAC system have been installed, including controls and control wiring.
2. Power wiring has been installed and energized to all motorized equipment. Also, all line voltage control wiring required has been installed.
3. All equipment has been started and run tested through all specified sequences of operation by factory-authorized representatives and all safety controls have been verified to be operational.
4. All required testing of piping and duct systems has been completed in accordance with the drawings and specifications.
5. Duct leakage testing, where required, shall be witnessed by the Owner's Representative and/or the TAB Agency.

B. HVAC WATER DISTRIBUTION SYSTEMS

1. Piping systems have been flushed thoroughly, strainers have been removed, cleaned and replaced as required. There is no evidence of plugged piping, coils, heat transfer equipment, valves, or flow measuring devices.
2. All air has been vented from the hydronic piping systems, equipment and coils.
3. Pressure reducing/regulator valves in make-up water piping have been set for the required fill pressure of each hydronic system.
4. Correct pump rotation has been verified. Pumps are not cavitating. Vibration isolators and flexible connectors have been installed where required. Vibration is not excessive with pumps operating. Pumps have been lubricated.
5. All control valves are installed and functioning properly according to the specified sequences of operation.
6. All required pressure, temperature and flow measuring devices and balancing valves have been installed. All taps and adjustment dials are accessible and adequate clearances have been provided for connection of instrument hoses and adjustment taps, dials and scales are free of paint, insulation mastic and other foreign matter.
7. System contains correct amount of water treatment chemicals and glycol where required.

C. AIR DISTRIBUTION AND VENTILATION SYSTEMS

1. All air system filters have been replaced with new filters. The air moving equipment, ductwork and air terminals are installed and connected. All air systems are unobstructed and free of debris.
2. All manual volume control dampers required are installed and properly connected to adjustment handles. All damper handles are accessible and not covered by insulation or draw bands. All automatic dampers required have been installed with linkages connected and adjusted to provide the specified sequence of operation.
3. Access doors have been installed where required to allow inspection and servicing of duct-mounted dampers, equipment and components.

4. All ductwork and connections of duct to air terminals have been checked and no visible or audible leakage exists.
5. Fans are rotating in correct direction. Fans have been lubricated. Drive pulleys are aligned and belt tension is correct. Setscrews are tight securing keys into key-ways. Fan wheels turn freely and are balanced. Belt guards are in place.
6. Vibration isolators and flexible connectors have been installed where required. With fans in operation, there is no excessive vibration of fan assemblies or ductwork.

I, _____ an authorized representative of
(Signature and Title)

_____
(Company)

attest that all items contained in the above Pre-Tab Checklist have been completed

and verified as of this date:_____.

APPENDIX B

Equipment Inventory Template

Project Name: **(Add Project Name)**

Project Address: **(Add Project Address)**

Description of Item: _____
(i.e., Air Handling Unit, Ductless Split System, etc.)

Classification:

- ☐ HVAC
- ☐ Plumbing
- ☐ Fire Protection

Building: _____

Equipment Location (Room Number): _____

Date Purchased: _____

Date Placed in Service: _____

Original Cost: _____

Life Expectancy (years): _____

Estimated Replacement Date: _____

Estimated Replacement Cost: _____

Manufacturer: _____

Model/Serial #: _____

END OF SECTION 230100

SECTION 230500 - HEATING, VENTILATING AND AIR CONDITIONING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections and Section 230100 “Mechanical General Provisions” apply to this Section.

B. Refer to Specification Sections 230900 “Automatic Temperature Controls” and Control Diagrams on drawings for additional requirements and coordination between equipment and controls.

1.2 WARRANTY-GUARANTEE

A. Contractor shall furnish written warranty, countersigned and guaranteed by the General Contractor, stating that work executed under this Section of the Specifications shall be free from defects of material and workmanship for a period of 12 months from date of Substantial Completion of the building. Refer to Section 230100 for additional warranty period responsibilities.

1.3 SUBMITTALS

A. Prior to fabrication of any ductwork, Mechanical Contractor shall prepare and submit for review and approval 1/4" scale ductwork shop drawings. Drawings shall indicate all equipment locations and double line ductwork layout. Drawings shall be coordinated with existing conditions and Architectural, Structural, and Electrical Drawings.

B. Submit manufacturer’s performance data and unit details on all products specified below or indicated on drawings.

1.4 PROTECTION OF EQUIPMENT AND MATERIAL

A. All equipment and material not specifically designed for exterior installation shall not be delivered to the job site until an indoor, dry location is available for storage. All equipment and material shall be covered and protected from dirt, debris, moisture, paint, coatings and damage of any kind. Store off the floor, in a location approved by the Owner, to prevent contact with water.

B. All air-conveying equipment and material, including but not limited unit ventilators, air handling units, split systems, diffusers and ductwork shall be kept clean as described above and all airside surfaces shall be wiped clean (metal surfaces) prior to installation. Where equipment

surfaces are subject to additional accumulation of dirt and debris, interior cleaning shall be done after the completion of ductwork installation at all unit openings.

1. Exterior surfaces of all equipment shall be cleaned at completion of construction in a manner that condition and appearance of equipment is the same as it left the factory.
2. No equipment shall be run without approval by the Engineer. Prior to granting approval, the Engineer will require the building to be broom swept clean without air bourn dust which can be pulled into the duct system. An individual area of the building may be partitioned off for temporary use of the HVAC system provided a partition is erected to separate it from the dirty areas and the air handler is adjusted to positively pressurize the conditioned area. The Contractor shall provide temporary filters for all intakes and return connections to air-conveying equipment at his own expense during the construction process in accordance with Specification Section 230100. Generally, a 2-inch MERV 8 temporary filter shall be placed over the return opening followed by two layers of blue construction filter media. The outer layer of blue media shall be changed weekly or sooner if the media is no longer blue. At all times, the filter media must be monitored for breakthrough. Maintain a filter log to record all inspections and changes. Filters shall be changed every 14 days regardless of condition. The Contractor assumes full responsibility for cleanliness of all equipment operated during the construction period and any ductwork used to convey air during construction prior to meeting Substantial Completion. If dust migrates into the duct system, it must be professionally cleaned. The Contractor shall clean all equipment to like-new condition as it appeared when it left the factory prior to substantial completion. All damages shall be repaired/replaced at the Contractor's expense.
3. Operation of the HVAC system during construction requires the safeties and duct smoke detectors to be operational to protect the building and personnel.

PART 2 - PRODUCTS

2.1 HEAT GENERATION

A. Boiler:

1. Contractor shall furnish and install full condensing boilers in accordance with the following specifications and capacities as shown on the plans. Basis of Design is LOCHINVAR "CREST". Alternates are RAYPAK "XVERS" and AERCO "BENCHMARK". NO SUBSTITUTIONS.
2. Boiler shall be natural gas fired, fully condensing, and fire tube design. The boiler shall be factory-fabricated, factory-assembled, and factory-tested, fire-tube condensing boiler with heat exchanger sealed pressure tight, built on a steel base; including insulated jacket; flue-gas vent; combustion-air intake connections; water supply, return, and condensate drain connections; and controls.
3. Heat Exchanger: The heater exchanger shall bear the ASME "H" stamp for 160 psi working pressure and shall be National Board listed. The heat exchanger shall be constructed of a fully welded 316L stainless steel and of fire tube design. Fire tube shall be of the Wave Fire Tube design and capable of transferring 30,000 to 40,000 Btu's per tube. The heat exchanger shall be designed for a single-pass water flow to limit the water

side pressure drop. There shall be no banding material, bolts, gaskets or "O" rings in the heat exchanger design. Cast iron, aluminum, or condensing copper tube boilers will not be accepted.

4. Condensate Collection Basin: Fully welded 316L stainless steel.
5. Intake Filter and Dirty Filter Switch: Boiler shall include an intake air filter with a factory installed air pressure switch. The pressure switch will alert the end user on the screen of the boiler that the intake filter is dirty and needs to be changed.
6. Pressure Vessel: The pressure vessel shall be in accordance with ASME Section IV pressure vessel code. The pressure vessel shall be designed for a single-pass water flow to limit the water side pressure drop. Pressure drop shall be no greater than 6.5 psi at 180 gpm. The pressure vessel shall contain a volume of water no less than 77 gallons.
7. Burner: Natural gas, forced draft single burner premix design with an upper and lower chamber supplied by individual combustion systems. The burner shall be high temperature stainless steel with a woven Fecralloy outer covering to provide modulating firing rates. The burner shall be capable of the stated gas train turndown without loss of combustion efficiency. The burner shall have an independent laboratory rating for Oxides of Nitrogen (NOx) to meet requirements of South Coast Air Quality Management District (SCAQMD) as compliant with Rule 1146.2.
8. Blower: Boiler shall be equipped with a pulse width modulating blower system to precisely control the fuel/air mixture to provide modulating boiler firing rates for maximum efficiency. The burner firing sequence of operation shall include pre-purge, firing, modulation, and post-purge operation.

9. Gas Train: The boiler shall be supplied with two gas valves designed with negative pressure regulation and shall be capable of the following minimum turndowns:

Model	Turndown	Minimum Input	Maximum Input
FB 1001	20:1	50,000	999,000

10. Ignition: Spark ignition with 100 percent main-valve shutoff with electronic flame supervision.

11. Casing:

    a. Jacket: Heavy gauge primed and painted steel jacket with snap-in closures.
    b. Control Compartment Enclosures: NEMA 250, Type 1A.
    c. Insulation: Minimum ½ inch thick, mineral fiber insulation surrounding the heat exchanger.
    d. Combustion-Air Connections: Inlet and vent duct collars.

12. Characteristics and Capacities:

    a. Heating Medium: Hot water.
    b. Design Water Pressure Rating: 160 psi working pressure.
    c. Safety Relief Valve Setting: 50 psig
    d. Minimum Water Flow Rate: 25 GPM

13. Trim:

a. Safety Relief Valve:

1) Size and Capacity: 50 lb.
2) Description: Fully enclosed steel spring with adjustable pressure range and positive shutoff; factory set and sealed.

b. Pressure Gage: Minimum 3-1/2 inch diameter. Gage shall have normal operating pressure about 50 percent of full range.
c. Drain Valves: Minimum NPS 3/4 or nozzle size with hose-end connection.
d. Condensate Neutralization Kit: Factory supplied condensate trap with condensate trip sensor, high capacity condensate receiver prefilled with appropriate medium.

14. Controls:

a. Refer to Division 23 Section "Instrumentation and Control for HVAC".

b. Boiler controls shall feature a standard, factory installed 8” LCD screen display with the following standard features:

1) Password Security: Boiler shall have a different password security code for the User and the Installer to access adjustable parameters.
2) Outdoor air reset: Boiler shall calculate the set point using a field installed, factory supplied outdoor sensor and an adjustable reset curve.
3) Pump exercise: Boiler shall energize any pump it controls for an adjustable time if the associated pump has been off for a time period of 24 hours.
4) Ramp delay: Boiler may be programmed to limit the firing rate based on six limits steps and six time intervals.
5) Boost function: Boiler may be programmed to automatically increase the set point a fixed number of degrees (adjustable by installer) if the setpoint has been continuously active for a set period of time (time adjustable by installer). This process will continue until the space heating demand ends.
6) PC port connection: Boiler shall have a PC port allowing the connection of PC boiler software.
7) Time clock: Boiler shall have an internal time clock with the ability to time and date stamp lock-out codes and maintain records of runtime.
8) Service reminder: Boiler shall have the ability to display a yellow colored service notification screen based upon months of installation, hours of operation, and number of boiler cycles. All notifications are adjustable by the installer.
9) Anti-cycling control: Boiler shall have the ability to set a time delay after a heating demand is satisfied allowing the boiler to block a new call for heat. The boiler will display an anti-cycling blocking on the screen until the time has elapsed or the water temperature drops below the anti-cycling differential parameter. The anti-cycling control parameter is adjustable by the installer.
10) Night setback: Boiler shall be programmed to reduce the space heating temperature set point during a certain time of the day.
11) Freeze protection: Boiler shall turn on the boiler and system pumps when the boiler water temperature falls below 45 degrees. When the boiler water temperature falls below 37 degrees the boiler will automatically turn on.

Boiler and pumps shall turn off when the boiler water temperature rises above 43 degrees.

12) BMS integration with 0-10V DC input: The Control shall allow an option to Enable and control set point temperature or control firing rate by sending the boiler a 0-10V input signal.
13) Data logging: Boiler shall have non-volatile data logging memory including last 10 lockouts, hours running and ignition attempts and should be able to view on boiler screen.

c. The boiler shall have a built in Cascade controller to sequence and rotate lead boiler to ensure equal runtime while maintaining modulation of up to 8 boilers of different btu inputs without utilization of an external controller. The factory-installed internal cascade controller shall include:

1) Lead lag:
2) Efficiency optimization: The Control module shall allow multiple boilers to fire at minimum firing rate in lieu of Lead/Lag.
3) Front end loading:
4) Rotation of lead boiler: The Control module shall change the lead boiler every hour for the first 24 hours after initializing the Cascade. Following that, the leader will be changed once every 24 hours.

d. Boiler operating controls shall include the following devices and features:

1) Set-Point Adjust: Set points shall be adjustable
2) Operating Pressure Control: Factory wired and mounted to cycle burner.
3) Sequence of Operation: Electric, factory-fabricated and factory-installed panel to control burner firing rate to reset supply-water temperature inversely with outside-air temperature. At 35 deg F outside-air temperature, set supply-water temperature at 140 deg F; at 60 deg F outside-air temperature, set supply-water temperature at 100 deg F.

e. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation.

1) High Temperature Limit: Automatic and manual reset stops burner if operating conditions rise above maximum boiler design temperature. Limit switch to be manually reset on the control interface.
2) Low-Water Cutoff Switch: Electronic probe shall prevent burner operation on low water. Cutoff switch shall be manually reset on the control interface.
3) Blocked Inlet Safety Switch: Manual-reset pressure switch field mounted on boiler combustion-air inlet.
4) High and Low Gas Pressure Switches: Pressure switches shall prevent burner operation on low or high gas pressure. Pressure switches to be manually reset on the control interface.
5) Blocked Drain Switch: Blocked drain switch shall prevent burner operation when tripped. Switch to be manually reset on the control interface.
6) Low air pressure switch: Pressure switches shall prevent burner operation on low air pressure. Switch to be manually reset on the control interface.

7) Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for any lockout conditions.

f. Building Automation System Interface: Factory installed BACnet MSTP gateway interface to enable building automation system to monitor, control, and display boiler status and alarms.

15. Electrical Power:

a. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections.
b. Single-Point Field Power Connection: Factory-installed and factory-wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.

16. Source Quality Control:

a. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.
b. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.

2.2 REFRIGERATION (NOT USED)

2.3 AIR HANDLING EQUIPMENT

A. Exhaust Fans:

1. Fans shall be size, type, and have capacity as indicated on drawings. GREENHECK, LOREN COOK, or approved equal.
2. Fans shall be licensed to bear the AMCA Air and Sound Certified Ratings Seal. Fan air performance ratings shall be based on tests conducted in an AMCA registered laboratory for AMCA 210 air performance testing. The Test Standard used shall be ANSI/AMCA Standard 210-85, ANSI/ASHRAE Standard 51-1985, “Laboratory Methods of Testing Fans for Rating.” All sizes must be tested, calculations to other sizes not acceptable. Fan sound performance shall be based on tests conducted in an AMCA registered laboratory for AMCA 300 Sound Performance Testing. The Test Standard used shall be AMCA 300 “Reverberant Room Method for Sound Testing of Fans.” All sizes must be tested, calculations to other sizes are not acceptable. Air or Sound Test results are to be included in submittal.
3. Each fan shall bear a permanently affixed manufacturer's nameplate containing the model number and individual serial number for future identification.
4. Provide solid-state speed controls for all direct drive fans.
5. All fans shall be statically and dynamically balanced.
6. Install as required for quiet operation.

7. Motor shall be a DC electronic commutation type motor (ECM) specifically designed for fan applications unless otherwise noted.

8. Downblast power roof ventilators:

    a. Downblast power roof ventilators shall have aluminum housing, backward-inclined aluminum fan wheel, gravity-type back-draft dampers, bird screen, aluminum curb cap with pre-punched mounting holes, aluminum rub ring, motor isolated shock mounts, corrosion-resistant fasteners, lifting lugs and factory-wired NEMA 1 toggle disconnect switch. Provide direct or belt drive as indicated. Shaft shall be mounted in ball bearing pillow blocks. Bearings shall have grease fittings. Provide adjustable pulley and motor plate on belt drive units.

9. Ceiling Exhaust Fans:

    a. Wheel: Forward curved centrifugal wheel constructed of calcium carbonate filled polypropylene. Statically and dynamically balanced in accordance with AMCA Standard 204-05.
    b. Motors: Motor enclosures shall be open drip proof (ODP), opening in the frame body and or end brackets. Motors shall be permanently lubricated sleeve bearing type to match with the fan load and furnished at the specific voltage and phase. Motor shall be mounted on vibration isolators and be accessible for maintenance. Motors shall be compatible for use with speed controls and provided with thermal overload protection.
    c. Housing: Constructed of heavy gauge galvanized steel. Interior shall be lined with 0.5 inches of acoustical insulation.
    d. Aluminum Backdraft Damper: Prevents air from entering back into the building when fan is off and eliminates rattling or unwanted backdrafts.
    e. Outlet. Outlet shall be square type field rotatable from horizontal to vertical discharge. Duct collar shall include an aluminum backdraft damper. Provide square to round transition where required by duct connection.
    f. Grille: Aluminum white enamel finish fully adjustable for multiple installation conditions.
    g. Access Panel: Once installed shall have easy access to internal components.
    h. Disconnect Switch: NEMA 1 indoor application no water. (Single pole rocker switch assembly). Positive electrical shut-off. Wired from fan motor to junction box installed within motor compartment. Access for wiring shall be external.
    i. Provide solid-state speed controls for all direct drive fans.
    j. Speed Controls: Controls the fan's output. Fan can be adjusted to 60 percent of full speed.
    k. Curb Cap Model RCC-7, Curb Cap: weathertight aluminum construction, integral birdscreen, built in curb cap sized to fit existing or new roof curb. Contractor shall field verify existing curb dimension where indicated.

10. Inline Exhaust Fans:

    a. Cabinet in-line type shall have forward curved centrifugal fan wheel, and galvanized fan housing and factory-wired disconnect switch. Provide vibration isolators as specified elsewhere in this section.

b. The fan housing shall be of the square design, constructed of heavy gauge galvanized steel and shall include duct mounting collars.
c. Fan construction shall include two removable access panels located perpendicular to the motor mounting panel. The access panels must be sufficient size to permit easy access to all interior components.

2.4 UNITARY EQUIPMENT

A. Vertical Classroom Unit Ventilators (UV's):

1. Quality Assurance:

a. Unit shall be approved and listed by Intertek ETL Listed (ETL US/C). Unit shall be factory assembled, pre-charged, pre-wired, tested and ready to operate. Unit performance shall be certified in accordance with the Air Conditioning Heating and Refrigeration Institute (AHRI) Standard 390-2003 for Single Package Vertical Units (SPVU). Unit efficiency shall be specified in terms of EER and IPLV.
b. Unit and refrigeration system shall comply with applicable requirements in ASHRAE 62.1-2010, Section 5 – "Systems and Equipment" and Section 7 – "Construction and Startup."
c. Unit Energy Efficiency Ratio (EER) shall be equal to or greater that prescribed by ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Buildings.
d. Unit shall be safety certified by ETL and be ETL US and ETL Canada listed. Unit nameplate shall include the Intertek/ETL US and Canada label.

2. Submittals

a. Product Data: Literature shall be provided that indicates dimensions, operating and shipping weights, capacities, ratings, fan performance, filter information, factory supplied accessories, electrical characteristics, and connection requirements. Installation, Operation and Maintenance manual with startup requirements shall be available in an electronic format.
b. Shop Drawings: Unit drawings shall be provided that indicate assembly, unit dimensions, construction details, clearances, and connection details. Wiring diagram shall be provided with details for both power and control systems and differentiate between factory installed and field installed wiring.

3. Delivery, Storage and Handling:

a. Unit shall be packaged and plastic wrapped prior to shipment to prevent damage during transport and thereafter while in storage awaiting installation.
b. Follow Installation, Operation and Maintenance manual instructions for rigging, moving, and unloading the unit at its final location.
c. Unit shall be handled carefully to avoid damage to components, enclosures and finish.

d. Unit shall be stored in a clean, dry place protected from weather and construction traffic in accordance with Installation, Operation and Maintenance manual instructions.
e. Unit shall be shipped on pallet constructed from galvanized sheet metal.

4. Warranty:

a. Refer to specification section 230100 for warranty information.

5. Manufacturer:

a. The design for vertical unit ventilators are based on BARD - Model “ITEC”. Alternatively, provide units manufactured by MARVAIR or approved equipment by Newport News Public School.

6. Construction:

a. Constructed of 20 gauge prepainted steel consisting of galvanized steel in accordance with ASTM A653, modified acrylic primer .25 MIL., top coat paint shall be .75 MIL. Exterior panels shall be double wall construction. No screws exposed on the exterior panels. Front panel is hinged and lockable for filter service and access to primary functional electrical controls. Front and side panels are easily removable for separation of top and bottom sections. Back of unit to be painted in neutral color to reduce visibility from outdoors. Color options shall be selected by the owner.
b. No fiberglass shall not be utilized in any part of the unit.
c. Exterior panels shall be easily removable, and cabinet shall consist of two modules with refrigeration system contained in top section. The two sections can easily be separated by removing 4 bolts. Fork slots allow for the top module to be lifted and separated. Each module shall pass thru a standard door frame, and/or into standard sized elevator doors without tilting or laying equipment down.
d. Unit shall be suitable for right or left hand corner installation without modification. No clearance is required. All service access shall be thru the front of the unit. Side supply grilles on accessory ductless plenum box shall include adjustable opposed damper to balance airflow for each side discharge, and in corner installations.
e. Refer to paragraph 2.9.C for condensate overflow switch.

7. Refrigeration System:

a. Compressor: Shall be 2-stage hermetically sealed scroll compressor with internal unloading providing 2 stages of heating and cooling operation.

The refrigeration circuit shall be equipped with factory installed high and low pressure control with resettable lockout circuit. An internal overload shall protect the compressor against excessive motor temperatures and currents. Refrigerant shall be R-410A.

Refrigeration circuit will include thermostatic expansion valve (TXV), liquid line filter dryer, refrigerant service ports and discharge muffler. Service gauge access ports shall be available without removing any panels.

The compressor shall be mounted on double floating isolation mounting system and fitted with a factory installed sound attenuation jacket.

8. Fans and Motors:

   a. The indoor blower motor shall be electronically commutated variable speed (ECM), factory programmed to produce rated air flow from 0 to .5 inch WC of external static pressure. The motor is to be self-adjusting to provide proper rated air flow at high static pressures without user adjustment or wiring changes by the user. The motor shall be pre-programmed for 20-second ramp up and 60-second down rate for quiet, smooth starting and stopping. PSC motor shall not be acceptable. Motor shall automatically adjust to proper blower speeds matching compressor operation: ultra-quiet ventilation only, stage 1 cooling, stage 2 cooling, stage 1 heating, and stage 2 heating, continuous circulation ventilation mode.
   b. The condenser fan motor shall be electronically commutated motor-ECM. Motor shall provide variable speed operation, ball bearing, 6kV surge protection and matched to a sweep designed low noise composite condenser fan. Factory integrated modulating low ambient control shall be provided as standard.

9. Filter:

   a. Filters shall be 2" thick radial pleated disposable cotton and synthetic blend filters. Minimum Efficiency Reporting Value of MERV 8 per ASHRAE standard 52.2.
   b. Filters shall be accessible thru front of unit. Filter size shall be readily available commercial sizes.

10. Control Panel:

    a. Control Panel: Located at top of the unit behind the front door for direct, centrally located access to controller, controller transformer (24V), and all necessary contactors, relays, and circuit breakers.
    b. Wiring: Individually numbered terminal blocks and wires are to match job-specific wiring diagrams. All electrical wires in the control panel shall run in an enclosed trough. Wiring outside the control panel shall be contained in a protective sleeve. All controls and wiring shall be factory installed in a clean, organized arrangement.
    c. Plug and Socket Wiring: Supply Fan deck, compressor and damper assembly shall include plugs local to the assembly allowing for quick wiring disconnect when the component requires removal for service.

11. Ventilation – Energy Recovery Ventilator:

    a. Energy Recovery module shall consist of 2 rotary wheels in an insulated cassette frame complete with silica gel media, seals, drive motor, belt, intake and exhaust blowers. Dampers will be used to prevent infiltration during off periods.

b. Intake and exhaust blower motors shall be fractional horsepower ECM motors providing either 3 selectable cfm levels (450, 375, 300) or modulating cfm based on 0-10 v modulating signal from a control source. Intake and exhaust airflow shall be independently adjustable providing for positive pressurization of the space.

c. The ERV thermal performance shall be certified by the manufacturer in accordance with ASHRAE Standard 84, Method of Testing Air-to Air Heat Exchangers and ARI Standard 1060, Rating for Air-to-Air Energy Recovery Ventilation Equipment Cassettes, and shall be listed in the ARI Certified Products. Unit complies with ANSI/ASHRAE Standard 62.1 Ventilation for Acceptable Air Quality.

d. The energy transfer media shall include enthalpy transfer utilizing silica gel desiccant of other media with high latent transfer capability. All components of the ERV assembly shall be warranted (parts only) 5 years from date of installation.

12. Dehumidification and Hot Gas Reheat:

a. The dehumidification option shall incorporate an independent reheat coil in the supply air stream in addition to the standard evaporator coil, 2-way valve, solid state dehumidification circuit board, and independent dehumidification terminal on 24-volt control terminal strip. The coil shall be mounted after the evaporator coil, and sized to nominally match the sensible cooling capacity. The solid state dehumidification circuit shall monitor the 24-volt terminal for a call for dehumidification. If the humidity rises above a set point the dehumidification terminal is energized the dehumidification control board shall:

1) Monitor unit operation. If dry bulb temperature is satisfied and no call for cooling or heating is active, the unit will energize in cooling mode and also energize the 2-way valve so that reheat coil becomes active.
2) If the unit is operating in cooling or heating at the time of the call for dehumidification, the unit shall remain in cooling or heating until comfort temperature set point is satisfied. If the high humidity call is still active, the unit will then operate in dehumidification mode.
3) If a call for cooling or heating is received during dehumidification operation, the solid state board will de-energize the 2-way valve. The unit shall operate in active cooling or heating mode until dry bulb set point is satisfied.
4) If the humidity set point control is satisfied and no call for cooling or heating is active the unit will cycle off.

13. Accessories:

a. Disconnect Switch: Located on the control panel, disconnect switch shall be sized for the full load amperage of the unit. This shall allow the unit to be disconnected from the power supply prior to any maintenance. In the off position, the switch shall have the ability to be locked out.
b. Duct Flange: Factory fitted discharge duct flange allowing for easy field connection of a discharge duct to top of the unit.
c. Wall Sleeve: Unit manufacturer shall furnish a properly sized wall plenum for intake and exhaust condenser air, including intake and exhaust air path for

ventilation air. Sleeve shall be telescoping for adjustable width, and adjustable 3" height from 31" to 34" AAF, or higher with factory supplied subbase. Wall sleeve shall be constructed of galvanized steel, coated with an epoxy primer and baked on polyester enamel paint. Wall sleeve casing shall be capable of withstanding 500-hour salt spray exposure per ASTM B117.

d. Outdoor Louver: Exterior Louver shall be a product of the SPVU manufacturer that has been designed, tested and rated to meet the manufacturers rated performance standards as a system. Louver shall be available in 1" or 2" depths. Louvers shall be constructed of mill finish aluminum and powder coated to color. Factory standards colors include: dark bronze, medium bronze, or aluminum. Color chart shall be provided for additional color options if required.
e. Top Discharge Plenum Box: Supply air discharge plenum box shall be provided by manufacturer. Exterior finish shall match unit, lined with sound deadening insulation. Insulation shall be covered with acoustically designed perforated galvanized metal. Plenum box shall include 1 or 2 front discharge diffusers, and may include one diffuser on each side of the plenum box.
f. Cabinet Extension: Three-sided assembly manufactured of prepainted steel matching unit color, to fill space from top of unit to ceiling. For use on ducted or plenum box installations. Contractor to field verify sizes required.
g. Riser Platform: Riser platform manufactured of prepainted steel, matching unit color, is used to elevate unit wall sleeve penetration if required to match existing wall opening height, existing windowsill height or other custom height requirement. Contractor to field verify sizes required.
h. Side Trim Kit: Side trim pieces, 6" in depth manufactured of prepainted steel matching unit color shall be used to trim out space between rear sides of unit and exterior wall. Contractor to field verify sizes required.

B. Split System Air Conditioning Units (SSAC-1/OU-1, SSAC-2/OU-2)

1. The air conditioning manufacturer shall design and furnish all equipment in the quantity and configuration shown on the project plans and specifications. The system shall be provided by ABOVE-AIR TECHNOLOGIES or equal and listed by Intertek to conform with UL Std 1995.
2. The system shall be factory tested prior to shipment. Testing shall include, but shall not be limited to: system and component operational and functional testing; electrical "HiPot" insulation test; refrigerant and water piping circuit pressuring testing per UL 1995 Safety Standard for Heating and Cooling Equipment.
3. The cabinet chassis and access panels shall be constructed of heavy gauge galvanized steel. Cabinet access panels shall rest in recessed pockets designed for minimum air leakage. The cabinet and access panels shall be lined with 2 lb./ft2 high density sound and thermal insulation conforming to NFPA 90A and 90B.
4. The unit shall be serviceable within the ceiling through large side access panels.
5. The electrical system shall conform to National Electric Code (NEC) requirements according to UL 1995. The control circuit shall be a 24 VAC low voltage circuit. The electrical system shall include, but not be limited to the following factory installed items: 24 VAC control transformer; terminal connections; grounding lug; overload protection; and starter/ contactors for blower motor, and compressor. Split systems shall require separate main power supplies to the evaporator and condensing unit sections. The evaporator and condensing unit sections shall be electrically interlocked by a field wired

24 volt control signal. The system shall be provided with a factory installed float type condensate pan overflow safety switch. The circuit shall be designed to shut down all system water producing operations in the event of an overflow condition.

6. The system air distribution shall be configured for a draw-through air pattern to provide even air distribution and maximum coil performance.
7. The blower shall be the belt-driven centrifugal type, double width double inlet (DWDI), and statically and dynamically balanced to a minimum vibration level. The shaft shall be heavy duty steel with self-aligning ball bearings sized for an average 100,000 hours of service life. The blower motor shall be mounted on an adjustable base. Belts shall be sized for 200% of the motor horsepower rating. Motors shall have overload protection and a minimum NEMA service factor of 1.15.
8. The filter(s) shall be 2 inch thick and rated for 30% dust spot efficiency (based on ASHRAE 52.1). The filter(s) shall be serviceable through a side access panel without shutting down the system.
9. The DX evaporator coil shall be constructed of copper tubes and aluminum fins. The system shall be designed for a draw-through air pattern for maximum heat transfer. Coil end-plates shall be hot dipped galvanized. The evaporator coil shall be mounted in an insulated stainless steel condensate drain pan.
10. Compressor(s) shall be high efficiency, low sound power scroll type. Each compressor shall be mounted on vibration isolators. Each compressor shall be complete with reversible positive oil pump, charging and service ports, internal spring isolation, and discharge gas vibration eliminator.
11. Each refrigeration circuit shall be pre-piped with type “L” refrigerant copper tubing. The refrigeration system shall include, but not be limited to: expansion valve with external equalizer; sight glass; refrigerant filter-drier; service valves and high & low refrigerant pressure safety switches.
12. Each refrigerant circuit shall be provided with a factory installed hot gas (discharge) bypass valve. The hot gas bypass valve shall be designed to supply hot gas to evaporator inlet as required to provide coil freeze-protection and capacity modulation under low load conditions.
13. The system shall be a split configuration with indoor ceiling mounted dx evaporator and outdoor dx air cooled propeller fan remote condenser. The compressor shall be located in the indoor evaporator section. The condenser shall be sized for full heat of rejection at 95°F ambient and be capable of operation to 15 °F low ambient air temperature. The system shall be refrigerant charged and run tested at the factory prior to shipment. The evaporator and condenser sections shall ship separately with a dry-nitrogen charge ready for field refrigerant charging.

14. The system shall be provided with a MC- 2000™ advanced microprocessor based temperature and humidity controller with alarms.

    a. 4x20 Character Liquid Crystal Alpha-numerical Display
    b. User Configurable
    c. Run-Time Hours
    d. Current Unit Mode Status
    e. Alarm Status
    f. Digital & Analog Inputs / Outputs
    g. Temperature Anticipation
    h. Remote Stop / Start Contact

i. Summary Alarm Contact
j. Automatic or Manual (selectable) Restart After Power Loss
k. Sequential Load After Restart
l. Recovery Delay
m. Compressor Short Cycle Timers
n. Cold Start Time Delay
o. Security Password Access
p. Self-Diagnostics
q. Service Mode

15. The control system shall display current unit functions and room status (if applicable):

    a. Current Dry Bulb Temp Set Point
    b. Current Relative Humidity Set Point
    c. System ON/OFF
    d. Cooling
    e. Heating
    f. Dehumidifying
    g. Reheating
    h. Actual Room DB Temperature
    i. Actual Room Relative Humidity

16. Alarm conditions activate an audible and visual indicator plus close a summary alarm dry contact connection. The control system shall alert to the following alarm conditions (if applicable):

    a. High Temperature
    b. High Head Press
    c. Low Temperature
    d. Smoke Detection
    e. High Humidity
    f. Firestat
    g. Low Humidity
    h. Leak Detection
    i. Sensor Failure
    j. Summary Failure
    k. Loss of Power
    l. Loss of Air Flow
    m. Dirty Filter

17. The control system shall be capable of both digital (ON/OFF) and analog (proportional integral, PI) input and output control. Unit shall be provided with BACnet interface capability.
18. Condensate pump shall be factory provided for field installation. The condensate pump shall be provided with dual internal float switches: one for pump operation initiation and the other for the pump reservoir overflow safety.
19. Each horizontal ceiling mounted section shall be provided with spring vibration hanging isolators sized for the total distributive eight of the unit. Refer to Section 2.8 for further information.

C. Split System Air Conditioning Unit with Hot Water Heat (AHU-1/CU-1, AHU-2/CU-2):

1. The air conditioning manufacturer shall design and furnish all equipment in the quantity and configuration shown on the project plans and specifications. The system shall be provided by ABOVE-AIR TECHNOLOGIES or equal and listed by Intertek to conform with UL Std 1995.
2. The system shall be factory tested prior to shipment. Testing shall include, but shall not be limited to: system and component operational and functional testing; electrical "HiPot" insulation test; refrigerant and water piping circuit pressuring testing per UL 1995 Safety Standard for Heating and Cooling Equipment.
3. The cabinet chassis and access panels shall be constructed of heavy gauge galvanized steel. Cabinet access panels shall rest in recessed pockets designed for minimum air leakage. The cabinet and access panels shall be lined with 2 lb./ft2 high density sound and thermal insulation conforming to NFPA 90A and 90B.
4. The unit shall be serviceable through large side access panels.
5. The electrical system shall conform to National Electric Code (NEC) requirements according to UL 1995. The control circuit shall be a 24 VAC low voltage circuit. The electrical system shall include, but not be limited to the following factory installed items: 24 VAC control transformer; terminal connections; grounding lug; overload protection; and starter/ contactors for blower motor, and compressor. Split systems shall require separate main power supplies to the evaporator and condensing unit sections. The evaporator and condensing unit sections shall be electrically interlocked by a field wired 24 volt control signal. The system shall be provided with a factory installed float type condensate pan overflow safety switch. The circuit shall be designed to shut down all system water producing operations in the event of an overflow condition.
6. The system air distribution shall be configured for a draw-through air pattern to provide even air distribution and maximum coil performance.
7. The blower shall be the belt-driven centrifugal type, double width double inlet (DWDI), and statically and dynamically balanced to a minimum vibration level. The shaft shall be heavy duty steel with self-aligning ball bearings sized for an average 100,000 hours of service life. The blower motor shall be mounted on an adjustable base. Belts shall be sized for 200% of the motor horsepower rating. Motors shall have overload protection and a minimum NEMA service factor of 1.15.
8. The filter(s) shall be 2 inch thick and rated for 30% dust spot efficiency (based on ASHRAE 52.1). The filter(s) shall be serviceable through a side access panel without shutting down the system.
9. The DX evaporator coil shall be constructed of copper tubes and aluminum fins. The system shall be designed for a draw-through air pattern for maximum heat transfer. Coil end-plates shall be hot dipped galvanized. The evaporator coil shall be mounted in an insulated stainless steel condensate drain pan.
10. Compressor(s) shall be high efficiency, low sound power scroll type. Each compressor shall be mounted on vibration isolators. Each compressor shall be complete with reversible positive oil pump, charging and service ports, internal spring isolation, and discharge gas vibration eliminator.
11. Each refrigeration circuit shall be pre-piped with type "L" refrigerant copper tubing. The refrigeration system shall include, but not be limited to: expansion valve with external equalizer; sight glass; refrigerant filter-drier; service valves and high & low refrigerant pressure safety switches.

12. Each refrigerant circuit shall be provided with a factory installed hot gas (discharge) bypass valve. The hot gas bypass valve shall be designed to supply hot gas to evaporator inlet as required to provide coil freeze-protection and capacity modulation under low load conditions.
13. The system shall be a split configuration with indoor vertical floor mounted dx evaporator and outdoor dx air cooled propeller fan remote condenser. The compressor shall be located in the indoor evaporator section. The condenser shall be sized for full heat of rejection at 95°F ambient and be capable of operation to 15 °F low ambient air temperature. The system shall be refrigerant charged and run tested at the factory prior to shipment. The evaporator and condenser sections shall ship separately with a dry-nitrogen charge ready for field refrigerant charging.

14. The system shall be provided with a MC- 2000™ advanced microprocessor based temperature and humidity controller with alarms.

    a. 4x20 Character Liquid Crystal Alpha-numerical Display
    b. User Configurable
    c. Run-Time Hours
    d. Current Unit Mode Status
    e. Alarm Status
    f. Digital & Analog Inputs / Outputs
    g. Temperature Anticipation
    h. Remote Stop / Start Contact
    i. Summary Alarm Contact
    j. Automatic or Manual (selectable) Restart After Power Loss
    k. Sequential Load After Restart
    l. Recovery Delay
    m. Compressor Short Cycle Timers
    n. Cold Start Time Delay
    o. Security Password Access
    p. Self-Diagnostics
    q. Service Mode

15. The control system shall display current unit functions and room status (if applicable):

    a. Current Dry Bulb Temp Set Point
    b. Current Relative Humidity Set Point
    c. System ON/OFF
    d. Cooling
    e. Heating
    f. Dehumidifying
    g. Reheating
    h. Actual Room DB Temperature
    i. Actual Room Relative Humidity

16. Alarm conditions activate an audible and visual indicator plus close a summary alarm dry contact connection. The control system shall alert to the following alarm conditions (if applicable):

a. High Temperature
b. High Head Press
c. Low Temperature
d. Smoke Detection
e. High Humidity
f. Firestat
g. Low Humidity
h. Leak Detection
i. Sensor Failure
j. Summary Failure
k. Loss of Power
l. Loss of Air Flow
m. Dirty Filter

17. The control system shall be capable of both digital (ON/OFF) and analog (proportional integral, PI) input and output control. Unit shall be provided with BACnet interface capability.
18. A Hot Water Heating system shall be factory provided. The hot water heating system shall be complete a factory installed aluminum fin, copper tube hot water coil and field installed 2-way motorized hot water control valve. Hot water shall be provided by a remote source at the specified flow rate and temperature.
19. Each indoor unit shall be provided with a set of quantity four (4”x4”x7/8”) Rubber/Cork Anti-Vibration Pad vibration mounting isolators.

D. 4-Way Ceiling Cassette Unit (2’x2’)(IU-1/OU-3):

1. General: Units shall be size, type, and have capacity as indicated. Provide units manufactured by DAIKIN, or approved equal. Indoor unit model FFQ shall be a ceiling cassette fan coil unit, operable with R-410A refrigerant, equipped with an electronic expansion valve, for installation into the ceiling cavity equipped with an air panel grill B4FQ.
2. It shall be a four-way air distribution type, white (RAL9010), impact resistant with a washable decoration panel. The supply air is distributed via motorized louvers which can be horizontally and vertically adjusted from 0° to 90°. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with remote control BRC1E72 and BRC7E830. The indoor units sound pressure shall range from 29 dB(A) to 34 dB(A) at low speed measured at 5 feet below the unit.
3. The system must be installed by a factory trained contractor/dealer. The bidders shall be required to submit training certification proof with bid documents. The mechanical contractor bids with complete knowledge of the HVAC system requirements.
4. Performance: Each unit’s performance is based on nominal operating conditions:

5. Indoor Unit:

   a. The Daikin indoor unit FFQ shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal

protector, flare connections, condensate drain pan, condensate drain pump, condensate safety shutoff and alarm, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.

b. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
c. Both refrigerant lines shall be insulated from the outdoor unit.
d. Return air shall be through the concentric panel, which includes a resin net mold resistant filter.
e. The indoor units shall be equipped with a condensate pan and condensate pump. The condensate pump provides up to 21" of lift and has a built in safety shutoff and alarm.
f. The indoor units shall be equipped with a return air thermistor.
g. All electrical components are reached through the decoration panel, which reduces the required side service access.
h. The indoor unit will be separately powered with 208~230V/1-phase/60Hz.
i. The voltage range will be 253 volts maximum and 187 volts minimum.

6. Unit Cabinet:

a. The cabinet shall be space saving and shall be located into the ceiling.
b. Three auto-swing positions shall be available to choose, which include standard, draft prevention and ceiling stain prevention.
c. The airflow of the unit shall have the ability to shut down one or two sides allowing for simpler corner installation.
d. Fresh air intake shall be possible by way of direct duct installation to the side of the indoor unit cabinet.
e. A branch duct knockout shall exist for branch ducting supply air.
f. The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.

7. Fan:

a. The fan shall be direct-drive turbo fan type with statically and dynamically balanced impeller with high and low fan speeds available.
b. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range from 0.06 to 0.12 HP.
c. The airflow rate shall be available in high and low settings.
d. The fan motor shall be thermally protected.

8. Filter:

a. The return air shall be filtered by means of a washable long-life filter with mildew proof resin.

9. Coil:

a. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.

b. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
c. The coil shall be a 2-row cross fin copper evaporator coil with 17 FPI design completely factory tested.
d. The refrigerant connections shall be flare connections and the condensate will be 1 -1/32 inch outside diameter PVC.
e. A condensate pan shall be located under the coil.
f. A condensate pump with a 21 inch lift shall be located below the coil in the condensate pan with a built in safety alarm.

10. Electrical:

a. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
b. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
c. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

11. Control:

a. The unit shall have controls provided by manufacturer to perform input functions necessary to operate the system.
b. The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.
c. The unit shall be compatible with a Daikin intelligent Touch advanced multi-zone controller or an intelligent Manager III customizable BMS. Consult with manufacturer prior to applying controls.

12. Outdoor Unit:

The outdoor unit shall be specifically matched to the corresponding indoor unit size. The outdoor unit shall be complete factory assembled and pre-wired with all necessary electronic and refrigerant controls. The outdoor shall be controlled by a microprocessor and dedicated EEV's shall be provided for capacity control during part load of the indoor unit.

a. Unit Cabinet:

1. The outdoor unit shall be completely weatherproof and corrosion resistant. The unit shall be constructed from rust-proofed mild steel panels coated with a baked enamel finish.
2. The outdoor unit will come furnished with four (4) mounting feet, mounted across the base pan, to allow bolting to a cement pad or optionally supplied mounting bracket.

b. Fan:

1. The fan shall be a direct drive, propeller type fan.
2. The motor shall be inverter driven, permanently lubricated type bearings, inherent.

3. A fan guard is provided on the outdoor unit to prevent contact with fan operation.
4. Airflow shall be horizontal discharge.

c. Coil:

1. The outdoor coil shall be nonferrous construction with corrugated fin tube.
2. The fins are to be covered with an anti-corrosion acrylic resin and hydrophilic film type E1, rated for up to 1000 hours salt spray.
3. Refrigerant flow from the condenser will be controlled via a metering device.

d. Compressor:

1. The outdoor compressor shall be a patented, variable speed Daikin swing inverter-driven compressor. The one piece action reduces noise, extends life, boasts higher efficiency and reduces energy consumption.
2. The outdoor unit shall have an accumulator and four-way reversing valve.
3. PVE Refrigerant Oil shall be used to provide improved lubrication & better chemical stability, and no hydrolysis, leading to higher product reliability.
4. The compressor shall have an internal thermal overload.
5. The outdoor unit can operate with a maximum vertical height difference of 65-5/8 feet and overall maximum length of 98-1/2 feet without any oil traps or additional components.

e. Electrical:

1. The electrical power requirement is 208-230 volt, 1-phase, and 60 Hz power.
2. The voltage range limitations shall be a minimum of 187 volts and a maximum of 253 volts.

2.5 TERMINAL EQUIPMENT

A. Electric Cabinet Unit Heater: (CUH-A & B)

1. Units shall be size, type, and have capacity as indicated. Provide units manufactured by MARKEL, or approved equal.
2. Cabinet: The cabinet shall be constructed of heavy-duty 16-gauge zinc-coated steel. The cabinet shall be finished with a durable powder coated beige paint. The front cover shall be removable for easy installation and service of all internal components. The grille configuration shall be convertible to any airflow configuration by removal of four fasteners. The cabinet shall be designed for floor, wall, or ceiling mounting.

3. Elements: Elements shall be all steel tubes with highest quality nickel-chromium resistance wire embedded in compacted efficient dielectric to ensure proper heat transfer. Steel helical fins shall be machine crimped and brazed to tube for effective transfer of heat.
4. Motor and Blower Assembly: Motor and blower shall be direct drive and resiliently mounted on a rigid heavy-gauge steel frame for quiet operation and long life. All motors shall have built-in overload protection and shall be lifetime lubricated. The motor shall be vented and mounted in the airstream to provide maximum cooling of the motor.
5. Limit Controls: The heater shall utilize two safety limits built into the controls to automatically shut off the heater if safe operating temperatures are exceeded. The primary limit shall be a capillary type, which senses the heat along the full length of the elements. The secondary limit shall be a manual reset thermal device. All heaters shall have a built-in fan purge to dissipate residual heat from elements on heater shutdown.
6. Controls: Heater shall have high/low heat and fan rocker switch. These controls shall be factory wired and tamper resistant and adjustable through front of louver assembly.

B. Unit Heaters (UH-A):

1. Unit shall be size, type, and have capacity as indicated. Provide units manufactured by MARKEL, or approved equal.
2. Unit shall be complete, including casing, electric heating coil, fans, fan motor, built-in disconnect switch, integral thermostat filters, and baked-enamel cabinet in color selected by Architect.
3. Construction: Heavy 18 Gauge welded steel cabinet with powder coated finish and control compartment housing a master terminal board with a hinged and latched access door, simplifying wiring, installation & maintenance.
4. Heating Element: Copper clad steel sheath element with continuously brazed steel fins formed to allow side draw through air flow.
5. Motor and Blower Assembly: Totally enclosed, 1-speed, 1-phase, permanently lubricated, thermally protected motors with unit bearings. Motor shall be mounted with rubber insulators to minimize vibration & noise. Fan over-ride purges unit of residual heat at shutdown.
6. Louver Assembly: Louvers are individually adjustable for directional control of air flow up to 15° from straight horizontal.
7. Installation: Unit Heater shall be mounted for horizontal discharge.

C. Hot Water Duct Mounted Heating Coil (DHC-A Thru F):

1. Provide duct heating coil as manufactured by GREENHECK, YORK, or approved equal.
2. General: Coil shall be designed with aluminum plate fins and copper tubes. Fins shall have collars drawn, belled and firmly bonded to the tubes by means of mechanical expansion of the tubes. Coil shall have airflow arrow and nameplate attached to coil casing. Capacities, pressure drops, and selection procedures shall be certified in accordance with ARI Standard 410.
3. Hot Water Coil: A double serpentine coil, with 1/2" OD tubes. Coil shall have a supply header to ensure distribution of hot water to each tube of coil. Coil shall be proof tested at a minimum of 300 psig and leak tested to 200 psig air pressure under water. Working pressure shall be 200 psig at 220°F.
4. Coil Casing: Coil casing shall be manufactured with galvanized steel.

5. Water Coil Tubes: Tubes shall be 12" OD, .016" thick copper tubes.

D. Electric Duct Mounted Heating Coil (DHC-G & H):

1. Provide duct heating coil as manufactured by GREENHECK, YORK, or approved equal.
2. General: Assembly shall be listed to UL standard 1996 and approved for installation with zero clearance to combustibles. Heater shall bear UL and CSA labels.
3. Heaters shall be made of N60 or 80/20 nickel/chromium resistance wire with ends terminated by means of staking and Heliarc welding to machine screws.
4. Control cabinet cover shall be held in place with hinges and tool-release latches or door-interlocking type disconnect switch handle when provided. Two latches shall be employed when cover is 48 inches wide or greater. Control panel shall provide means of safety disconnect and overcurrent protection.
5. Over-temperature protection: Duct heater shall be supplied with primary automatically resetting and secondary manually reset thermal cut-out devices. These devices must function independently to prohibit the heater's operation if either one is activated. A disconnecting magnetic contractor circuit is required. All safety components must be serviceable through the control cabinet access panel without the need to remove the heater from the duct.
6. Unit installation shall meet or exceed all applicable federal, state local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

E. Electric Wall Heaters (EWH-A)

1. Units shall be size, type, and have capacity as indicated. MARKEL, TRANE CO., QMARK, or approved equal.
2. Units shall be complete, including casing, 16-gauge steel bar grille, electric heating coil, fan, and permanently lubricated motor. Provide with built-in and factory-wired disconnect switch and integral thermostat.
3. Color of enclosure shall be selected by the Architect.

2.6 HVAC PIPING AND SPECIALTIES

A. PIPING

1. Water, refrigerant, and HVAC drain piping shall be provided as specified below. Where options of different materials are given for the same service, contractor shall select materials and use them uniformly throughout the system. Contractor shall submit experience with all of the materials and joining methods specified.

2. Hot water piping:

a. Above ground

1) Type L copper (2 inch and under)
2) Schedule 40 black steel (2 inch and under)
3) Schedule 40 black steel (2-1/2 inch and over)

b. Threaded steel Piping

1) Schedule 40 black steel (2 inch and under)

3. Condensate drain piping:

a. Above ground (within building and plenum rated ceiling)

1) Type L copper

b. Above ground (exterior to building)

1) Schedule 40 PVC

4. Refrigerant piping:

a. Above ground

1) Copper Type ACR

5. Gas Piping:

a. Within building:

1) Schedule 40 black steel - screw fabricated (2 inch and under)
2) Schedule 40 black steel – welded (2-1/2 inch and over)

6. Drain piping in mechanical equipment rooms:

a. Above ground

1) Type L copper

7. Type L copper pipe shall conform to ASTM B42, and be assembled with wrought-copper soldering fittings using 95-5 solder as specified herein.
8. Schedule 40 PVC pipe shall be assembled in strict accordance with manufacturer's instructions. Solvent cement shall conform to ASTM D2564.
9. Schedule 40 black steel pipe shall be fabricated by welding using Schedule 40 steel welding fittings conforming to ASTM A53.
10. ACR tubing shall be nitrogen-filled assembled with wrought-copper soldering fittings using silver solder.
11. Piping shall be run concealed, except where no ceiling is provided. Coordinate installation of piping with other disciplines. Locate all piping tight against structure where possible. No piping shall be installed below mechanical equipment, or within mechanical or electrical equipment clearance requirements.

B. Pressurized Expansion Tanks:

1. Tanks shall be ASME Code construction for 125 psi service, of sizes indicated. Tanks shall be pre-charged bladder type. BELL & GOSSETT Series "B-LA," or equal by TACO.

a. Expansion tanks are ASME rated pre-charged bladder-type pressure vessels designed to absorb the expansion forces of heating/cooling system water while maintaining proper system pressurization under varying operating conditions.
b. Tank shall have a heavy-duty bladder to contain system water to prevent tank corrosion and water logging problems.
c. Maximum working pressure shall be 125 PSI and maximum operating temperature shall be 240ºF.
d. System connections shall be forged steel. Tank shell shall be carbon steel
e. Bladder shall be heavy duty butyl rubber
f. Tank shall be designed and constructed per ASME Section VIII, Division.
g. Tanks shall be complete with system and drain connections, air charging valve connection, and lifting ring.
h. Volume of tank indicated is acceptance volume.

C. Pressure Relief and Reducing Valves

1. Provide relief and reducing valves with fast fill feature. Construction shall be cast iron with brass seats and brass strainer. BELL & GOSSETT, or approved equal.

D. Air Eliminator and Dirt Separator:

1. Furnish and install a coalescing type air eliminator and dirt separator on the hot water system, SPIROVENT Model VDN-400 or equal. All combination units shall be fabricated steel, rated for 150 psig working pressure with entering velocities not to exceed 4 feet per second at specified GPM.
2. Units shall include an internal bundle filling the entire vessel to suppress turbulence and provide high efficiency. The bundle must consist of a copper core tube with continuous wound copper medium permanently affixed to the core.
3. A separate copper medium is to be wound completely around and permanently affixed to the internal element. Each eliminator shall have a separate venting chamber to prevent system contaminants from harming the float and venting valve operation.
4. At the top of the venting chamber shall be an integral full port float actuated brass venting mechanism.
5. Units shall include a valved side tap to flush floating dirt or liquids and for quick bleeding of large amounts of air during system fill or refill.
6. Separator shall have the vessel extended below the pipe connections an equal distance for dirt separation.
7. Air Eliminators shall be capable of removing 100% of the free air, 100% of the entrained air, and up to 99.6% of the dissolved air in the system fluid. Dirt separation shall be at least 80% of all particles 30 micron and larger within 100 passes.
8. Separator shall include a removable flanged lower head to facilitate removal of assembly for inspection or cleaning.

E. Thermometers

1. Thermometers shall be provided as indicated. WEKSLER INSTRUMENT, Type “AF.”
2. Thermometers in pipelines shall be separable socket 5" dial bi-metal insertion type, with scale suitable for temperature range of medium being measured. Thermometers shall be

located to facilitate reading from floor. Angle-type shall be used where necessary to facilitate reading. Install in thermal well in flow of fluid.

3. Thermometer range shall be 0-150°F for chilled water and 30-240°F for hot water.

F. Pressure Gauges

1. Pressure gages shall be provided on suction and discharge line of each pump and where indicated. WEKSLER INSTRUMENT, model AA-14-2.
2. Gages shall be bourdon spring type with 4-1/2" dial set in polypropylene case. Gauges shall be equipped with brass tee-handle shut-off cocks. Gauges shall have required range of 0-100 psig and not in more than 2 psi graduations.

G. Test Stations – Pressure/Temperature (PT):

1. Install a 1/4" NPT fitting (Test Plug) of solid brass with brass chain at indicated locations. Test plug shall be capable of receiving either a pressure or temperature probe 1/8" o.d. Dual seal core shall be neoprene for temperature to 200°F and shall be rated zero leakage from vacuum to 1,000 psig. PETERSON EQUIPMENT COMPANY, SISCO, or approved equal.
2. One Master Test Kit shall be provided to the Owner. Kit shall contain one 2-1/2" pressure gage of suitable range, one Gage Adapter 1/8" o.d. probe, and one 5" stem pocket testing thermometer 0° to 220°F.

H. Valves:

1. Valves 2" size and under shall be bronze with soldered ends, rough bodies, and finish trim. Valves 2-1/2" size and over shall be iron-body, bronze-mounted with flanged ends, except where specifically indicated. Valves on cold or chilled piping shall have extended shafts to match the pipe insulation thickness to prevent condensation. Catalog numbers indicated below are NIBCO. Valves with equivalent characteristics by APOLLO, or MILWAUKEE are acceptable.

Size	Pipe Material	Globe	Check	Ball/Butterfly
2" and under	Copper	S-235	S-413-Y	S-585-70-66NS
2-1/2" and over	Copper	F718-B	F918-B	LC-2000
2-1/2" and over	Steel	F718-B	F918-B	LC-2000

2. Check valves in pump discharge lines shall be NIBCO F-910 “silent check valve,”. Valves with equivalent characteristics by APOLLO, or MILWAUKEE are acceptable.
3. Balancing valves 2" and smaller shall be NIBCO S-585-70-66NS. Balancing valves 2-1/2" and larger shall be butterfly valves as specified below. Valves shall be complete with memory stops. Valves on cold or chilled piping shall have extended shafts to match the pipe insulation thickness to prevent condensation. Valves with equivalent characteristics by APOLLO, or MILWAUKEE are acceptable.
4. Butterfly valves used for balancing purposes shall be cast iron, lug type and suitable for dead-end service, 200 psig, bubble-tight shutoff, and 250°F service. Disc shall be aluminum bronze with 416 stainless-steel extended shaft and copper or brass bushings. Seat shall be EPDM. Provide lever actuators with ten positions with memory stops.

Valves on cold or chilled piping shall have extended shafts to match the pipe insulation thickness to prevent condensation. NIBCO LC-2000, or approved equal. Valves 6" and above shall be provided with gear operators. Valves with equivalent characteristics by APOLLO, or MILWAUKEE are acceptable.

5. Pressure Relief Valves:

   a. Provide ASME-rated bronze body, direct spring-loaded, diaphragm-type, lever-operated relief valve with factory-set discharge pressure. Valve body shall have threaded connections and be designed for a working pressure of 150 psi. Fluid shall not discharge into spring chamber.
   b. Provide relief valves on low pressure side of pressure reducing valves where indicated.
   c. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity.

I. Chemical Shot Filter Feeder:

1. Provide one feeder for condenser water system NEPTUNE, WALCO.
2. Tanks shall be ASME Code construction for 125 psi service, 5-gallon chemical shot feeder.
3. Feeder shall include funnel, legs and isolation valves.
4. Provide with (2) 20 micron filter bag for immediate use and one for replacement.

J. Y-Strainers:

1. Strainers shall be self-cleaning “Y” type, of same size as pipe in which it is installed. Provide METRAFLEX, Model LPD or equal.
2. Provide valved blow-off outlet with hose connection and cap on each strainer. Blow-off connections shall be at bottom of strainer and shall be of size equal to ½ the pipe up to a maximum of 2".
3. Provide 30 mesh micron screens.

K. Base Mounted End Suction Circulating Pumps (P-1 & 2):

1. Pumps shall be size, type, have capacity and arrangement as indicated, designed for service encountered. BELL & GOSSETT, or equal by TACO, PATTERSON or ARMSTRONG.

2. End suction pumps shall be bronze fitted, cast-iron case. Pumps shall be base-mounted, single stage, end suction design.

   a. Pump volute shall be made of cast iron with integrally cast pedestal support. The impeller shall be cast bronze, enclosed type, statically and hydraulically balanced. Impeller shall be keyed to the shaft and secured by a hex head impeller nut and washer.
   b. Pumps shall be provided with a single inside unbalanced mechanical shaft seal for leakless operation. A suitable arrangement shall be provided to furnish a portion of the pumped liquid to lubricate and cool the seal faces.

c. Pump shall be rated for a minimum of 175 psi working pressure. Casings shall be provided with tapped and plugged holes for priming, vent, and drain.
d. Pump bearing housing shall have heavy duty re-greaseable ball bearings.
e. Baseplate shall be channel steel, sufficiently rigid to support the pump and driving motor.
f. A flexible-type coupler, capable of absorbing torsional vibration, shall be employed between the pump and motor, and it shall be equipped with a suitable coupling guard as required. Contractor to level and grout each unit according to manufacturer's instructions.
g. The motor shall be NEMA specifications and shall be the size, voltage and enclosure called for on the plans. Motor shall be suitable for use with variable frequency drive. Pump and motor shall be factory aligned, and shall be realigned by contractor after installation.
h. Each pump shall be factory tested. It shall then be thoroughly cleaned and painted with at least one coat of high grade machinery enamel prior to shipment.
i. Each pump shall be checked by the contractor and regulated for proper differential pressure, voltage and amperage draw. This data shall be noted on a permanent tag or label and fastened to the pump for owner's reference.

3. Pumps shall be non-overloading over entire impeller curve within service factor of motor. Pumps shall be sized for a maximum discharge velocity of 16 FPS and a maximum suction velocity of 12 FPS.
4. Provide suction diffusers matched to pump and system piping for end suction pumps.

L. Suction Diffusers:

1. Contractor shall furnish and install a suction diffuser on the suction side of pumps as indicated on the drawings. Suction diffuser shall be as manufactured by BELL & GOSSETT or approved equal. Suction diffusers shall meet sizes and characteristics as specified in the following and as scheduled.
2. Units shall consist of an angle type body with internal straightening vanes that run the full length of the diffuser and a combination diffuser/strainer/orifice cylinder with 3/16" diameter openings for pump protection. The orifice cylinder shall be equipped with a disposable bronze fine 16-mesh strainer, which shall be removed after system start-up. Orifice cylinder shall be designed to withstand pressure differential equal to pump shutoff head and 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 a connection point where a field fabricated support foot can be attached to carry weight of suction piping.
3. Diffuser manufacturer shall be responsible for any reduction in pump performance or damage due to high pressure drops, internal failures of components or harmonic oscillations caused by the diffuser.

M. Vertical Inline Circulating Pumps (P-3 and P-4):

1. Pumps shall be size, type, have capacity and arrangement as indicated, designed for service encountered. BELL & GOSSETT, or equal by TACO, WILO or ARMSTRONG.

2. Vertical Inline Pumps shall be split-coupled in-line, single-stage design, for installation in a vertical position motor up, capable of being serviced without disturbing piping connections.

    a. Pump volute shall be of Class 30 cast iron. It shall be designed with a base ring matching an ANSI 125# flange for pump support. The impeller shall be of cast bronze, enclosed type, balanced to Hydraulic Institute Standards (ANSI/HI 9.6.4.5-2000, figure 9.6.4.15B). The allowable residual imbalance shall conform to ANSI grade 6.3, keyed to the stainless steel shaft and secured by a locking capscrew. The pump shaft shall be guided by a carbon graphite lower throttle bushing.
    b. The combination motor bracket and volute coverplate shall be a one-piece unit to ensure concentric alignment of the motor to the pump casing.
    c. The liquid cavity shall have a tapped flush line with manual valve to remove air from the seal chamber for fast initial start-up. The mechanical seal shall have a compact Rotating Unitized Seal Head design with EPR elastomer bellows and a positive metal-to-metal drive system to reduce the torsional stress on the bellows. The bellows shall be pressure supported without creases or folds for long life.
    d. The spacer coupling shall be of high tensile aluminum, split to allow the servicing of the seal without disturbing the pump or motor. The motor bracket shall contain a carbon steel coupler guard conforming to both ANSI B15.1-2000 and OSHA 1910.219 standards for safety.
    e. Pumps shall be rated for continuous operation at a minimum of 175 psi working pressure and 250ºF. The volute shall have gauge tappings at the suction, and discharge nozzles and vent and drain tappings at the top and bottom.
    f. Motor shall be TEFC energy efficient EPACT complying to NEMA or IEC specifications and shall be the size, voltage and enclosure called for on the plans. It shall have heavy-duty grease-lubricated ball bearings, completely adequate for the maximum load for which the pump is designed.
    g. Each pump shall be factory tested per Hydraulic Institute standards. It shall then be thoroughly cleaned and painted with at least one coat of high-grade machinery enamel prior to shipment.
    h. Provide with liquid tight conduits suitable for outdoor installations.
    i. Each pump shall be checked by the contractor and regulated for proper differential pressure, voltage and amperage draw. This data shall be noted on a permanent tag or label and fastened to the pump for owner's reference.

3. Pumps shall be non-overloading over entire impeller curve within service factor of motor. Pumps shall be sized for a maximum discharge velocity of 16 FPS and a maximum suction velocity of 12 FPS.

2.7 AIR DISTRIBUTION

A. Ductwork

1. Provide all ducts, plenums, connections, dampers, and related items required to form a complete system as indicated on drawings and specified herein.
2. All ductwork shall be sheet metal.

3. Sheet-metal ducts shall be fabricated from G60 galvanized-steel sheets, 304 stainless steel, or 3003 aluminum, and shall be of gauges called for and as detailed in 2005 SMACNA Manual, HVAC Duct Construction Standards (Metal and Flexible). All constant volume ductwork shall be 1" w.g. pressure class construction and shall be single-wall rectangular or round.

4. Duct sealing requirements shall be Class A for all ductwork except for the following which may be Class B:

    a. Exhaust in conditioned spaces
    b. Supply duct <2" w.g. operating pressure in conditioned spaces
    c. Return duct in conditioned spaces

5. All companies being considered as potential suppliers of duct and fitting components shall submit drawings and dimension data for approval. These submittals will serve as a basis for acceptance or rejection of product.

    a. All fittings furnished for use on a project must be identical to the approved submittal data.
    b. Any fittings rejected by the project engineer shall be replaced with fittings equal to the original approved submittals. All expenses incurred in the replacement of fittings that do not conform to these requirements shall be the responsibility of the installing contractor.

6. Rectangular low velocity ductwork shall be constructed from galvanized steel sheets of lock form quality per ASTM A653 with a G60 zinc coating (0.60 oz/ft^2), unless otherwise shown on the contract documents. Sheets shall be free of pits, blisters, slivers, and un-galvanized spots.
7. Insulated-flexible acoustical air ducts shall be FLEXMASTER USA TYPE 1M, THERMAFLEX Type M-KE, or approved equal, suitable for up to 10" w.g. positive pressure and rated velocity of 5500 FPM. Flexible ductwork shall meet NFPA 90A standards, conform to UL standard 181, and be ETL listed Class 1 air duct. Flexible duct shall have a flame spread of less than 25 and smoke developed of less than 50. Flexible ductwork shall be fabricated with a polyethylene or chlorinated polyethylene inner film, wrapped in 2" thick with a thermal conductance of R-6 fiberglass insulation, with an outer reinforced metallized vapor barrier. The inner film shall be supported by a corrosion resistant galvanized steel helix formed and mechanically locked to the polyethylene fabric. The inside bend radius shall be ½ x inside diameter in all sizes. Flexible branch ductwork to diffusers shall be limited to maximum length of 5 feet long and maximum velocity of 600 feet per minute. Flexible duct connections at variable air volume terminals shall be a maximum of 3 feet long. Contractor to provide proper flex duct size to ensure velocity limit is not exceeded. Support flexible ducts a minimum of every 4 feet. Supports shall not compress or constrict the flexible duct. Refer to the diffuser installation details on the drawings.
8. Provide flexible connections of fiberglass between ducts and air-handling unit connections, fan coil units, and exhaust fans. Connector shall be constructed using double lock gripping fingers at metal to fabric contact. Connector shall be rated airtight and watertight up to 10" w.g. positive to 10" w.g. negative pressure. Provide flexible connections, not less than 4 inches wide, constructed of approved fireproof, waterproof,

non-asbestos, glass fabric, at the inlet and outlet connection of each fan unit, securely fastened to the unit and to the ductwork by a 24 gauge galvanized steel band provided with tightening screws. There shall be no metal-to-metal contact at flexible connections. There shall be no stretching of the flexible material at flexible connections. The connection shall be UL listed, to meet NFPA 90A and 90B requirements and the following applications:

Indoor: Neoprene coated glass fabric, minimum 30 oz./sq.yd., DUCTMATE "PROFLES™" or approved equal.

Outdoor: U.V. resistant Hypalon coated glass fabric, minimum 24 oz./sq.yd. DUCTMATE "PROflex™" or approved equal.

9. Fabricate ductwork with airtight joints, presenting smooth surface on inside, neatly finished on outside; construct with curves and bends to aid in easy flow of air. Unless otherwise indicated, make inside radius of curves and bends at least width of ducts. Where square elbows have to be used, provide double wall turning vanes in all elbows. Deflecting vanes shall be double wall blades, fit into side rails, and screw or rivet to duct elbow in field. Blades and side strips shall be small or large double vanes as detailed in SMACNA Duct Manual. DUCTMATE "PROrail™" or approved equal.
10. Construct, brace, and support ducts and air chambers in a manner that they will neither sag nor vibrate to any perceptible extent when fans are operating at maximum speed or capacity.
11. Provide sandwich type or square framed access doors for service temperature and pressure required, where indicated and where not indicated, in locations and of sizes which will afford easy access to multi-blade dampers, smoke detectors, fire dampers, and other equipment and devices requiring inspection and servicing. Access doors shall be installed to avoid lights, piping, conduit, ceiling grid, etc., to provide unobstructed access. Access doors shall be installed on the underside of the ductwork. Access doors shall be a minimum of 24" x 18" where possible. Access doors in all factory fabricated ductwork shall be factory installed and sizes and locations shall be identified on the ductwork shop drawing submittal. In non-accessible ceilings, provide access doors in ceiling. DUCTMATE or approved equal.
12. Connect ductwork to intake and discharge louvers, dampers, and other work installed in various trades requiring sheet-metal connections.
13. Make sheet-metal connections to masonry work airtight and watertight in approved manner.
14. Provide opposed-blade dampers for control of air volume and for balancing system, where indicated or required. Dampers shall be of sheet metal at least one gauge heavier than duct and reinforced; shall be installed in an accessible location. Provide indicating quadrant and locking device for adjusting and locking dampers in position. Provide extended shafts on all volume dampers greater than the thickness of the insulation to provide free movement of damper positioner. Stiffen duct at damper location, install damper in manner to prevent rattling.
15. Provide remote cable operated volume damper for control of air volume and for balancing system as manufactured by UNITED ENERTECH CORPORTATION, model BO-RI or approved equal. The damper shall be constructed of galvanized steel. The inner wire of the casing shall be stainless steel with tensile strength of 260,000 lbs. For application where the diffuser or grille is installed in hard ceiling below 16'-0" AFF, the adjustable controller shall be installed in diffuser or grille face, model BO-150. Otherwise provide 50' cable and locate adjustable controller concealed in wall with 3-3/4" cover plate, model BO-702.

16. Provide square to round transition fittings with balancing damper at all round-duct take-offs to supply diffusers and registers.
17. Provide access doors in building walls and ceilings where damper quadrants are concealed in shafts or above non-accessible ceilings.
18. Duct sizes are inside free area. Increase duct sizes as required.
19. Ductwork and accessories shall not be delivered to the job site until just prior to erection and must be stored in an approved manner.
20. All ductwork shall be internally cleaned by vacuuming prior to installation.
21. All ductwork open ends shall be sealed with polyethylene and duct tape during construction after hanging.

B. Grilles, Registers and Diffusers:

1. Refer to drawings for types, material, models, finishes as manufactured by PRICE, TITUS, METALAIRE, or approved equal. Air devices shall have performance characteristics (throw, noise, and pressure drop) equal to air devices scheduled on the drawings. This information shall be provided with the submittal.
2. Grille and register frames and louvers shall be one-piece construction.
3. Paint interior surfaces of ducts behind grilles and registers with flat black enamel.

2.8 VIBRATION ISOLATION

A. Vibration Isolators:

1. Mechanical equipment indicated below shall be isolated from the structure by resilient vibration and noise isolators. Equipment to be isolated includes unit heaters, horizontal split system, exhaust fans……. Minimum deflection shall be 1".

    a. Hangers shall be pre-compressed and locked at the rated deflection by means of a resilient upstop to keep the equipment at a fixed elevation during installation. The hangers shall be designed with a release mechanism to free the spring after the installation is complete and the hanger is subjected to its full load. Deflection shall be clearly indicated by means of a scale. Submittals shall include a drawing of the hanger showing the 30° capability. Hangers shall be type PC30N as manufactured by Mason Industries, Inc. or equal.

    Springs shall be seated in a steel washer reinforced neoprene cup that has a neoprene bushing projecting through the bottom hole to prevent rod to hanger contact. Spring diameters and the lower hole sizes shall be large enough to allow the hanger rod to swing through a 30° arc from side to side before contacting the cup bushing.

2.9 MEASUREMENT AND CONTROL

A. Variable frequency Drives

1. 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.

2. Provide variable speed frequency drive (VFD) units for the following equipment:

   a. P-1 through P-4
   b. AHU-1 & 2

3. Manufacturers:

   ASEA BROWN BOVERI
   DANFOSS GRAHAM
   TOSHIBA

4. The VFD package as specified herein shall be enclosed in a UL Listed Type 1 enclosure for indoor applications, completely assembled and tested by the manufacturer in an ISO9001 facility.

   a. Environmental operating conditions: VFDs shall be capable of continuous operation at 32 to 120 F ambient temperature or VFD must be oversized to meet these temperature requirements.
   b. Enclosure for indoor applications shall be rated UL Type 1, Enclosures for outdoor applications shall be UL Type 3R . All enclosures shall be UL listed as a plenum rated VFD.

5. All VFDs shall have a Short Circuit Withstand Rating of not less than the rating of the connected equipment in accordance with UL508.

6. All VFDs shall have the following standard features:

   a. The keypad shall include Hand-Off-Auto selections and manual speed control. The drive shall incorporate "bumpless transfer" of speed reference.
   b. There shall be a built-in time clock in the VFD keypad.
   c. The VFD's shall utilize pre-programmed application macro's specifically designed to facilitate start-up.
   d. The VFD shall have cooling fans that are designed for easy replacement.
   e. The VFD shall have the ability to automatically restart after an over-current, over-voltage, under-voltage, or loss of input signal protective trip.
   f. 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.
   g. The VFD shall have internal 5% impedance reactors to reduce the harmonics to the power line and to add protection from AC line transients.
   h. The input current rating of the VFD shall be no more than 3% greater than the output current rating.
   i. The VFD shall include a coordinated AC transient surge protection system.
   j. The VFD shall provide a programmable loss-of-load Form-C relay output.

k. The VFD shall have user programmable underload and overload curve functions to allow user defined indications of mechanical failure / jam condition causing motor overload.
l. 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.
m. If the input reference (4-20mA or 2-10V) is lost, the VFD shall give the user the option of either (1) stopping and displaying a fault, (2) running at a programmable preset speed, (3) hold the VFD speed based on the last good reference received, or (4) cause a warning to be issued, as selected by the user.
n. Door interlocked, pad lockable molded case switch that will disconnect all input power from the drive and all internally mounted options.

7. All VFDs to have the following adjustments:

a. Three (3) programmable critical frequency lockout ranges.
b. Two (2) PID Set point controllers allowing pressure or flow signals to be connected to the VFD.
c. There shall be an independent, second PID loop that can utilize the second analog input and modulate one of the analog outputs to maintain the set point of an independent process (i.e., valves, dampers, etc.). All set points, process variables, etc. to be accessible from the serial communication network.
d. Two (2) programmable analog inputs shall accept current or voltage signals.
e. Two (2) programmable analog outputs (0-20ma or 4-20 ma).
f. Six (6) programmable digital inputs for flexibility in interfacing with external devices.
g. Three (3) programmable, digital Form-C relay outputs.
h. Run permissive circuit - There shall be a run permissive circuit for damper or valve control.
i. The VFD control shall include a programmable time delay for VFD start and a keypad indication that this time delay is active.
j. Seven (7) programmable preset speeds.
k. Two independently adjustable accel and decel ramps with 1 - 1800 seconds adjustable time ramps.
l. 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.
m. The VFD shall have selectable software for optimization of motor noise, energy consumption, and motor speed control.
n. The VFD shall include a carrier frequency control circuit that reduces the carrier frequency based on actual VFD.
o. The VFD shall include password protection against parameter changes.

8. The Keypad shall include a backlit LCD display. All VFD faults shall be displayed in English words. The keypad shall include the following assistants:

a. Start-up assistant
b. Parameter assistants
c. Maintenance assistant
d. Troubleshooting assistant
e. Drive optimizer assistants

9. 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:

a. Output Frequency
b. Motor Speed (RPM, %, or Engineering units)
c. Motor Current
d. Motor Torque
e. Motor Power (kW)
f. DC Bus Voltage
g. Output Voltage

10. 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. 2) Operate in a specific fireman's override PID algorithm. The mode shall override all other inputs except customer defined safety run interlocks, and force the motor to run in one of the two modes above.

11. Serial Communications

a. 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.

b. 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:

i. Data Sharing - Read Property - B.
ii. Data Sharing - Write Property - B.
iii. Device Management - Dynamic Device Binding (Who-Is; I-Am).
iv. Device Management - Dynamic Object Binding (Who-Has; I-Have).
v. Device Management - Communication Control - B.

c. 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.

d. 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.

e. 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.

f. The VFD shall include an independent PID loop for customer use.

12. EMI / RFI filters. All VFD's shall include EMI/RFI filters.

13. All VFD's through 75HP at 480 V shall be protected from input and output power mis-wiring.

14. Bypass Controller

    a. A complete factory wired and tested bypass system shall be provided with the following operators:

        1) Bypass Hand-Off-Auto
        2) Drive mode selector
        3) Bypass mode selector
        4) Bypass fault reset

    b. The bypass shall include an LCD display that allows the user to access owner requested data including but not limited to fails, bypass power (KW), and energy savings.

    c. The following indicating lights (LED type) or keypad display indications shall be provided.

15. Emergency Stop Function

    a. An emergency stop function shall meet all of the following requirements:

        1) The function shall override all other functions and operations under all conditions.
        2) Reset must not initiate a restart.
        3) An emergency stop shall operate in such a way that, when it is activated, the hazardous movement of the machinery is stopped and the machine is unable to start under any circumstances, even after the emergency stop is released. Releasing the emergency stop only allows the machine to be restarted.

4) The emergency stop shall stop hazardous movement by applying a stop category 0.

a) Emergency stop category 0 (according to EN 60204-1) means that the power to the motor shall cut off immediately. Stop category 0 is equivalent to the safe torque off (STO)function, as defined by standard EN/IEC 61800-5-2.

16. 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.
17. Power wiring shall be completed by the electrical contractor, to NEC code 430.122 wiring requirements based on the VFD input current.
18. 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.
19. The VFD Product Warranty shall be 24 months from the date of certified start-up. The warranty shall include all parts, labor, travel time and expenses. There shall be 365/24 support available via a toll free phone number.

B. Low Voltage Condensate Overflow Shut-off Switch

1. Low voltage condensate overflow shut-off switches shall be installed on all condensate drain pans as manufactured by RECTORSEAL approved equal.
2. The condensate shut-off switch shall detect rising water in condensate drain pans and interrupts the thermostat circuit to shut off the unit before flooding occurs. The device shall be installed on the primary drain pan rim with a two-piece clamp system that does not require drilling.
3. Mechanical equipment without adequate pan clearance to install a primary drain pan switch shall provide a switch installed on the primary drain pan outlet. The condensate shut-off switch shall detect downstream clogs in condensate drains and interrupts the thermostat circuit to shut off the unit before flooding occurs.
4. The switch shall incorporate a high capacity 5-amp, 24 volt AC magnetic float switch in a fully housed protective cover. The housing shall include a pull up test knob for functional testing of system.
5. The switch shall include an alarm wire to connect to the BAS. The switch shall send an alarm signal to the BAS frontend workstation. The mechanical contractor shall be responsible for coordinating the switch connections with the controls contractor.
6. The switch shall be UL Listed to comply with UL 508.

C. Air Purification System

1. This section describes the design, performance and installation of an air purification system intended for use as part of another manufacturer's air handling unit or mounted on the duct as shown on the plans, details and equipment schedules.
2. The air purification system(s) shall be of the size, type, arrangement and capacity indicated and required by the unit furnished and manufactured by GLOBAL PLASMA SOLUTIONS model GPS-FC, AMERICAN ION, ACTIVE AIR SOLUTIONS, or approved equal.

3. Each piece of air handling equipment, so designated on the plans, details, equipment schedules and/or specifications shall contain a Plasma Generator with Bi-polar Ionization output as described here within.

4. The Bi-polar Ionization system shall be capable of:

   a. Effectively killing microorganisms downstream of the bi-polar ionization equipment (mold, bacteria, virus, etc.).
   b. Controlling gas phase contaminants generated from human occupants, building structure and furnishings.
   c. Capable of reducing static space charges.
   d. All manufacturers shall provide documentation by an independent NELEC accredited laboratory that proves the product has minimum kill rates for the following pathogens given the allotted time and in a space condition:

      1) MRSA - >96% in 30 minutes or less
      2) E.coli - > 99% in 15 minutes or less
      3) TB - > 69% in 60 minutes or less
      4) C. diff - >86% in 30 minutes or less

   e. The ionization device shall be designed such that it may fit into any scheduled mounting configuration. The ionization device shall be powered from the control board without having to require revised fusing.
   f. The bi-polar ionization system shall operate in a manner such that equal amounts of positive and negative ions are produced. Uni-polar ion devices shall not be acceptable.
   g. Humidity: Plasma Generators shall not require preheat protection when the relative humidity of the entering air exceeds 85%. Relative humidity from 0 - 100%, condensing, shall not cause damage, deterioration or dangerous conditions within the air purification system. Air purification system shall be capable of wash down duty.

5. Ionization Requirements:

   a. The Bi-polar ionization system shall consist of Bi-Polar Plasma Generator and integral power supply. The Bi-polar system shall be installed where indicated on the plans or specified to be installed. The device shall be capable of being powered by 18VAC, 24VAC, 110VAC or 200VAC to 240VAC without the use of an external transformer. Ionization systems requiring isolation transformers shall not be acceptable.
   b. Ionization Output: The ionization output shall be controlled such that an equal number of positive and negative ions are produced. Imbalanced levels shall not be acceptable. An LED indicator shall be provided to prove ion output is activated.
   c. Ionization output from each electrode shall be a minimum of 200 million ions/cc when tested at 2” from the ionization generator.

6. Ozone Generation:

a. The operation of the electrodes or Bi-polar ionization units shall conform to UL 867-2007 and UL 2988 with respect to ozone generation. There shall be no detectable ozone generation during any operating condition, with or without airflow.

7. Electrical Requirements:

a. Wiring, conduit and junction boxes shall be installed within housing plenums in accordance with NEC NFPA 70. Plasma Generator shall accept an electrical service of 24VAC, 115 VAC or 200-240VAC, 1 phase, 50/60 Hz. The contractor shall coordinate electrical requirements with air purification manufacturer during submittals.

8. Control Requirements:

a. All Plasma Generators shall have internal short circuit protection, overload protection, and automatic fault reset.

b. The installing contractor shall mount and wire the Plasma device within the air handling unit specified or as shown or the plans. The contractor shall follow all manufacturer IOM instructions during installation.

c. A control relay shall be provided to sense the ion output and indicate to the BAS via dry-contacts that the ion output is functioning normally. NO and NC contacts shall be available to the BAS system for ease of integration.

1) Each piece of air handling equipment, so designated on the plans, details, equipment schedules and/or specifications shall contain a Plasma Detector with integral BAS contacts.

2) The Plasma Detector sensor shall be designed to these minimum standards:

a) Ability to detect both positive and negative ion levels from 1,000 ions/cc to 20 million ions/cc minimum. Detection limit shall be field adjustable based on sensor mounting location and manufacturer being sensed.

b) Plasma detector shall have integral dry alarm contacts for connection to the BAS to prove the ion system is operating properly and the ion system output is above the minimum preset threshold from the sensor manufacturer. The alarm shall activate when either positive or negative ion output drops below the preset setpoint. Cold plasma systems only providing indication the input power is applied or output power is present shall not be acceptable. The independent cold plasma detector shall be capable of working with any air purification manufacturer's system.

c) Cold plasma detector shall have an input voltage of 12VDC, 24VDC or 24VAC user selectable.

d) Cold plasma detector shall be capable of duct mounting or integral air stream mounting.

e) Housing shall be constructed of fire retardant ABS plastic.

f) Temperature and humidity shall have no effect on the cold plasma detector output accuracy.
g) The alarm output shall be provided with NO, NC and C terminals for ease of integration to the BAS. The contacts shall be rated for up to 5 amps at 230VAC or up to 24VDC at 2 amps.
h) A BACnet or Lonworks control interface shall be provided by the cold plasma detector manufacturer.

9. GPS-FC Equipment Requirements:

a. Electrode Specifications (Bi-polar Ionization):

1) Each Plasma Generator with Bi-polar Ionization output shall include the required number of electrodes and power generators sized to the air handling equipment capacity. A minimum of one electrode pair per 1,200 CFM (2,039 m^3/h) of air flow shall be provided. Bi-polar ionization tubes manufactured of glass and steel mesh shall not be acceptable due to replacement requirements, maintenance, performance output reduction over time, ozone production and corrosion.
2) Electrodes shall be energized when the main unit disconnect is turned on and the fan is operating. Ionization systems requiring the use of a mechanical air pressure switch to cycle the electrodes only when the fan is operating shall not be acceptable due to high failure rates and pressure sensitivity.

PART 3 - EXECUTION

3.1 TESTS

A. Refer to Section 230593 “Testing, Adjusting and Balancing” for related requirements.

B. At his discretion, the Owner shall be represented at all tests. Contractor shall provide 48 hours’ notice to the Owner prior to the tests unless otherwise specified.

C. Before insulation is installed and before piping is concealed, test water piping hydrostatically and prove tight under 100 psig pressure. Test pressure shall be held for minimum of 8 hours. An air test in lieu of water may be used when danger of freezing is possible and when approved.

D. Refrigerant piping shall be tested with dry nitrogen and trace of refrigerant at test pressures recommended by equipment manufacturer. After system has been proven tight under test pressure, it shall be evacuated to a pressure 2.5 mm Hg absolute. The refrigerant compressor shall not be used for evacuating the system. Vacuum shall be checked by use of a mercury manometer.

E. Coupled pumps shall be field aligned in accordance with the manufacturer’s recommended procedures, alignment completed prior to shipment is not acceptable. After the equipment has

been aligned, the contractor shall provide a written report verifying that the pumps vertical and horizontal angularity and parallel offset gap are within one of the following tolerances:

1. Pump parallel offset gap shall be within 1/64" at operating speed and pump angularity shall be within 1/64" per inch of coupler radius.
2. The manufacturer's recommended tolerance for the application and with the Engineer's approval.

F. Test all gas piping at 50 psig with oil-free compressed air for 2 hours with no loss in pressure.

END OF SECTION 230500

SECTION 230593 - TESTING, ADJUSTING AND BALANCING (TAB)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections and Section 230100 “Mechanical General Provisions” apply to this Section.

1.2 SCOPE OF WORK

A. The General Contractor shall obtain the services of an independent testing and balancing agency whose business is limited to testing, adjusting and balancing and shall be certified by AABC (or NEBB). Agency shall have been in the TAB business for a minimum of 5 years. The TAB (Testing, Adjusting and Balancing) Agency shall be a direct subcontractor of the General Contractor and not affiliated in any way with the Mechanical Contractor.

B. Testing and balancing shall be performed in accordance with National Standards for Testing and Balancing Heating, Ventilating and Air-conditioning Systems, 2002, as published by Associated Air Balance Council (AABC).

C. All work shall be performed under the direct supervision of a certified TAB Engineer. All other personnel shall be regular full-time employees of the TAB Agency.

D. Test and Balance Agency shall submit within 30 days after receipt of construction contract two copies of qualifications, including current TAB Engineer’s certificate and National Project Certification Performance Guaranty.

E. TAB work shall not commence until all components of the HVAC system have been installed completely, including all power wiring and controls and all equipment has been started and run tested in each mode of operation. Should any items be found incomplete at the time that TAB work is performed, the TAB Agency shall immediately notify the General Contractor and Owner’s Representative of any deficiencies found. The General Contractor shall be responsible for correcting reported deficiencies and verifying that the system is 100% complete, operable and ready for TAB work to proceed.

PART 2 - PRODUCTS

2.1 MATERIAL AND EQUIPMENT

A. Provide all necessary instrumentation required to measure and adjust the HVAC air and water systems.

B. Equipment and instruments shall be of types approved by the Owner's Representative and/or manufacturers of devices installed.

C. Instruments used for testing and balancing of air and hydronic systems shall have calibration verified within a period of 12 months prior to balancing.

PART 3 - EXECUTION

3.1 GENERAL, MECHANICAL AND ELECTRICAL CONTRACTOR'S RESPONSIBILITY

A. The General Contractor shall be responsible for directing the Mechanical and Electrical Contractors to fulfill the Contractors' Responsibility for Testing, Adjusting and Balancing as required in Section 230100. TAB work shall not commence until the conditions of paragraph 1.2.E of this Section and all requirements of Section 230100 for TAB have been completed.

3.2 TAB AGENCY'S RESPONSIBILITY

A. Carefully review the drawings and Specifications for the various systems noting all facilities incorporated in the design for purposes of adjusting and balancing. Should it be deemed necessary to provide additional dampers, baffles, valves, or other devices which would aid in the required adjusting and balancing, same shall be provided by the installing contractor.

B. The TAB Agency shall report any and all deficiencies that prohibit adjusting and balancing in accordance with the Contract Documents to the Contractor and the Owner's Representative.

C. Adjust all water piping, duct and equipment, including valves, controls, dampers, cocks, etc., to properly perform to ±10% of their respective design quantities of flow.

D. Determination of the air volumes shall be made by pitot tube and differential draft gauge for all supply, return, outdoor air and exhaust air ducts. Openings for pitot traverses shall be provided as required and shall be fitted with neat removable plugs or covers. Air quantities at grilles, registers, diffusers, etc., shall be measured as recommended by the various manufacturers of the outlets.

E. The Test and Balance Agency shall perform the following:

1. Adjust fan RPM, tighten and align fan belts, measure operating amps.
2. Adjust volume dampers to obtain designed air volume.
3. Adjust grilles, diffusers and registers to obtain designed airflow and air pattern.
4. Set balancing valves to obtain designed water flow at units, coils and branches.
5. Adjust each air handler to obtain designed airflow.
6. Adjust dampers to provide design outside air quantities.
7. Adjust airflow exhausted from and supplied to hoods.
8. In cooperation with the ATC Contractor's representative, setting adjustments of automatically controlled dampers to operate as specified. The TAB Agency shall inform

ATC Contractor of all abnormalities in sequencing and/or calibration of components discovered during balancing.

9. Final settings of dampers and valves shall be permanently marked. Where provided, memory stops and locking devices shall be adjusted and locked to the final setting.
10. Assist Fire Alarm Contractor in the testing of all duct smoke detectors. Measure the air velocity across each duct smoke detector with air handling unit at full airflow.

F. Before the work is offered for Final Acceptance, all equipment shall be run through a test to demonstrate that it has been adjusted to meet the requirements of the drawings and Specifications. Copies of the test and adjustment data shall be submitted in a report to the Owner's Representative prior to final inspection.

G. The TAB Report shall include a General Comments section providing an overview of systems operation, observations of system installation abnormalities and deficiencies, problems encountered, etc. If required, provide explanation of methods of measurement and disparity between measured and design quantities.

H. Test and Balance Agency Report shall include the following data for each system. All sheets shall be neatly typed. Balancing Agency shall submit with his report a set of neatly marked plans identifying location of each piece of equipment, air terminal, flow measuring device and points of traverse. Report all measured quantities and design quantities where applicable.

1. CFM of each supply, return, exhaust grille and diffuser.
2. RPM and CFM of each fan.
3. Supply, return and outdoor air CFM of each AHU and fan terminal unit where required.
4. Air pressure drop across A/C unit cooling coils.
5. Air pressure drop across each filter bank.
6. Discharge and suction static pressure of each fan.
7. Maximum and minimum differential pressure and corresponding CFM of each terminal box.
8. Voltage rating and operating volts of each fan motor. For fan motors requiring three-phase power, record voltage of each individual phased leg and check for voltage imbalance.
9. CFM of each exhaust hood.
10. Temperatures for each air handling unit at maximum capacity including the following measurements:

    a. Entering and Leaving air temperature at each coil.
    b. Entering and Leaving water temperature at each coil.

11. Air Handling unit is defined as any equipment that consists of a fan and coil, including split systems.

12. Temperatures for each heat exchanger device at maximum capacity, including the following:

    a. Entering and Leaving water temperature.
    b. Entering and Leaving air temperature.

13. Nameplate data of each piece of HVAC equipment installed.
14. GPM of each pump and corresponding suction and discharge pressure.
15. Voltage rating and operating volts of each pump motor. For pump motors requiring three-phase power, record voltage of each individual phased leg and check for voltage imbalance.
16. Amp rating and operating amps of each pump. For pump motors requiring three-phase power, record amps of each individual phase.
17. Differential pressure and corresponding GPM across each flow measuring device, including automatic flow control devices.
18. Final percent setting after adjustment of each balancing valve where applicable.
19. Velocity across each duct smoke detector at full airflow.

I. During the Final Inspection, the Agency shall have present all necessary instrumentation and an individual to make readings of select information which was submitted in the balance report. The select readings shall be made where directed by and in the presence of the Owner's Representative and shall not deviate more than 5% from the values submitted in the report.

J. The Owner's Representative may select no more than 20% of all reported data for rechecking. If more than 20% of data verified is not within ±5% of submitted data, the Owner's Representative may void entire report and ask for complete rebalancing. The field check shall be made within 45 days of approved TAB submittal.

END OF SECTION 230593

SECTION 230700 - MECHANICAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections and Section 230100 “Mechanical General Provisions” apply to this Section.

1.2 SUBMITTALS

A. Submit manufacturers’ data on all insulation products, schedule which indicates where each product is to be used and thickness of each product.

1.3 WARRANTY-GUARANTEE

A. Contractor shall furnish written warranty, countersigned and guaranteed by the General Contractor, stating that work executed under this Section of the Specifications shall be free from defects of materials and workmanship for a period of 12 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 INSULATION – GENERAL

A. All insulation shall have a composite (insulation, jacket or facing and adhesive used to adhere the facing or jacket to the insulation) fire and smoke rating as requested by ASTM E84, NFPA 255 and UL 723, not exceeding:

Flame spread	25
Smoke developed	50

B. Accessories, such as adhesive, mastics, cements, tapes and fire-resistant cloth for fittings, shall have same fire and smoke ratings as components listed above.

C. Installation of insulation shall be accomplished in strict accordance with manufacturer’s recommendations and shall be CERTAINTEED, OWENS-CORNING, JOHNS MANVILLE or KNAUF INSULATION for glass fiber insulation; ARMACELL for flexible unicellular insulation.

2.2 PIPE INSULATION

A. Glass fiber insulation having a thermal conductivity not greater than 0.24 Btu x in./hr. x sq. ft. x °F in a mean temperature of 75°F. Insulation shall have factory-applied all-purpose jacket.

B. Flexible unicellular insulation having a thermal conductivity not greater than 0.27 Btu x in./hr. x sq. ft. x °F in a mean temperature of 75°F.

2.3 DUCT INSULATION

A. Blanket Type within the conditioned space: Glass fiber, ¾-lbs/cu. ft., foil faced, vapor-sealed flexible duct insulation. Thermal conductivity shall not exceed 0.29 Btu x in./hr. x sq. ft. x ºF.

B. Board Type within the conditioned space: Glass fiber, 3.0-lbs./cu. ft., foil faced, vapor-sealed board insulation. Thermal conductivity shall not exceed 0.23 Btu x in./hr. x sq. ft. x ºF.

C. Blanket Type in unconditioned space or outside building: Glass fiber, 1-1/2-lbs/cu. ft., foil faced, vapor-sealed flexible duct insulation. Thermal conductivity shall not exceed 0.25 Btu x in./hr. x sq. ft. x ºF.

D. Board Type in unconditioned space or outside building: Glass fiber, 3.0-lbs./cu. ft., foil faced, vapor-sealed board insulation. Thermal conductivity shall not exceed 0.23 Btu x in./hr x sq. ft. x ºF.

2.4 ACOUSTIC DUCT LINER

A. Fiberglass duct liner shall not be used.

2.5 INSULATED DUCT COATING

A. Provide insulated duct coating on all exterior galvanized sheet metal ductwork, POLAR SEAL, ASTEC, or approved equal.

1. Water based acrylic plastic primer “prime security” shall provide 100% adhesion to substrate, stop oil migration and set base for waterproof membrane “top security”.
2. Water-based acrylic plastic waterproof membrane “top security” with bright white reflective heat shield consisting of a high concentrate of titanium dioxide to reflect ultraviolet rays.
3. Membrane “top security” shall be non-chalking, mildew and fungus resistant and crack resistant.
4. Membrane “top security” shall be capable of withstanding sub-zero and extreme heat conditions without degradation. Membrane shall not shrink or become brittle because of age. Membrane shall be resistant to environmental pollution and other chemicals, such as ammonia, chlorine, insecticides, herbicides and other common airborne chemicals.

2.6 SELF-ADHESIVE, FIELD-APPLIED, OUTDOOR JACKETS

A. Subject to compliance with requirements, provide self-adhesive outdoor jacket by POLYGUARD PRODUCTS INC., 3M, MFM BUILDING PRODUCTS CORP., or approved equal.

B. Outdoor jacker shall consist of a laminated vapor barrier and waterproofing membrane with perm rating 0.00 perm, when tested according to ASTM 96/E 96M, for installation over either fiberglass or foam board insulation located above ground outdoors. System shall consist of a foil polymer laminated film with a coating of rubberized bituminous compound or acrylic adhesive that allows membrane to self-adhere to the substrate.

C. Composite membrane shall consist of a multi-ply embossed UV resistant aluminum foil/polymer laminate to which is applied a layer of rubberized asphalt and shall have the following characteristics:

a. Membrane Thickness: 59 mils
b. Solar Reflectance, CRRC Initial Rating: 0.86
c. Solar Reflectance, CRRC 3-year Rating: 0.77
d. Thermal Emittance, CRRC Initial Rating: 0.82
e. Thermal Emittance, CRRC 3-Year Rating: 0.86

2.7 ALUMINUM PIPE JACKETS

A. Aluminum jacket shall be .016" thick (28 ga.) smooth aluminum sized to provide a minimum 2" self-gauging overlap longitudinal and circumferentially, minimum 3/4" by .015" thick (30 ga.) draw bands. Jacket shall be supplied with a factory-applied polykraft moisture barrier. CHILDERS PRODUCTS COMPANY, STRAP-ON JACKETING.

B. Provide fitting covers of same material as jacket and of same manufacturer.

2.8 CALCIUM SILICATE PIPE INSULATION INSERTS

A. Calcium silicate meeting ASTM C533, Type I, water resistant; rigid molded pipe; asbestos-free JOHNS MANVILLE Thermo-1200, or approved equal.

B. Thermal conductivity of 0.437 Btu at 300°F mean temperature as tested in accordance with ASTM C335.

C. Minimum compressive strength of 100 psi to produce 5% compression at 1-1/2" thickness.

D. Non-combustible as determined by test complying with ASTM E136.

E. Inserts shall have sufficient compressive strength to adequately support the pipe without compressing the inserts to a thickness less than the adjacent insulation. Insulation inserts shall cover the bottom half of the pipe circumference 180 degrees and be not less in length than the

protection shield. Vapor-barrier facing of the insert shall be of the same material as the facing on the adjacent insulation.

2.9 PVC PIPE JACKET FITTING COVERS

A. One-piece molded-type PVC plastic fitting covers and jacketing material, color matching JOHNS MANVILLE Zeston 2000, or approved equal.

B. Connections shall be made using pressure-sensitive color matching vinyl tape.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Insulation shall be installed by a licensed applicator and in strict accordance with the manufacturer's instructions. Deliver all materials to the job site and store in a safe, dry place. Use all means necessary at the job site to protect materials from dust, dirt, moisture and physical abuse before and during installation. Insulation that becomes damaged prior to installation shall not be installed and shall be removed from the job site. Insulation that becomes wet or damaged after installation shall be removed and disposed of and replaced with new insulation.

B. Surfaces to be insulated shall be cleaned free of dirt, scale, moisture, oil and grease prior to installation of the insulation.

3.2 PIPING (GLASS FIBER INSULATION, UNLESS OTHERWISE NOTED)

A. Schedule:

Refrigerant Suction Piping:	1" thickness flexible unicellular for pipe sizes up to 1-1/2" and 1-1/2" thickness for pipe sizes over 1-1/2".
Condensate Drain Above Floor:	1/2" Thickness

B. Fittings and valves on insulated piping smaller than 4" shall be insulated with fiberglass blanket to thickness equal to adjoining pipe insulation unless otherwise noted. Fittings and valves for insulated piping 4" and larger shall be insulated with segments of molded insulation, secured in place. On all fittings and valves, insulation shall be finished with a preformed PVC jacket.

C. Fittings and valves on refrigerant suction piping shall be insulated with cut sections of flexible unicellular insulation of thickness equal to adjoining pipe insulation.

D. All flexible unicellular and glass fiber piping insulation exposed to the weather shall be provided with aluminum jacketing.

E. No piping shall be insulated until it has been tested and thoroughly cleaned.

F. Provide pipe inserts between pipe hanger support shields and on piping 1-1/2" diameter or larger. Insulation inserts shall not be less in length than the following:

1-1/2" to 2-1/2" pipe size	10" long
3" to 6" pipe size	12" long

3.3 DUCTWORK

A. Definitions:

1. Concealed: Ductwork which shall be hidden from view by ceilings, walls, chases, or soffits, either by the work of this Contract, or by future tenant build-out work.
2. Exposed: Ductwork which is permanently in view, typically found in mechanical, storage, electrical, or other unfinished space.

B. Schedule:

Concealed Supply, Return, Relief and Outside Air Ductwork Externally Insulated: (inside the conditioned space)	2" thickness blanket
Exposed Supply, Return, Relief and Outside Air Ductwork Externally Insulated: (inside the conditioned space)	1-1/2" thickness rigid board
Exposed Supply, Return, Relief and Outside Air Ductwork Externally Insulated: (outside building and in all mechanical rooms and mechanical mezzanines)	2" thickness rigid board
Plenums:	2" thickness (or externally insulate with 2" blanket or 1-1/2" rigid board)
Transfer Ducts:	Not required
Exhaust Ducts:	Not Required

C. Insulate necks and tops of all supply air diffusers, registers and grilles.

D. Blanket-type insulation shall be stapled and taped in accordance with manufacturer's instructions.

E. Insulation on ductwork over 16" in height or width must be attached with stick pins. When using self-adhesive pins, prepare surface to be applied to ensure adhesion.

F. Tape all edges of insulation to ensure that no insulation is exposed.

3.4 INSULATED DUCT COATING

A. Clean galvanized outer surface of sheet metal ductwork as recommended by the manufacturer of the duct coating.

B. Apply POLAR SEAL “prime security” over all exposed ductwork at a rate of 100 square feet per gallon. Use polyester scrim over any joints or open areas. Completely saturate scrim in the first coat of “prime security”.

C. After first coat is dry (dries from milky white when wet to clear opaque when dry), apply second coat of “prime security” at a rate of 100 square feet per gallon and let dry.

D. Apply POLAR SEAL “top security” at a rate of 100 square feet per gallon and allow to dry.

E. After first coat is dry, apply a second coat of POLAR SEAL “top security” at a rate of 100 square feet per gallon.

3.5 SELF-ADHESIVE, FIELD-APPLIED, OUTDOOR JACKETS

A. Ducts shall be sealed in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible - Second Edition (1995) Seal Class B (or latest version of SMACNA) prior to installation of insulation and the outdoor, field-applied jacket.

B. Outdoor, field-applied insulation and jacket on ductwork insulation shall be pitched to shed water and prevent water ponding on top of the duct.

C. Fiberglass insulations shall have a factory applied FSK facing. Contractor shall be responsible for testing adhesion to any substrate.

D. Substrate surfaces shall be clean, dry, and free of oil films.

E. Select outdoor, field-applied jacket materials in accordance with manufacturer's instructions for coverage on the underside of the ductwork, to avoid pins.

F. Contractor shall adhere to the following duct installation criteria for proper maintenance of vapor barrier and physical integrity:

1. Board insulation shall be mechanically installed on properly sealed ductwork according to the specifications using insulation fasteners (mini-cup weld pins or perforated. based pins and washers).

2. Washers shall be covered with a 4-inch square piece of smooth foil tape prior to jacketing the ductwork to prevent the puncture of the outer membrane by the fasteners.
3. Insulation on the top of the ductwork shall be installed to allow for the water to shed from the top of the duct and to prevent water from ponding on the top of the duct.

G. Contractor shall follow one of the options below for the installation of the outdoor, field-applied jacket depending on the jacket product and the duct sizes:

1. Two Piece Installation.
2. Four Piece Installation.

H. Contractor shall protect outdoor, field-applied jackets from damaging chemicals. Solvation will occur to the rubberized bitumen when exposed to petroleum or coal tar based compounds. Contact the manufacturer immediately for more information if there is doubt, before any chemical interaction.

I. Contractor shall allow each piece of the outdoor, field-applied jacket to stretch by using a 6-inch lap over the circumferential lap, and a 4-inch wide butt lap or overlap over the joint, and then roll with a roller. Position longitudinal laps at a water shed position.

J. Contractor shall not pre-apply the outdoor, field-applied jacket to fabricated insulation unless metal banding is used. Outdoor, field-applied jackets are not mechanical fastening systems and will not hold the insulation on the duct.

END OF SECTION 230700

SECTION 230800 - COMMISSIONING OF HVAC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections, and Section 230100, “Mechanical General Provisions” apply to this Section.

1.2 WORK INCLUDED

A. A separate Commissioning Agent (the Architect/Engineer) will be engaged by the Owner to administer the commissioning.

B. The Contractor shall provide all commissioning services as outlined in this Section; perform all testing, measurements, and inspection outlined in the ‘Commissioning Plan”; and coordinate with the Commissioning Agent. A template Commissioning Plan is attached. The final plan will be written after the construction contract is underway.

C. The Systems to be commissioned include:

1. All HVAC and related systems

1.3 COMMISSIONING OBJECTIVES

A. To ensure that all building systems, subsystems, equipment, controls, and interfaces with other building systems are installed, tested, and are operating in compliance with Contract Documents and within the scope of design requirements.

B. To ensure that all system operation and maintenance personnel are properly instructed to effectively and efficiently operate and maintain the systems, subsystems, equipment, and controls, and that they will receive all required manuals and documentation.

C. The Commissioning Agent shall provide the following to the Contractor for implementation and execution.

1. Commissioning Plan: The Commissioning Agent shall prepare the Commissioning Plan in accordance with contents as specified herein.
2. Checklists and Test Forms: The Commissioning Agent shall prepare the Pre-Functional Checklists and Functional Performance Test Forms, specifically for this project, and edited to suit the equipment and systems installed.

3. Submittals:

a. The Contractor shall submit the following documents to the Commissioning Agent for review and inclusion in the Commissioning Plan.

i. Piping pressure and vacuum test reports
ii. Equipment startup reports
iii. DALT report
iv. TABs report
v. HVAC Water quality test report
vi. Prefunctional Checklists completed by the installing Foreman.
vii. O&M Manuals with warranties
viii. Training class agenda and schedule

b. Commissioning Report: The Commissioning Agent shall assemble the final Commissioning Report comprised of completed prefunctional and functional checklists, equipment startup test reports, etc. organized by subsystem and submitted as one package. The results of failed tests shall be included along with a description of the corrective action taken.

1.4 REFERENCED STANDARDS

A. ASHRAE Guideline 1-1996, "The HVAC Commissioning Process."

B. NEBB, "Procedural Standards for Building Systems Commissioning."

C. SMACNA, "HVAC Systems Commissioning Manual."

1.5 COMMISSIONING TEAM

A. The Contractor shall designate team members from each of the following to participate in the Commissioning Process (both pre- and post-occupancy):

1. General Contractor
2. Mechanical Subcontractor (and HVAC startup technicians)
3. Electrical Subcontractor
4. Testing, Adjusting and Balancing (TAB) Subcontractor
5. Automatic Temperature Controls Subcontractor

B. The Owner shall designate a representative to participate in the Commissioning Process.

C. Each of the team member's names shall be submitted in writing to the Commissioning Agent for inclusion in the Commissioning Plan.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 IMPLEMENTATION OF COMMISSIONING PLAN

A. Plan Submittal: After the start of construction, the Commissioning Agent shall provide the Commissioning Plan to the Contractor for implementation and execution. The Plan shall provide the scope of commissioning tasks to the appropriate parties. Typical elements of the Plan shall include the following:

1. Commissioning Agent's preparation of the Commissioning Test Schedule and distribution to the Contractor and Owner.
2. Commissioning Agent visits to the job site to observe installation activities.
3. Contractor's pre-startup verification and completion of the Pre-functional Checklists.
4. Contractor's submittal of equipment and systems startup verification to the Commissioning Agent.
5. Contractor's submittal of testing, adjusting, and balancing (TAB) reports to the Commissioning Agent.
6. Contractor's functional performance testing with the Commissioning Agent.
7. Contractor's completion of operating and maintenance manuals and submittal to the Commissioning Agent.
8. Contractor's operation and maintenance personnel instruction.
9. Commissioning Agent's preparation of the Final Commissioning Report and submission to Owner.
10. Owner acceptance

B. Equipment and Systems Startup:

1. Pre-startup Verification: Prior to startup of equipment and systems, the Contractor shall indicate on the pre-start checklists and Commissioning Agent shall observe and verify that all items have been substantially installed in accordance with the project Contract Documents, including all change orders. Verification of the basic installation testing of systems shall be performed by the Contractor and shall include:

a. Hydrostatic testing of hydronic piping systems
b. Cleaning, flushing, and venting of piping systems, including removal and cleaning of all strainers
c. Cleaning of equipment and systems of construction dirt and debris, including replacement of filters, and all items per the approved checklists

2. Startup Verification: The Contractor shall indicate on the startup checklists, and Commissioning Agent shall verify that all HVAC equipment, systems, and subsystems have been activated and operate substantially in accordance with Contract Documents, with all equipment, system, and electrical operating and safety devices checked and functional. The Contractor's work also includes but is not limited to:

a. Calibration and testing of all automatic temperature control devices and building automation systems.

b. Testing and verification of all interlocks and interfacing between HVAC equipment, systems, subsystems, and other building systems.
c. Completion of testing, adjusting, and balancing (TAB) work, including the rechecking of 10% of the measurements.

3. Startup Documentation: Completed startup checklists shall be filled out by the Contractor after startup verification of each HVAC system, subsystem or each item of HVAC equipment. Startup checklists used by the Contractor Technicians shall be neat and typed using standard formats appropriate for the equipment. On request, the Contractor shall provide trend data demonstrating equipment has been started and is operating within design parameters.

4. Notification: The Commissioning Agent shall notify the Owner and Contractor when the startup verification has been completed and the HVAC functional performance testing can be started.

3.2 FUNCTIONAL PERFORMANCE TESTING

A. Purpose: Every item of equipment, all systems and subsystems, controls, and all related equipment shall be tested and evaluated for conformance to performance data in the Contract Documents. Included is conformance to:

1. Equipment input and output capacities.
2. Systems and subsystems flow and distribution performance.
3. Control system performance, accuracy, and adherence to sequences of operation.
4. Minimum or part load operations and performance.
5. Interface with other equipment and/or systems.

B. Equipment Testing: Equipment functional performance testing shall not begin until the following notification of completion has been given to the Owner by the Commissioning Agent.

1. Copies of the manufacturer's equipment start up reports are submitted to the Engineer for review and approval.
2. Copies of the commissioning pre-start up and start up reports are submitted to the Engineer and Owner for review and approval.
3. Direct digital control graphic screen shots of all equipment are submitted showing unit is operating within design parameters.
4. Demonstrate through trend data successful operation of the HVAC systems for a period of not less than 2 weeks.
5. Functional performance test checklists developed by the Commissioning Agent shall be used by the Contractor to document the equipment functional performance tests. Each item of equipment will be functional performance tested by the Contractor and the results documented by the Contractor at full load (and under part load conditions where required by the Contract Documents). Operation under "abnormal and/or emergency conditions" shall be simulated by the Contractor for equipment and systems, and all safety equipment and control operations verified. Test methods shall be documented and approved by the Commissioning Agent prior to implementation and shall be covered during the Owner's

training as well. No equipment test functions or procedures shall be eliminated from the functional performance test unless approved by the Commissioning Agent and the Owner.

C. Systems Testing: Functional performance testing shall not begin until all equipment and systems have had startup verification by the Contractor and notification of completion has been given to the Owner by the Commissioning Agent.

1. Functional performance test checklists to document system or subsystem functional performance tests.
2. The functional performance testing of systems by the Contractor shall begin after equipment and subsystems have been tested and documented. The system interlock and interface testing sequence shall depend on the system design, complexity, and other factors.
3. HVAC systems and subsystems shall be tested under full load conditions and under part load conditions by the Contractor.
4. Actual physical responses shall be observed. Reliance on control signals or other indicators is not acceptable.
5. Control component input and output signals shall be confirmed by the Contractor for correctness under all operating conditions.
6. At the end of the functional performance test procedures, every mode of each operation of a system, each piece of equipment, every item in the control sequence description, and every zone or subsystem shall be proven to operate by the Contractor as defined in the project Contract Documents.

D. Test Documentation: Functional performance test checklists developed by the Commissioning Agent shall be used by the Contractor to document the results of the functional performance testing process.

1. Testing verification shall be provided by signatures of responsible parties (the Contractor, Sub-Contractors, Commissioning Agent, and Owner's Representative) on the functional performance test checklists and equipment checklists.
2. Functional performance testing shall be performed by the Contractor, by members of the Commissioning Team as outlined, and approved by the Commissioning Plan.
3. All members shall remain on the Commissioning Team throughout the entire functional performance testing procedures. Substitutions shall be permitted only by written approval of the Commissioning Agent and Owner.

E. Test Failures: No system or subsystem shall be accepted until all items of equipment in the system have approved and verified functional performance test checklists.

1. When a functional performance test is not approved, the Contractor shall be directed to provide a written report to the Commissioning Agent listing the deficiencies causing the test failure, and the possible remedies to correct the deficiencies.
2. After all deficiencies have been corrected; the entire functional performance test for the equipment, system, or subsystem shall be repeated.
3. The Commissioning Agent will continue to monitor the actions to correct the equipment or system deficiencies until an acceptable functional performance test has been accomplished.

F. Deferred Tests: If any checklist or functional performance test cannot be completed for seasonal reasons, lack of occupancy, or for other reasons, a written report shall be sent by the Contractor to the Commissioning Agent indicating when the test will be scheduled.

1. If any checklist or functional performance test cannot be accomplished due to deficiencies outside the scope of the work, the deficiencies shall be resolved and corrected by the appropriate parties before completion of the commissioning process.

G. Control System Verification: The Control Contractor shall provide a field technician on site with a portable control access computer and related test equipment. The date and time of this control system verification testing shall be scheduled in advance with the Commissioning Agent. The field technician shall demonstrate to the Commissioning Agent the accuracy of each physical input point, and the response of each physical output point during each mode of operation identified in the Sequence of Controls.

H. A checklist shall be provided by the Contractor for each of the physical hardware points prior to this system verification demonstration, with all identification information and the physical location of each physical input/output device. For input sensors, this checklist shall be completed during the field test to indicate what the actual measured reading was during the verification, verses what the control system indicated it was. For output devices, this checklist shall indicate what the response actually was verses what it should have been for each mode of operation. Any defective control component shall be replaced, and any programming errors identified shall be corrected and re-demonstrated to the Commissioning Agent.

I. Every item of the systems listed in 1.2.B shall be functionally tested in the presence of the Commissioning Agent and Owners Representative by installing contractor and supplying vendor technical representative.

3.3 OPERATOR INSTRUCTION

A. During System Installation: Schedules and materials for the participation of the operation and maintenance personnel during the installation of the systems and equipment shall be implemented as per the Commissioning Plan or as indicated in the Contract Documents by the Contractor.

1. Operation and maintenance personnel instruction shall include:

a. An instruction agenda with objectives
b. Classroom sessions using Contract Documents (specifications, system drawings), shop drawings, sequence of operations, equipment installation and operation manuals, and audio-visual aids, etc.
c. “Factory specialist” presentations by representatives approved by the Commissioning Agent
d. Job site visits
e. Sign-in sheets to verify attendance
f. Video-taping of all sessions

B. During Commissioning: The Contractor shall prepare schedules and coordinate the training sessions with the parties involved.

1. Equipment and systems maintenance manuals and schedules should be provided along with other information not provided during the installation phase instruction sessions.

C. Turn-over Instruction: When the systems are ready to be turned over to the Owner, the Contractor shall schedule a final session for operation and maintenance personnel instruction. The following shall be included:

1. Attendance by the Commissioning Agent, installing contractors, major equipment suppliers, and all other interested parties
2. Review of all system and equipment operations
3. Additional hands-on instruction where requested by the Owner or Commissioning Agent
4. A question/answer discussion period

3.4 COMMISSIONING REPORT

A. The commissioning documentation shall be prepared by the Commissioning Agent and shall be organized into a format similar to the Commissioning Plan. All pages shall be numbered, a table of contents provided, and shall include the following information:

1. Commissioning Plan: Provide a copy of the Commissioning Plan.
2. TAB Reports: Contractor shall provide approved testing, adjusting, and balancing (TAB) reports for all HVAC systems being commissioned to the Commissioning Agent for inclusion in the Report.
3. Drawings: As-built shop drawings of equipment and systems, sequence of operations, and as-built Contract Documents as modified by change orders shall be provided by the Contractor to the Commissioning Agent for inclusion in the Report.
4. Startup Checklists: Provide all startup checklists and equipment startup reports, organized by systems and subsystems.
5. Functional Performance Tests: Functional performance test checklists for all equipment, systems, subsystems, interlocks, and system interfaces organized by systems and subsystems shall be provided by the Contractor to the Commissioning Agent for inclusion in the Report.
6. Operation and Maintenance Manuals: Copies of approved operation and maintenance manuals specified in the systems Contract Documents and/or in the Commissioning Plan shall be provided by the Contractor to the Commissioning Agent for inclusion in the Report.
7. Video Recording: Copies as indicated in the Contract Documents shall be provided by the Contractor to the Commissioning Agent for inclusion in the Report.

3.5 ACCEPTANCE

A. Documents to Owner: The Commissioning Agent shall be responsible for maintaining the commissioning documentation until Final Acceptance of the project. All checklists required by this Section shall become part of the commissioning documentation. The commissioning

documentation shall be kept current and shall be available for inspection at all times. At the time of final acceptance of the project, the Commissioning Agent shall furnish copies of the commissioning documentation to the Owner and Contractor.

B. Warranties: All equipment and system guarantees and warranties specified in the Contract Documents shall be furnished to the Owner by the Contractor at the time of final acceptance of the project.

END OF SECTION 230800

NEWPORT NEWS PUBLIC SCHOOLS

COMMISSIONING PLAN

GATEWOOD SENIOR CENTER HVAC REPLACEMENT

PROJECT NO. 20-127

THOMPSON
Consulting Engineers
Mechanical and Electrical Engineering
22 Enterprise Parkway, Suite 200, Hampton, VA 23666

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COMMISSIONING OVERVIEW

The purpose of this Commissioning Plan is to provide a clear and concise roadmap for the implementation of the commissioning process. The systems to be commissioned are identified in the Project Specifications.

This Commissioning Plan is a living document. The basic process and procedures for commissioning this project are detailed below. As the project develops appendices will be added to organize test reports, startup technician reports, issues logs, and completed checklists. Test documentation will be added throughout the construction project. At the end of the project the resulting compilation of information will become the Final Commissioning Report.

Integrating commissioning into a fast-moving construction project can be a challenge. The points below describe how our firm performs Commissioning.

- Commissioning begins during the design stage when our Commissioning Agent (CxA) reviews the project documents and makes comments to the designers. A Commissioning Plan is prepared for inclusion in the Bid Documents.

- After the construction contract is awarded and prior to the start of system rough-in, a Kick Off Meeting is held with the construction team. This will include the Project Managers and Foremen for the General, Mechanical, Electrical, TABs, and Controls Contractors; Equipment Representatives; and the Owner.

- The General Contractor (GC) is asked to maintain the Prefunctional Checklist. This document is a part of the Commissioning Plan and has a checklist for every unit on the drawing HVAC equipment schedule. The installing trade Foreman is asked to review the Prefunctional Checklist and confirm completion by initialing each item. When the Prefunctional Checklist is complete, the GC requests a CxA site visit.

- The GC is requested to not start HVAC equipment until receiving concurrence from the Engineer, CxA and Owner. Prior to granting concurrence, the CxA will confirm the Prefunctional Checklist is complete and discuss the building conditions with the GC. The goal being to prevent permanent damage to the equipment.

- Equipment startup is required to be performed by Factory Authorized technicians and documented on standardized report forms.

- After startup, the Test and Balance Contractor (TABs) may begin his work.

- The Design Engineer and CxA will review all startup and testing, adjusting, and

balancing (TABs) reports.

- When the TABs report has been submitted and approved by the Design Engineer and the control system is complete; Functional Commissioning may begin.

- Functional Testing will include all specified modes of control and sequence of operation under full and part load. The performance of alarms will be checked.

- Typically, Functional Commissioning occurs between Substantial and Final Completion of the Project. As such, design weather conditions may not be available when the project has achieved Substantial Completion. To address this issue, we follow the following guidelines.

    - Refrigerant based systems which reject heat to the atmosphere can be properly verified only when near design conditions are present. For these systems, second season testing is sometimes required.

    - Gas and electric heating sources and geothermal water source heat pumps can typically be verified by measuring the temperature differential across the appliance. For cases when this is not possible, second season commissioning will be performed.

    - Equipment shall not be forced to operate in the cooling or heating mode other than through the raising or lowering of coil discharge or indoor space temperature setpoints.

    - If there is insufficient time to perform the functional testing during the construction period, seasonal commissioning may have to be performed the following year.

    - When the building must be occupied prior to Functional Commissioning, the testing occurs after normal hours for the occupants.

- The Engineer shall review all as-built record drawings, control drawings, and sequences of operation. Any changes to the electrical design to accommodate a substitute piece of equipment shall be reflected in the Record Drawings.

- The CxA or another member of Thompson Consulting Engineers will review the O&M manuals and Training Agenda.

- A Final Commissioning Report will be prepared and issued by the CxA along with a recommendation on Final Acceptance after all the Issues Log items have been resolved.

DESIGN PHASE

During the design phase, the CxA performs the following activities:

- Review and Modify Project Specifications
- Develop Initial Commissioning Plan
- Attend Pre-Bid Meeting (if requested)

Review and Modify Project Specifications

There are specific commissioning requirements located throughout the project specifications. During design, the CxA will review the specifications and suggest changes to the Design Engineer.

The specifications include the format in which contractor submittals will be presented, pressure testing of piping and duct systems, startup requirements, training requirements, system manual requirements, and so on.

The CxA will include the quality related items from the specifications in the commissioning checklists.

Develop Initial Commissioning Plan

The initial commissioning plan is similar to many other projects. It is intended to clarify individual roles and responsibilities relative to the commissioning process, identify the systems to be commissioned, and include a few typical commissioning checklists.

The commissioning plan will be distributed as a part of the project specifications.

Attend Pre-Bid Meeting

A representative of Thompson Consulting Engineering will attend the Pre-Bid Meeting, if requested.

CONSTRUCTION PHASE

During construction phase, the CxA tasks include:

- Attend the Pre-Construction Meeting (if requested).
- Conduct the Commissioning Kickoff Meeting.
- Back check Prefunctional Checklists maintained by the Installing Contractors.
- Monitor system startup
- Maintain and distribute the Issues Log.
- Conduct Functional Testing.
- Review the Owner Training Agenda.
- Review the Operation and Maintenance (O&M) manual.

Pre-Construction Meeting

Once the contractor is selected, the commissioning authority will attend and participate in the pre-construction meeting if requested. The role of CxA during the meeting will be to review and discuss the commissioning and the communication protocols the project team has developed.

Commissioning Kickoff Meeting

Prior to the start of Pre-Functional testing, the CxA will lead a kickoff meeting. This will include the Project Managers and Foremen for the General, Mechanical, Electrical, TABs, and Controls Contractors; Equipment Representatives; and the Owner.

The meeting will review the goals of commissioning, establish a schedule, and assign responsibilities to specific individuals. Once an individual is assigned to be a part of the commissioning team, they cannot be removed with out prior concurrence of the commissioning authority to preserve continuity.

Prefunctional Checklists

The Prefunctional Checklists are developed by the commissioning authority. They are to be completed by the General Contractor and Subcontractors. The intent of the checklists is to provide an organized method to verify the equipment is properly installed and requirements of the Project Documents are met.

System Startup

When the Prefunctional Checklists are complete, and the building cleanliness is adequate, equipment startup can proceed. The specifications contain specific requirements for startup. A field report for each unit is required to be submitted for review and inclusion in the final commissioning report.

Issues Log

The CxA will maintain an Issues Log to track items of concern. Each item will stay open until it is resolved; either by correcting the construction, demonstrating compliance as-is; or Owner acceptance.

Functional Testing

Functional testing occurs after all construction and startup is complete, the TABs report is approved by the Engineer, and DDC graphics are finished. A small team consisting of the CxA, Controls Technician, Mechanical Contractor, Equipment Startup Technicians, TABs Agent, and Owners Representative will exercise all the systems in the project scope.

Review Training

The CxA will review the contractor's submitted training agenda to ensure the specification requirements are covered and the contractor understands the expectations of training.

O&M Systems Manual

The Construction Administrator or the CxA will review the final manual for completeness and clarity.

Warranty Review

The Construction Administrator or CxA will review the warranty certificates provided by the Contractor.

CONTACT INFORMATION

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Engineer

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Thompson Consulting Engineers
22 Enterprise Parkway
Hampton, VA 23666
(757) 599-4415

General Contractor

TO BE DETERMINED

Mechanical Contractor

TO BE DETERMINED

Controls Contractor

TO BE DETERMINED

TABs Contractor

TO BE DETERMINED

SECTION 230885 - DUCT CLEANING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Construction Contract General Conditions, Contract Forms, other Division-l Specification Sections and Section 230100 “Mechanical General Provisions” apply to this Section.

1.2 APPLICABLE STANDARDS AND PUBLICATIONS

A. The following current standards and publications of the issues currently in effect form a part of this Specification to the extent indicated by any reference thereto:

1. National Air Duct Cleaners Association (NADCA): “Assessment, Cleaning & Restoration of HVAC Systems (ACR 2006),” 2006.
2. National Air Duct Cleaners Association (NADCA): “Understanding Microbial Contamination in HVAC Systems,” 1996.
3. National Air Duct Cleaners Association (NADCA): “Introduction to HVAC System Cleaning Services,” 2004.
4. National Air Duct Cleaners Association (NADCA): Standard 05 “Requirements for the Installation of Service Openings in HVAC Systems,” 2004.
5. Underwriters’ Laboratories (UL): UL Standard 181.
6. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE): Standard 62-89, "Ventilation for Acceptable Indoor Air Quality".
7. Environmental Protection Agency (EPA): "Building Air Quality," December 1991.
8. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA): “HVAC Duct Construction Standards - Metal and Flexible,” 1985.
9. North American Insulation Manufacturers Association (NAIMA): "Cleaning Fibrous Glass Insulated Air Duct Systems," 1993.

1.3 SPECIAL PROVISIONS

A. Qualification of the HVAC System Cleaning Contractor:

1. Membership: The HVAC system cleaning contractor shall be a certified member of the National Air Duct Cleaners Association (NADCA), or shall maintain membership in a nationally recognized non-profit industry organization dedicated to the cleaning of HVAC systems.
2. Certification: The HVAC system cleaning contractor shall have a minimum of one (1) Air System Cleaning Specialist (ASCS) certified by NADCA on a full time basis, or shall have staff certified by a nationally recognized certification program and organization dedicated to the cleaning of HVAC systems.
3. Supervisor Qualifications: A person certified as an ASCS by NADCA, or maintaining an equivalent certification by a nationally recognized program and organization, shall be responsible for the total work herein specified.

4. Experience: The HVAC system cleaning contractor shall submit records of experience in the field of HVAC system cleaning as requested by the Engineer. Bids shall only be considered from firms which are regularly engaged in HVAC system maintenance with an emphasis on HVAC system cleaning and decontamination.

5. Equipment, Materials and Labor: The HVAC system cleaning contractor shall possess and furnish all necessary equipment, materials and labor to adequately perform the specified services.

    a. The Contractor shall assure that its employees have received safety equipment training, medical surveillance programs, individual health protection measures, and manufacturer's product and Material Safety Data Sheets (MSDS) as required for the work by the U.S. Occupational Safety and Health Administration, and as described by this Specification.
    b. The Contractor shall maintain a copy of all current MSDS documentation and safety certifications at the site at all times, as well as comply with all other site documentation requirements of applicable OSHA programs and this Specification.
    c. Contractor shall submit to the Engineer all MSDS for all chemical products proposed to be used in the cleaning process.

6. Licensing: The HVAC system cleaning contractor shall provide proof of maintaining the proper license(s), if any, as required to do work in this state. Contractor shall comply with all Federal, state and local rules, regulations, and licensing requirements.

1.4 STANDARDS

A. NADCA Standards: The HVAC system cleaning contractor shall perform the services specified here in accordance with the current published standards of the National Air Duct Cleaners Association (NADCA).

B. All terms in this Specification shall have their meaning defined as stated in the NADCA Standards.

C. NADCA Standards must be followed with no modifications or deviations being allowed.

1.5 DOCUMENTS

A. Mechanical Drawings: The Contractor shall provide the HVAC system cleaning contractor with one copy of the following documents:

1. Project drawings and specifications.
2. Approved construction revisions pertaining to the HVAC system.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SCOPE OF WORK

A. The scope of this work applies to existing ductwork to remain and be re-used as part of the new systems.

B. This section defines the minimum requirements necessary to render HVAC components clean, and to verify the cleanliness through inspection and/or testing in accordance with items specified herein and applicable NADCA Standards.

C. The Contractor shall be responsible for the removal of visible surface contaminants and deposits from within the HVAC system in strict accordance with these Specifications.

D. The HVAC system includes any interior surface of the facility's air distribution system for conditioned spaces and/or occupied zones. This includes the entire supply air ducts and supply diffusers and the return air ducts to the rooftop unit and return air grilles.

3.2 HVAC SYSTEM COMPONENT INSPECTIONS AND SITE PREPARATIONS

A. HVAC System Component Inspections: Prior to the commencement of any cleaning work, the HVAC system cleaning contractor shall perform a visual inspection of the HVAC system to determine appropriate methods, tools, and equipment required to satisfactorily complete this project. The cleanliness inspection should include ductwork and associated diffusers and grilles.

B. The cleanliness inspection shall be conducted without negatively impacting the indoor environment through excessive disruption of settled dust, microbial amplification or other debris. In cases where contamination is suspected, and/or in sensitive environments where even small amounts of contaminant may be of concern, environmental engineering control measures should be implemented

C. Damaged system components found during the inspection shall be documented and brought to the attention of the Engineer.

D. Site Evaluation and Preparations: Contractor shall conduct a site evaluation, and establish a specific, coordinated plan which details how each area of the building will be protected during the various phases of the project.

E. Inspector Qualifications: Qualified personnel should perform the HVAC cleanliness inspection. At minimum, such personnel should have an understanding of HVAC system design, and experience in utilizing accepted indoor environmental sampling practices, current industry HVAC cleaning procedures, and applicable industry standards.

3.3 GENERAL HVAC SYSTEM CLEANING REQUIREMENTS

A. Containment: Debris removed during cleaning shall be collected and precautions must be taken to ensure that Debris is not otherwise dispersed outside the HVAC system during the cleaning process.

B. Particulate Collection: Where the Particulate Collection Equipment is exhausting inside the building, HEPA filtration with 99.97% collection efficiency for 0.3-micron size (or greater) particles shall be used. When the Particulate Collection Equipment is exhausting outside the building, Mechanical Cleaning operations shall be undertaken only with Particulate Collection Equipment in place, including adequate filtration to contain Debris removed from the HVAC system. When the Particulate Collection Equipment is exhausting outside the building, precautions shall be taken to locate the equipment down wind and away from all air intakes and other points of entry into the building.

C. Controlling Odors: Measures shall be employed to control odors and/or mist vapors during the cleaning process.

D. Component Cleaning: Cleaning methods shall be employed such that all HVAC system components must be Visibly Clean as defined in applicable standards (see NADCA Standards). Upon completion, all components must be returned to those settings recorded just prior to cleaning operations.

E. Service Openings: The Contractor shall utilize service openings, as required for proper cleaning, at various points of the HVAC system for physical and mechanical entry, and inspection.

F. Contractor shall utilize the existing service openings already installed in the HVAC system where possible.

G. Other openings shall be created where needed and they must be created so they can be sealed in accordance with industry codes and standards.

H. Closures must not significantly hinder, restrict, or alter the airflow within the system.

I. Closures must be properly insulated to prevent heat loss/gain or condensation on surfaces within the system.

J. Openings must not compromise the structural integrity of the system.

K. Construction techniques used in the creation of openings should conform to requirements of applicable building and fire codes, and applicable NFPA, SMACNA and NADCA Standards.

L. All service openings capable of being re-opened for future inspection or remediation shall be clearly marked and shall have their location reported to the Architect in project report documents.

M. Air Distribution Devices (Registers, Grilles & Diffusers): The Contractor shall clean all air distribution devices.

N. Duct Systems: Contractor shall:

1. Create service openings in the system as necessary in order to accommodate cleaning of otherwise inaccessible areas.
2. Mechanically clean all duct systems to remove all visible contaminants, such that the systems are capable of passing Cleaning Verification Tests.

3.4 HEALTH AND SAFETY

A. Safety Standards: Cleaning contractors shall comply with applicable federal, state, and local requirements for protecting the safety of the contractor's employees, building occupants, and the environment. In particular, all applicable standards of the Occupational Safety and Health Administration (OSHA) shall be followed when working in accordance with this Specification.

B. Occupant Safety: No processes or materials shall be employed in such a manner that they will introduce additional hazards into occupied spaces.

C. Disposal of Debris: All Debris removed from the HVAC System shall be disposed of in accordance with applicable federal, state and local requirements.

3.5 MECHANICAL CLEANING METHODOLOGY

A. Removal Cleaning Methods: The HVAC system shall be cleaned using Source Removal mechanical cleaning methods designed to extract contaminants from within the HVAC system and safely remove contaminants from the facility. It is the Contractor's responsibility to select Source Removal methods that will render the HVAC system Visibly Clean and capable of passing cleaning verification methods and other specified tests, in accordance with all general requirements. No cleaning method, or combination of methods, shall be used which could potentially damage components of the HVAC system or negatively alter the integrity of the system.

B. All methods used shall incorporate the use of vacuum collection devices that are operated continuously during cleaning. A vacuum device shall be connected to the downstream end of the section being cleaned through a predetermined opening. The vacuum collection device must be of sufficient power to render all areas being cleaned under negative pressure, such that containment of debris and the protection of the indoor environment are assured.

C. All vacuum devices exhausting air inside the building shall be equipped with HEPA filters (minimum efficiency), including hand-held vacuums and wet-vacuums.

D. All vacuum devices exhausting air outside the facility shall be equipped with Particulate Collection, including adequate filtration to contain Debris removed from the HVAC system. Such devices shall exhaust in a manner that will not allow contaminants to re-enter the facility. Release of debris outdoors must not violate any outdoor environmental standards, codes, or regulations.

E. All methods require mechanical agitation devices to dislodge debris adhered to interior HVAC system surfaces, such that debris may be safely conveyed to vacuum collection devices. Acceptable methods will include those, which will not potentially damage the integrity of the ductwork, nor damage porous surface materials, such as liners inside the ductwork or system components.

F. Methods of Cleaning Fibrous Glass Insulated Components:

1. Fibrous glass thermal or acoustical insulation elements present in any ductwork shall be thoroughly cleaned with HEPA vacuuming equipment, while the HVAC system is under constant negative pressure, and not permitted to get wet in accordance with applicable NADCA and NAIMA standards and recommendations.

G. Cleaning methods used shall not cause damage to fibrous glass components and will render the system capable of passing Cleaning Verification Tests.

H. Damaged Fibrous Glass Material:

1. Evidence of Damage: If there is any evidence of damage, deterioration, delaminating, friable material, mold or fungus growth, or moisture such that fibrous glass materials cannot be restored by cleaning or resurfacing with an acceptable insulation repair coating, they shall be identified for replacement.
2. Replacement: When requested or specified, Contractor must be capable of remediating exposed damaged insulation in ductwork requiring replacement.
3. Replacement Material: In the event fiberglass materials must be replaced, all materials shall conform to applicable industry codes and standards, including those of UL and SMACNA.
4. Replacement of damaged insulation is not covered by this Specification.

3.6 CLEANLINESS VERIFICATION

A. General: Verification of HVAC System cleanliness will be determined after mechanical cleaning and before the application of any treatment or introduction of any treatment-related substance to the HVAC system, including biocidal agents and coatings.

B. Visual Inspection: The HVAC system shall be inspected visually to ensure that no visible contaminants are present.

C. If no contaminants are evident through visual inspection, the HVAC system shall be considered clean; however, the Engineer reserves the right to further verify system cleanliness through Surface Comparison Testing or the NADCA vacuum test specified in the NADCA standards.

D. If visible contaminants are evident through visual inspection, those portions of the system where contaminants are visible shall be re-cleaned and subjected to re-inspection for cleanliness.

E. NADCA vacuum test analysis should be performed by a qualified third party experienced in testing of this nature.

3.7 PRE-EXISTING SYSTEM DAMAGE

A. Contractor is not responsible for problems resulting from prior inappropriate or careless cleaning techniques of others. Any such issues found shall be brought to the attention of the Engineer.

3.8 POST-PROJECT REPORT

A. At the conclusion of the project, the Contractor shall provide a report to the Engineer indicating the following:

1. Success of the cleaning project, as verified through visual inspection and/or gravimetric analysis.
2. Areas of the system found to be damaged and/or in need of repair.

END OF SECTION 230885

SECTION 230900 - AUTOMATIC TEMPERATURE CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections, and Section 230100, “Mechanical General Provisions,” apply to this section.

B. Refer to drawings for unit control sequences, control diagrams, and points lists.

1.2 SCOPE OF WORK

A. The Building Automation System (BAS) manufacturer shall furnish and install a fully integrated building automation system, incorporating direct digital control (DDC) for energy management, equipment monitoring and control, and subsystems with open communications capabilities as herein specified.

B. The Automatic Temperature Controls (ATC) contractor shall be responsible for salvaging the existing controllers from the unit ventilators and returning the equipment to the owner.

C. The installation of the control system shall be performed under the direct supervision of the controls manufacturer with the shop drawings, flow diagrams, bill of materials, component designation or identification number and sequence of operation all bearing the name of the manufacturer. The installing manufacturer shall certify in writing, that the shop drawings have been prepared by the equipment manufacturer and that the equipment manufacturer has supervised their installation. In addition, the equipment manufacturer shall certify, in writing, that the shop drawings were prepared by their company and that all temperature control equipment was installed under their direct supervision.

D. All materials and equipment used shall be standard components, regularly manufactured for this and/or other systems and not custom designed specifically for this project. All systems and components shall have been thoroughly tested and proven in actual use for at least two years.

E. BAS manufacturer shall be responsible for all BAS and Temperature Control wiring for a complete and operable system. All wiring shall be done in accordance with all local and national codes.

F. Controls system shall be upgraded to support new equipment and upgrades. The project shall include the addition of a complete Honeywell direct digital controls system. The controls contractor shall provide all necessary valves, valve actuators, controls, and front-end workstations as required to provide a complete and operable system of new and existing mechanical equipment. Controls contractor to fully investigate the system to ensure a complete transfer of existing controls system and ensure all existing equipment not replaced in this

project is integrated into the new Honeywell Controls system. Controls contractor shall be a Honeywell Authorized Controls Integrator.

1.3 QUALITY ASSURANCE

A. The BAS system shall be designed and installed, commissioned and serviced by manufacturer employed, factory trained personnel. Manufacturer shall have an in-place support facility within 50 miles of the site with technical staff, spare parts inventory and necessary test and diagnostic equipment. Distributors or licensed installing contractors are not acceptable.

B. The manufacturer shall provide a full time, on site, experienced project manager for this work, responsible for direct supervision of the design, installation, start up and commissioning of the B.M.S.

C. The Bidder shall be regularly engaged in the manufacturing, installation and maintenance of BMS systems and shall have a minimum of ten (10) years of demonstrated technical expertise and experience in the manufacture, installation and maintenance of B.M.S. systems similar in size and complexity to this project, a maintained service organization consisting of at least ten (10) competent servicemen for a period of not less than ten years and provide a list of 10 projects, similar in size and scope to this project, completed within the last five years.

D. Materials and equipment shall be the catalogued products of manufacturers regularly engaged in production and installation of automatic temperature control systems and shall be manufacturer's latest standard design that complies with the specification requirements.

E. All BAS peer-to-peer network controllers, central system controllers and local user displays shall be UL Listed under Standard UL 916, category PAZX; Standard ULC C100, category UUKL7; and under Standard UL 864, categories UUKL, UDTZ, and QVAX. and be so listed at the time of bid. All floor level controllers shall comply, at a minimum, with UL Standard UL 91 6category PAZX; Standard UL 864, categories UDTZ, and QVAX. and be so listed at the time of Bid.

F. The BAS peer-to-peer network controllers and local user display shall also comply with the Australian Electromagnetic Compatibility (EMC) Framework and bear the C-Tic Mark to show compliance. The purpose of the regulation is to minimize electromagnetic interference between electronic products, which may diminish the performance of electrical products or disrupt essential communications.

G. DDC peer-to-peer controllers shall be compliant with the European EMC Directive, Standards EN 50081-2 and EN 50082-2, at the Industrial Levels. Additionally, the equipment shall be compliant with the European LVD Directive and bear the CE mark in order to show compliance to both Directives.

H. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference and be so labeled.

I. The manufacturer of the building automation system shall provide documentation supporting compliance with ISO-9002 (Model for Quality Assurance in Production, Installation, and

Servicing) and ISO-140001 (The application of well-accepted business management principles to the environment). The intent of this specification requirement is to ensure that the products from the manufacturer are delivered through a Quality System and Framework that will assure consistency in the products delivered for this project.

J. This system shall have a documented history of compatibility by design for a minimum of 15 years. Future compatibility shall be supported for no less than 10 years. Compatibility shall be defined as the ability to upgrade existing field panels to current levels of technology and extend new field panels on a previously installed network.

K. Compatibility shall be defined as the ability of any existing field panel microprocessor to be connected and directly communicate with new field panels without bridges, routers or protocol converters.

L. The building automation system (BAS) shall conform to the following standard for Year 2000 Compliance:

1. The system shall not produce errors when processing date data (including calculating, sorting or displaying) from, into and between the years 1999 and 2000 and leap year calculations in the year 2000, to the extent that date information provided from other systems, is accurate.
2. The BAS supplier shall provide documentation to support the individual device(s) Year 2000 Compliance. This document shall include a listing of compliance by device and any exceptions to the above definition.

1.4 SUBMITTALS

A. Submit 6 complete sets of documentation in the following phased delivery schedule:

1. Equipment data cut sheets

2. System schematics, including:

   a. Sequence of operations
   b. Point names
   c. Point addresses
   d. Interface wiring diagrams
   e. Panel layouts
   f. System riser diagrams
   g. Auto-CAD compatible record drawings

B. Upon project completion, submit operation and maintenance manuals, consisting of the following:

1. Index sheet, listing contents in alphabetical order
2. Manufacturer's equipment parts list of all functional components of the system
3. Auto-CAD disk of system schematics, including wiring diagrams
4. Description of sequence of operations

5. As-Built interconnection wiring diagrams
6. Operator's Manual
7. Trunk cable schematic showing remote electronic panel locations and all trunk data
8. List of connected data points, including panels to which they are connected and input device (ionization detector, sensors, etc.)
9. Conduit routing diagrams

1.5 WARRANTY

A. Provide all services, materials and equipment necessary for the successful operation of the entire BAS system for a period of one year after substantial completion.

B. The adjustment, required testing, and repair of the system includes all computer equipment, transmission equipment and all sensors and control devices.

C. The on-line support services shall allow the local BAS subcontractor to dial out over telephone lines to monitor and control the facility's building automation system. This remote connection to the facility shall be within 2 hours of the time that the problem is reported. This coverage shall be extended to include normal business hours, after business hours, weekends and holidays.

D. If the problem cannot be resolved on-line by the local office, the national office of the building automation system manufacturer shall have the same capabilities for remote connection to the facility. If the problem cannot be resolved with on-line support services, the BAS manufacturer shall dispatch the appropriate personnel to the job site to resolve the problem within 3 hours of the time that the problem is reported.

PART 2 - PRODUCTS

2.1 PRE-APPROVED CONTROL CONTRACTORS

A. Manufacturers: Subject to compliance with requirements, provide products by the following pre-qualified manufacturers; NO SUBSTITUTIONS.

1. HONEYWELL: Controls provide by licensed Authorized Control Integrator (ACI) contractor only.

B. Pre-Approved Controls Contractors shall also have completed two projects of similar scope to the HVAC Replacement at Gatewood Senior Center. Upon request, contractor shall submit a summary of similar completed projects along with the contact information for an Owner’s Representative who can serve as a reference.

C. No additional control contractors will be considered.

2.2 DDC EQUIPMENT

A. The current Tridium/Niagara/LonWorks Software workstation shall be used as the basis for this project. The workstation database shall be modified to accept the added system graphics, alarms and utilities necessary for this project. The software shall be upgraded to the latest Tridium level required for the applications indicated herein. All cost associated with license modifications, additional node license and software updates shall be furnished and installed by this contractor. The software for Niagara Database generation and the software required for the generation of the local LON DDC controller shall be upgraded to the level recommended by the manufacturer for the current products being installed.

B. Front End Hardware Station: Use Newport News Public School's existing front end workstation.

C. GUI Server Application Software: Include the following: Input/output capability from operator station for monitoring and controlling all of the points listed in the input/output point list. The operator shall be able to monitor and access all points by means of clear concise English names without having to understand or reference hardware point locations or controller programs.

1. Operating System: The GUI shall run on Microsoft Windows 7 or 10.
2. The GUI 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.

3. Real-Time Displays. The GUI, shall at a minimum, support the following graphical features and functions:

    a. 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 GUI shall support the use of scanned pictures.
    b. 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.
    c. Graphics shall support layering and each graphic object shall be configurable for assignment to one a layer. A minimum of six layers shall be supported.

    d. Modifying common application objects, such as schedules, calendars, and set points shall be accomplished in a graphical manner.

        1) Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.

2) Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.

4. 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.
5. 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.

6. System Configuration. At a minimum, the GUI shall permit the operator to perform the following tasks, with proper password access:

   a. Create, delete or modify control strategies.
   b. Add/delete objects to the system.
   c. Tune control loops through the adjustment of control loop parameters.
   d. Enable or disable control strategies.
   e. Generate hard copy records or control strategies on a printer.
   f. Select points to be alarmable and define the alarm state.
   g. Select points to be trended over a period of time and initiate the recording of values automatically.

7. 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.
8. 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.
9. 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.

10. Alarm Console:

    a. 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.
    b. 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.

D. Web Browser Clients:

1. The system shall be capable of supporting 64 clients using a standard Web browser such as Internet Explorer™. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, are only acceptable if 64 licensed copies of the client machine software are provided, installed, and tested.
2. 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 FMCS, shall only be acceptable if 64 workstations or workstation hardware upgrades are provided.
3. 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 Graphical 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.

4. The Web browser client shall support at a minimum, the following functions:

    a. 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.
    b. Graphical screens developed for the GUI shall be the same screens used for the Web browser client. Any animated graphical objects supported by the GUI shall be supported by the Web browser interface.
    c. 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.
    d. Storage of the graphical screens shall be in the Building Control Units (BC), without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client are not acceptable.
    e. Real-time values displayed on a Web page shall update automatically without requiring a manual “refresh” of the Web page.

    f. User’s shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:

        1) Modify common application objects, such as schedules, calendars, and set points 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.

2) 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.
3) View logs and charts
4) View and acknowledge alarms

g. 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 just their 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.
h. 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.

E. Portable Engineering Stations for LON Controllers:

1. It is the intention of this specification to use the owners existing Laptops and Technician's software. The software shall be upgraded to the latest recommended by the manufacturer of the controllers. Contractor to confirm with owner required amount of Laptop upgrades required.

F. Control Units General: Provide an adequate number of control units to achieve monitoring and control of all data points specified and necessary to satisfy the sequence of operation for all mechanical systems shown on the plans. Provide a minimum of one separate controller for each AHU or other HVAC system. Multiple DDC controllers may control one system provided that all points associated with individual control loops are assigned to the same DDC controller. Points used for control loop reset such as outside air or space temperature are exempt from this requirement. Each of the following panel types shall meet the following requirements.

1. Controllers shall be suitable for the anticipated ambient conditions.

a. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures and shall be rated for operation at -40°F to 140°F and 5 to 95% RH, non-condensing.
b. Controllers used in conditioned ambient space shall be mounted in dustproof enclosures and shall be rated for operation at 32°F to 122°F and 5 to 95% RH, non-condensing.

2. Serviceability: Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
3. Memory: The Control Units shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.
4. Diagnostics: The Building Controller shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall assume a predetermined failure mode and generate an alarm notification.
5. Immunity to power and noise: Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal

voltage. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 3 ft.

6. Automatic staggered restart of field equipment after restoration of power and short cycle protection.

G. Universal Network Controllers (UNC) –Area Controllers

1. The existing Universal Network Controllers shall be re-used where possible for the addition of the systems specified herein. The existing LON trunk shall be extended to the new LON controllers and the UNC database shall be modified as required for a complete and operable system with the standards and functionality currently available with the systems installed at Newport News Public Schools. Lesser functionality or accessibility to SNVTS shall not be acceptable.
2. Where the existing Universal Network Controllers (UNC's) cannot be used by a new vendor a new Area Controller with the functionality detailed in this specification shall be provided as indicted by the term UNC herein.

3. The UNC 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 UNC. It shall be capable of executing application control programs to provide:

    a. Calendar functions
    b. Scheduling
    c. Trending
    d. Alarm monitoring and routing
    e. Time synchronization by means of an Atomic Clock Internet site including automatic synchronization
    f. Integration of LonWorks controller data and BACnet controller data
    g. Network Management functions for all LonWorks based devices

4. The Universal Network Controller Type 2 must provide the following hardware features as a minimum:

    a. One Ethernet Port – 10/100 Mbps
    b. Two RS-232 ports
    c. Four RS-RS485 ports electrically isolated
    d. One LonWorks Interface Port – 78KB FTT-10A with Weidmuller connector
    e. Power supply 24 VAC or 24 VDC
    f. Battery Backup
    g. Real-time clock
    h. Processor @ 200 MHz or greater
    i. 64 Mb 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)
    j. 128 Mb Ram or greater

5. The UNC shall provide multiple user access to the system and support for ODBC or SQL. A database resident on the UNC shall be an ODBC compliant database or must provide an ODBC data access mechanism to read and write data stored within it.
6. The UNC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 64 simultaneous users.

7. Event Alarm Notification and Actions:

    a. The UNC shall provide alarm recognition, storage, routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.
    b. The UNC 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.

    c. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but limited to:

        1) To alarm
        2) Return to normal
        3) To fault

    d. Provide for the creation of a minimum of eight of alarm classes for the purpose of routing types and or classes of alarms, i.e.: security, HVAC, Fire, etc.
    e. Provide timed (schedule) routing of alarms by class, object, group, or node.
    f. 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 UNC for each alarm (at a minimum):

        1) Time and date

2) Location (building, floor, zone, office number, etc.)
3) Equipment (air handler #, accessway, 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 UNC 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.

8. Data Collection and Storage:

a. The UNC 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 UNC 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.

9. All log data shall be stored in a relational database in the UNC and the data shall be accessed from a server (if the system is so configured) or a standard Web Browser.
10. All log data, when accessed from a server, shall be capable of being manipulated using standard SQL statements.

11. All log data shall be available to the user in the following data formats:

a. HTML
b. XML
c. Plain Text
d. Comma or tab separated values

12. Systems that do not provide log data in HTML and XML formats at a minimum shall provide as an alternative Microsoft SQL Serverâ, Oracle 8i or Expressâ, Hyperion Solutions™ SQL Server.

13. The UNC shall have the ability to archive its log data either locally (to itself), or remotely to a server or other UNC on the network. Provide the ability to configure the following archiving properties, at a minimum:

    a. Archive on time of day
    b. Archive on user-defined number of data stores in the log (buffer size)
    c. Archive when log has reached its user-defined capacity of data stores
    d. Provide ability to clear logs once archived

14. Audit Log:

    a. Provide and maintain an Audit Log that tracks all activities performed on the UNC. 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 UNC), to another UNC on the network, or to a server. For each log entry, provide the following data:

        1) Time and date
        2) User ID
        3) Change or activity: i.e., Change setpoint, add or delete objects, commands, etc.

15. Database Backup and Storage:

    a. The UNC 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 UNC. The age of the most recently saved database is dependent on the user-defined database save interval.
    c. The UNC 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.

H. Custom Application Control Units: Modular, comprising processor board with programmable, nonvolatile, RAM/EEPROM memory for custom control applications. CAC's shall be provided for Roof Top Units, Boiler Plant, Chiller Plant and other applications as shown on drawings and shall have published Lon-Works™ application source code, device resource files and external interface definitions.

1. Units monitor or control each input/output point; process information; and at least 50 expressions for customized HVAC control including mathematical equations, Boolean logic, PID control loops with anti-windup, sequencers, timers, interlocks, thermostats, enthalpy calculation, counters, interlocks, ramps, drivers, schedules, calendars, OSS, compare, limit, curve fit, and alarms.

2. Stand-alone mode control functions operate regardless of network status. Functions include the following:

    a. Peer to peer primary network level communications supporting BACnet objects and services according to PIC and BIBBs statement. at least 200 LonMark™ Standard Network Variables (SNVTs) per CAC utilizing at least 100 different SNVT types as documented by the LonMark™ Interoperability Association to assure present and future compatibility with third party LonMark™ devices. The 200 LonMark™ SNVTs, minimum, must be configurable in any combination – all inputs or all outputs or any combination of input/outputs in any combination of the 100 different, minimum, SNVT types. The XIF SNVT order shall be definable, rather than random, to provide logical and effective LonMark™ network management. With the submittal package, contractor shall provide CAC performance data that specifies the exact maximum number of SNVTs available in any combination and a list of all available SNVT types including the LonMark™ Interoperability Association SNVT number.
    b. Automatic communications loss detection to maintain normal control functionality regardless of available network communications.
    c. Discrete/digital, analog, and pulse input/outputs.
    d. Monitoring, controlling, or addressing data points.
    e. Local energy management control strategies
    f. Incorporate internal customizable safeties and limits to prevent third party LonMark ™ tools from providing improper and unrealistic inputs to CAC's.

3. Local operator interface port provides for download from and connection to portable workstation.
4. Communication: ASCs shall communicate with the building controller at a baud rate of not less than 78.8 baud using LonWorks ™ communications protocol (EIA 709.1).

I. Application Specific Control Units: Single board construction comprising processor board with programmable, nonvolatile, RAM/EEPROM memory for custom control and unitary applications. ASCs shall be provided for Variable Air Volume Terminals, Rooftop Units, and other applications as shown on the drawings. To assure complete interoperability, all ASCs firmware shall support all mandatory and all optional LonMark™ Standard Network Variables (SNVTs) for their LonMark™ profile as documented by the LonMark™ Interoperability Association. Bidder shall provide proof of ASC compliance for all the mandatory and all optional LonMark™ SNVTs. ASCs shall be based on the Echelon Neuron 3150 microprocessor working with the ASCs stand alone control program.

1. Units monitor or control each input/output point; process information; and download from the operator station.

2. Stand-alone mode control functions operate regardless of network status. Functions include the following:

    a. Peer to peer primary network level communications with automatic communications loss detection to maintain normal control functionality regardless of available network communications.

b. Discrete/digital, analog, and pulse input/output.
c. Monitoring, controlling, or addressing data points.
d. Appropriate LonMark™ profiles for specific unitary applications.
e. Support for all mandatory and optional LonMark™ Standard Network Variable Types (SNVTs) for their LonMark™ profile as documented by the LonMark™ Interoperability Association
f. Internal customizable safeties and limits to prevent third party LonMark™ tools from providing improper and unrealistic inputs to ASC's.

3. Local operator interface port located on ASC and ASC sensor provides for download from or upload to portable workstation. All Lon bus devices shall be accessible from either port.
4. ASC units monitor or control each input/output point; process information; and at least 50 expressions for customized HVAC control including mathematical equations, Boolean logic, PID control loops with anti-windup, sequencers, timers, interlocks, thermostats, counters, interlocks, compare, limit, and alarms.
5. All ASC Controller setpoints shall be digital display setpoints with dual setpoint limits (integral hard limits which the user cannot exceed above and below and independent soft limits which are hidden from the user). All digital setpoints shall be network retentive after power outages and after replacement of sensor.

J. ASC Room Sensor:

1. The ASC Sensor shall provide room temperature value to the ASC.
2. The ASC Sensor shall connect directly to the ASC and shall not utilize any of the I/O points of the controller.
3. The ASC Sensor shall provide a two-wire connection to the controller that is polarity and wire type insensitive.
4. There shall be one ASC Sensor per floor wired so that the communication jack will provide for a connection to the LON communication trunk to which the ASC controller is connected.
5. By connecting to this ASC Sensor, the connected controller, and all other devices on the LON bus shall be accessible by the Portable Engineering Station.
6. The ASC Sensor shall be provided in a modular configuration that allows for the rough in of all wiring without the presence of the electronics or esthetic covering.
7. The ASC Sensor shall be provided in a modular configuration that allows for the rough in of all wiring without the presence of the electronics or esthetic covering.
8. The ASC Sensor shall allow for the customization of the color on the esthetic covering as a standard offering.

9. The ASC Sensor shall be supplied in the following manner:

a. Digital readout for showing (typically) the current temperature.
b. LED indication of override state.
c. Up/Down keys to allow 3-degree adjustment of the current setpoint

K. ASC – Packaged Rooftop Controller Functionality: Controls shall be microprocessor based as shown in the drawings or indicated in the sequence of operations. The ASC shall be a single integrated package consisting of a microprocessor, power supply, field terminations, and

application software. The units shall be started and stopped from the BMS. A low limit protection thermostat in the mixed air section of the unit shall close down the outdoor air damper, open coil valves, and alarm the BMS when a temperature below 38°F (adjustable) is sensed. All input/output signals shall be directly hardwired to the ASC controller. In all cases, the controller shall automatically resume proper operation following the return of power to, or control by the ASC.

1. All ASCs must have an operating temperature range -40°F to 140°F and 5 to 95% RH, non-condensing because they are located in the proximity of extreme temperatures (hot water/steam pipes or the outdoor air.)
2. All ASCs shall have capability for both ASHRAE Cycle II and ASHRAE Cycle III fully tested and validated. Bidder shall provide application documentation for ASC ASHRAE cycle II and III compliance including sequence of operation, controller program, and available SNVT's. The control program shall also be fully customizable in the field to accommodate any local or project specific requirements that may be required.
3. All duct averaging sensors for ASCs must be true continuous averaging units that sense the mean temperature over the complete length of the sensor end to end. Sensors that provide four or nine sensing points, which may be accurate due to air temperature stratifications, are not acceptable.
4. All ASCs shall be easily replaceable for ease of future maintenance and to minimize downtime.
5. The outputs of the ASC shall be of the relay Form C and universal analog form. All digital outputs shall be relay type Form C. ASC devices utilizing non-relay outputs shall provide an interface relay for all points. All analog outputs shall be programmable for their start points and span to accommodate the control devices.

L. LANs: Capacity for a minimum of 64 client workstations connected to multi-user, multitasking environment with concurrent capability to access DDC network or control units.

1. Enterprise Network LAN:

   a. Media: Ethernet (IEEE 802.3), peer-to-peer CSMA/CD, operating at 10 or 100 Mbps, cable 10 Base-T, UTP-8 wire, category 5

2. Primary Controller Network LAN:

   a. Media: LonTalk™ (EIA 709.1), peer to peer, FTT-10 operating at 78.8K.

3. Secondary Network LAN (If Required):

   a. Media: LonTalk™ (EIA 709.1), peer to peer, FTT-10 operating at 78.8K

4. Remote Connection:

   a. ISDN, ADSL, T1 or dial-up connection, monthly charges paid by building owner

M. Software:

1. Controller and System HVAC Applications:

a. Update to latest version of software at Project completion. Include and implement the following capabilities from the control units if documented by the specified sequence of operations:

1) Load Control Programs: Demand limiting, duty cycling, automatic time scheduling, start/stop time optimization, occupied/unoccupied setback/setup, DDC with PID, and trend logging.
2) HVAC Control Programs: Optimal run time, supply-air reset, and enthalpy/economizer switchover.
3) Boiler Control Programs: Boiler plant optimization with hot water supply reset, boiler and pump equipment selection and sequencing.
4) Programming Application Features: Include trend point, alarm reporting, alarm lockout, weekly scheduling, staggered start, sequencing, anti-short cycling and calculated point.

2. Controller and Network Setup Software:

a. Network managements tools for LonTalk™ protocol and the ANSI / ASHRAE™ Standard 135-1995, BACnet protocol shall be provided including a network learn function, LonMark bindings, service pins, winks, and diagnostics.

2.3 CONTROL PANELS

A. Local Control Panels: Unitized NEMA 1 cabinet with suitable brackets for wall or floor mounting, located adjacent to each system under automatic control. Provide common keying for all panels.

1. Fabricate panel's 0.06-inch thick, furniture-quality steel, or extruded-aluminum alloy, totally enclosed, with hinged doors and keyed lock and with manufacturer's standard shop-painted finish.
2. Interconnections between internal and face-mounted devices pre-wired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL Listed for 600-volt service, individually identified per control/interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.
3. Door-Mounted Equipment: Flush-mount (on hinged door) manual switches, including damper-positioning switches, changeover switches, thermometers, and gauges.
4. Provide ON/OFF power switch with over-current protection for control power sources to each local panel.

2.4 SENSORS

A. Electronic Temperature Sensors: Vibration and corrosion resistant for wall, immersion, or duct mounting as required.

1. Resistance Temperature Detectors: Platinum, thermistor, or Balco

a. Accuracy: Plus or minus 0.2 percent at calibration point; thermistors shall have a maximum 5-year drift of no more than .225°F maximum error of no more than .36°F
b. Wire: Twisted, shielded-pair cable
c. Insertion Elements in Ducts: Single point, 6 inches long; use where not affected by temperature stratification or where ducts are smaller than 4 sq. ft.
d. Averaging Elements in Ducts: 60 inches long, flexible for use where prone to temperature stratification or where ducts are larger than 4 sq. ft.; 264 inches long, flexible for use where prone to temperature stratification or where ducts are larger than 16 sq. ft; length as required.
e. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches.
f. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.

2. Humidity Sensors: Bulk polymer sensor element.

a. Accuracy: 2 percent at 10-90% RH with linear output.
b. Room Sensors: Range of 0 to 100 percent relative humidity
c. Duct and Outside-Air Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity.

3. Static-Pressure Transmitter: Non-directional sensor with suitable range for expected input, and temperature compensated.

a. Accuracy: +/- 1 percent of full scale with repeatability of 0.5 percent.
b. Output: 4 to 20 mA, 0-5 vDC, 0-10 vDC.
c. Building Static-Pressure Range: -.1 to .1, -0.25 to 0.25, -.5 to .5, -1.0 to 1.0 IN WC., jumper selectable.
d. Duct Static-Pressure Range: 0 to 1, 0 to 2.5, 0 to 5, 0 to 10 IN WC., jumper adjustable.

4. Pressure Transmitters: Direct acting for gas, liquid, or steam service; range suitable for system; proportional output 4 to 20 mA.

B. Equipment operation sensors as follows:

1. Status Inputs for Fans: Differential-pressure switch with adjustable range of 0 to 5 IN WC.
2. Status Inputs for Pumps: Differential-pressure switch piped across pump with adjustable pressure-differential range of 8 to 60 psig.
3. Status Inputs for Electric Motors: Current-sensing relay with current transformers, adjustable and set to 175 percent of rated motor current.

C. Electric Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- or automatic-reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below set point.

1. Bulb Length: Minimum 20 feet

2. Quantity: One thermostat for every 20 sq. ft. of coil surface.
3. Quantity: One thermostat for every 20 sq. ft. of coil surface.

2.5 ACTUATORS

A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action under all environmental conditions (temperature, low power voltage fluctuations, tight seal damper design, maximum air and water flow forces).

1. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
2. Nonspring-Return Motors for Valves Larger Than NPS 2-1/2": Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
3. Spring-Return Motors for Valves Larger Than NPS 2-1/2": Size for running and breakaway torque of 150 in. x lbf.
4. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
5. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.

B. Electronic Damper and Valve Actuators: Direct-coupled type non-hydraulic designed for minimum 100,000 full-stroke cycles at rated torque. The actuator shall have rating of not less than twice the thrust needed for actual operation of the damper or valve

1. Coupling: V-bolt and V-shaped, toothed cradle.
2. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
3. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on non-spring-return actuators.
4. Actuators shall have the ability to be tandem mounted.
5. All spring-return actuators shall have a manual override. Complete manual override shall take no more than 10 turns.
6. Power Requirements (Two-Position Spring Return): 24V ac or dc, Maximum 10VA.
7. Power Requirements (Modulating): Maximum 15 VA at 24V ac.
8. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
9. Temperature Rating: -22°F to 140ºF.
10. Run Time: 200 seconds open, 40 seconds closed.
11. All actuators shall have a 5-year warranty.

C. Electronic Damper and Valve Actuators:

1. Provide control valves.
2. Size for torque required for valve close-off at maximum pump differential pressure (regardless of water loop system pressures).
3. Valve and Actuators shall come from the factory fully assembled.

4. Spring Return Manual Override shall come with a 10 Degree Valve Preload to assure tight close off.

2.6 CONTROL CABLE

A. LON communication cable shall be category 4.

2.7 VARIABLE FREQUENCY DRIVES

A. Variable Frequency Drives are to be provided by controls contractor. Refer to 230500 Specification Section 2.9A for VFD requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. The project plans shall be thoroughly examined for control device and equipment locations. Any discrepancies, conflicts, or omissions shall be reported to the Architect/Engineer for resolution before rough-in work is started.

B. The Contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the Engineer for resolution before rough-in work is started.

C. The Contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate, or if any discrepancies occur between the plans and the Contractor's work and the plans and the work of others, the Contractor shall report these discrepancies to the Engineer and shall obtain written instructions for any changes necessary to accommodate the Contractor's work with the work of others.

3.2 PROTECTION

A. The Contractor shall protect all work and material from damage by its employees and/or subcontractors and shall be liable for all damage thus caused.

B. The Contractor shall be responsible for its work and equipment until finally inspected, tested, and accepted.

3.3 COORDINATION

A. Site:

1. The project coordination between trades is the responsibility of the prime contractor who is the one tier higher contractual partner, such as Mechanical Contractor, General Contractor, Construction Manager, Owner or Owner's representative as applicable.
2. The Controls Contractor shall follow prime contractor's job schedule and coordinate all project related activities through the prime contractor except otherwise agreed or in minor job site issues. Reasonable judgment shall be applied.
3. Where the work will be installed in close proximity to, or will interfere with, work of other trades, the Contractor shall assist in working out space conditions to make a satisfactory adjustment.
4. If the Contractor deviates from the job schedule and installs work without coordinating with other trades, so as to cause interference with work of other trades, the Contractor shall make the necessary changes to correct the condition without extra charge.
5. Coordinate and schedule work with all other work in the same area, or with work that is dependent upon other work, to facilitate mutual progress.

B. Submittals:

1. Refer to the "Submittals" paragraph in PART 1 of this Specification for requirements.

C. Test and Balance:

1. The Contractor shall furnish a single set of all tools necessary to interface to the control system for test and balance purposes.
2. The Contractor shall provide training in the use of these tools. This training will be planned for a minimum of 2 hours.

D. Coordination with controls specified in other Sections or Divisions:

1. Other Sections and/or Divisions of this Specification include controls and control devices that are to be part of or interfaced to the control system specified in this Section. These controls shall be integrated into the system and coordinated by the Contractor as follows:

    a. Each supplier of controls product is responsible for the configuration, programming, startup, and testing of that product to meet the sequences of operation described in this Section.
    b. The Contractor shall coordinate and resolve any incompatibility issues that arise between the control products provided under this Section and those provided under other Sections or Divisions of this Specification.
    c. The Contractor is responsible for providing all controls described in the Contract Documents regardless of where within the Contract Documents these controls are described.

E. The Contractor is responsible for the interface of control products provided by multiple suppliers regardless of where this interface is described within the Contract Documents.

3.4 GENERAL WORKMANSHIP

A. Install equipment, piping, and wiring/raceway parallel to building lines (i.e., horizontal, vertical, and parallel to walls) wherever possible.

B. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.

C. Install all equipment in readily accessible locations as defined by Chapter 1, Article 100, Part A of the National Electrical Code (NEC).

D. Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.

E. All equipment, installation, and wiring shall comply with acceptable industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices.

3.5 FIELD QUALITY CONTROL

A. All work, materials, and equipment shall comply with the rules and regulations of applicable local, state, and federal codes and ordinances as identified in PART 1 of this Specification.

B. Contractor shall continually monitor the field installation for code compliance and quality of workmanship.

C. Contractor shall have work inspected by local and/or state authorities having jurisdiction over the work.

3.6 WIRING

A. All control and interlock wiring shall comply with national and local electrical codes and Division 26 of this Specification. Where the requirements of this Section differ from those in Division 26, the requirements of this Section shall take precedence.

B. All NEC Class 1 (line voltage) wiring shall be UL-Listed in approved 3/4" conduit according to NEC and Division 26 requirements.

C. All low-voltage wiring shall meet NEC Class 2 requirements. (Low-voltage power circuits shall be sub fused when required to meet Class 2 current limit.)

D. Where NEC Class 2 (current-limited) wires are in concealed and accessible locations, including ceiling return air plenums, approved cables not in conduit may be used provided that cables are UL-Listed for the intended application. For example, cables used in ceiling plenums shall be UL-Listed specifically for that purpose.

E. All wiring in mechanical, electrical, or service rooms, or where subject to mechanical damage, shall be installed in conduit.

F. Do not install Class 2 wiring in conduit containing Class 1 wiring. Boxes and panels containing high voltage wiring and equipment may not be used for low-voltage wiring except for the purpose of interfacing the two (e.g., relays and transformers).

G. Do not install wiring in conduit containing tubing.

H. Where plenum-rated cable is run exposed, wiring is to be run parallel along a surface or perpendicular to it and neatly tied at 3 m (10 ft) intervals.

I. Where plenum-rated cable is used without conduit, it shall be supported from or anchored to structural members. Cables shall not be supported by or anchored to ductwork, electrical conduits, piping, or ceiling suspension systems.

J. All wire-to-device connections shall be made at a terminal block or wire nut. All wire-to-wire connections shall be at a terminal strip or wire nut.

K. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.

L. Maximum allowable voltage for control wiring shall be 120 V. If only higher voltages are available, the Contractor shall provide step-down transformers or interposing relays.

M. All plenum-rated wiring shall be installed as continuous lengths, with no splices permitted between termination points.

N. All wiring in conduit shall be installed as continuous lengths, with no splices permitted between termination points or junction boxes.

O. Maintain fire rating at all penetrations. Install plenum wiring in sleeves where it passes through walls and floors.

P. Size and type of conduit and size and type of wire shall be the responsibility of the Contractor, in keeping with the manufacturer’s recommendations and NEC requirements, except as noted elsewhere.

Q. Include one pull string in each conduit 3/4 in. or larger.

R. Control and status relays are to be located in designated enclosures only. These enclosures can include packaged equipment control panel enclosures unless they also contain Class 1 starters.

S. Conceal all conduit, except within mechanical, electrical, or service rooms. Install conduit to maintain a minimum clearance of 15 cm (6 in.) from high-temperature equipment (e.g., steam pipes or flues).

T. Secure conduit with conduit clamps fastened to the structure and spaced according to code requirements. Conduit and pull boxes may not be hung on flexible duct strap or tie rods. Conduits may not be run on or attached to ductwork.

U. Adhere to this Specification's Division 26 requirements where conduit crosses building expansion joints.

V. The Contractor shall terminate all control and/or interlock wiring and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site.

W. Flexible metal conduits and liquid-tight, flexible metal conduits shall not exceed 1 m (3 ft) in length and shall be supported at each end. Flexible metal conduit less than 1/2 inch electrical trade size shall not be used. In areas exposed to moisture, including chiller and boiler rooms, liquid-tight, flexible metal conduits shall be used.

X. Conduit must be adequately supported, properly reamed at both ends, and left clean and free of obstructions. Conduit sections shall be joined with couplings (according to code). Terminations must be made with fittings at boxes and ends not terminating in boxes shall have bushings installed.

3.7 COMMUNICATION WIRING

A. The Contractor shall adhere to the items listed in the "Wiring" paragraph in PART 3 of the Specification.

B. All cabling shall be installed in a neat and workmanlike manner. Follow manufacturer's installation recommendations for all communication cabling.

C. Do not install communication wiring in raceway and enclosures containing Class 1 or other Class 2 wiring.

D. Maximum pulling, tension, and bend radius for cable installation, as specified by the cable manufacturer, shall not be exceeded during installation.

E. Contractor shall verify the integrity of the entire network following the cable installation. Use appropriate test measures for each particular cable.

F. When a cable enters or exits a building, a lightning arrestor must be installed between the lines and ground. The lighting arrestor shall be installed according to the manufacturer's instructions.

G. All runs of communication wiring shall be un-spliced length when that length is commercially available.

H. All communication wiring shall be labeled to indicate origination and destination data.

I. Grounding of coaxial cable shall be in accordance with NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."

3.8 INSTALLATION OF SENSORS

A. General:

1. Install sensors in accordance with the manufacturer's recommendations.
2. Mount sensors rigidly and adequately for the environment within which the sensor operates.
3. Room temperature sensors shall be installed in existing junction boxes.
4. All wires attached to sensors shall be air sealed in their raceways or in the wall to stop air transmitted from other areas affecting sensor readings.
5. Low-limit sensors used in mixing plenums shall be installed in a serpentine manner horizontally across the full face of the coil.

3.9 INSTRUMENTATION INSTALLED IN PIPING SYSTEMS

A. Actuators:

1. Electric/Electronic:

a. Valves: Actuators shall be connected to valves with adapters approved by the actuator manufacturer. Actuators and adapters shall be mounted following the actuator manufacturer's recommendations.

3.10 IDENTIFICATION OF HARDWARE AND WIRING

A. All wiring and cabling, including that within factory-fabricated panels shall be labeled at each end within 5 cm (2 in.) of termination with the DDC address or termination number.

B. Permanently label or code each point of field terminal strips to show the instrument or item served.

C. Identify control panels with minimum 1 cm (1/2 in.) letters on laminated plastic nameplates.

D. Identify all other control components with permanent labels. All plug-in components shall be labeled such that removal of the component does not remove the label.

E. Identify room sensors with nameplates.

F. Manufacturers' nameplates and UL or CSA labels are to be visible and legible after equipment is installed.

G. Identifiers shall match record documents.

3.11 PROGRAMMING

A. Provide sufficient internal memory for the specified sequences of operation and trend logging.

B. Point Naming: System point names shall be modular in design, allowing easy operator interface without the use of a written point index. Point Naming standard shall be agreed upon between Owner and BAS contractor. Refer to "Submittals" in PART 1.

C. Software Programming:

1. Provide programming for the system and adhere to the sequences of operation provided. The Contractor also shall provide all other system programming necessary for the operation of the system, but not specified in this document. Imbed into the control program sufficient comment statements to clearly describe each section of the program. The comment statements shall reflect the language used in the sequences of operation and be of different font and color in text editor. Use the appropriate technique based on one of the following programming types:

   a. Text-based:

      1) Must provide actions for all possible situations
      2) Must be modular and structured
      3) Must be commented
      4) Must provide line by line programming and compilation wizard to allow for ease of editing.

   b. Graphic-based:

      1) Must provide actions for all possible situations
      2) Must provide programming and compilation wizard to allow for ease of editing.
      3) Must be documented

D. Operator Interface:

1. Standard graphics—Provide graphics for all mechanical systems and floor plans of the building. This includes each chilled water system, hot water system, chiller, boiler, air handler, and all terminal equipment. Point information on the graphic displays shall dynamically update. Show on each graphic all input and output points for the system. Also show relevant calculated points, such as setpoints.
2. Show terminal equipment information on a "graphic" summary table. Provide dynamic information for each point shown.
3. The Contractor shall provide all the labor necessary to install, initialize, start up, and troubleshoot all operator interface software and its functions as described in this Section. This includes any operating system software, the operator interface database, and any third-party software installation and integration required for successful operation of the operator interface.
4. Contractor shall provide necessary programming to create all reports referred to in PART 2, "Operator Interface Software."

3.12 CONTROL SYSTEM CHECKOUT AND TESTING

A. Perform a three-phase commissioning procedure consisting of field I/O calibration and commissioning, system commissioning and integrated system program commissioning. Document all commissioning information on commissioning data sheets that shall be submitted prior to acceptance testing. Commissioning work that requires shutdown of system or deviation from normal function shall be performed when the operation of the system is not required. The commissioning must be coordinated with the Owner and Construction Manager to ensure systems are available when needed. Notify the operating personnel, in writing, of the testing schedule so that authorized personnel from the Owner and Construction Manager are present throughout the commissioning procedure. Controls Contractor to coordinate commissioning requirements with section 230800.

B. Phase I – Field I/O Calibration and Commissioning:

1. Verify that each control panel has been installed according to plans, specifications, and approved shop drawings. Calibrate, test, and have signed off each control sensor and device. Commissioning to include, but not be limited to:

   a. Sensor accuracy at 10, 50 and 90% of range.
   b. Sensor range.
   c. Verify analog limit and binary alarm reporting.
   d. Point value reporting.
   e. Binary alarm and switch settings.
   f. Actuator and positioner spring ranges if pneumatic actuation is utilized.
   g. Fail safe operation on loss of control signal, pneumatic air, electric power, network communications, etc.

C. Phase II – System Commissioning:

1. Each BMS program shall be put on line and commissioned. The Contractor shall, in the presence of the Owner and Construction Manager, demonstrate each programmed sequence of operation and compare the results, in writing. In addition, each control loop shall be tested to verify proper response and stable control, within specified accuracy. System program test results shall be recorded on commissioning data sheets and submitted for record. Any discrepancies between the specification and the actual performance will be immediately rectified and re-tested.

D. Phase III – Integrated System Program Commissioning:

1. Tests shall include, but not be limited to:

   a. Data communication, both normal and failure modes.
   b. Fully loaded system response time.
   c. Impact of component failures on system performance and system operation.
   d. Time/Date changes.
   e. End of month/end of year operation.
   f. Season changeover.
   g. Global application programs and point sharing.
   h. System backup and reloading.
   i. System status displays.

j. Diagnostic functions.
k. Power failure routines.
l. Battery backup.
m. Testing of all electrical and HVAC systems with other division of work.

2. Submit for approval, a detailed acceptance test procedure designed to demonstrate compliance with contractual requirements. This Acceptance test procedure will take place after the commissioning procedure but before final acceptance, to verify that sensors and control devices maintain specified accuracy and the system performance does not degrade over time.
3. Using the commissioning test data sheets, the Contractor shall demonstrate each point. The Contractor shall also demonstrate 100% of the system functions. The Contractor shall demonstrate all points and system functions until all devices and functions meet specification.
4. The BMS Contractor shall supply all instruments for testing. Instruments shall be turned over to the Owner after acceptance testing.

5. All test instruments shall be submitted for approval prior to their use in commissioning.

   a. Test Instrument Accuracy:

      1) Temperature: 1/4°F or 1/2% full scale, whichever is less.
      2) Pressure: High Pressure (PSI): 1/2 PSI or 1/2% full scale, whichever is less.
      3) Low Pressure: 1/2% of full scale (in w.c.).
      4) Electrical: 1/4% full scale.

6. After the above tests are complete and the system is demonstrated to be functioning as specified, a 30-day performance test period shall begin. If the system performs as specified throughout the test period, requiring only routine maintenance, the system shall be accepted. If the system fails during the test, and cannot be fully corrected within 8 hours, the Owner may request that performance tests be repeated.

3.13 CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE

A. Demonstration:

1. Prior to acceptance, the control system shall undergo a series of performance tests to verify operation and compliance with this Specification. These tests shall occur after the Contractor has completed the installation, started up the system, and performed his/her own tests.
2. The tests described in this Section are to be performed in addition to the tests that the Contractor performs as a necessary part of the installation, start-up, and debugging process and as specified in the “Control System Checkout and Testing” paragraph in PART 3 of this Specification. The Engineer will be present to observe and review these tests. The Engineer shall be notified at least 10 days in advance of the start of the testing procedures.

3. The demonstration process shall follow that approved in PART 1, "Submittals." The approved checklists and forms shall be completed for all systems as part of the demonstration.
4. The Contractor shall provide at least two persons equipped with two-way communication and shall demonstrate actual field operation of each control and sensing point for all modes of operation, including day, night, occupied, unoccupied, fire/ smoke alarm, seasonal changeover, and power failure modes. The purpose is to demonstrate the calibration, response, and action of every point and system. Any test equipment required to prove the proper operation shall be provided by and operated by the Contractor.
5. As each control input and output is checked, a log shall be completed showing the date, technician's initials, and any corrective action taken or needed.
6. Demonstrate compliance with PART 1, "System Performance."
7. Demonstrate compliance with sequences of operation through all modes of operation.

8. Additionally, the following items shall be demonstrated:

    a. DDC control loop response: The Contractor shall supply trend data output in a graphical form showing the step response of each DDC control loop. The test shall show the loop's response to a change in set point, which represents a change of actuator position of at least 25% of its full range. The sampling rate of the trend shall be from 10 seconds to 3 minutes, depending on the speed of the loop. The trend data shall show for each sample the setpoint, actuator position, and controlled variable values. Any loop that yields unreasonably under-damped or over-damped control shall require further tuning by the Contractor.
    b. Optimum start/stop: The Contractor shall supply a trend data output showing the capability of the algorithm. The change-of value or change-of-state trends shall include the output status of all optimally started and stopped equipment, as well as temperature sensor inputs of affected areas.
    c. Operational logs for each system that indicate all setpoints, operating points, valve positions, mode, and equipment status shall be submitted to the Architect/Engineer. These logs shall cover three 48-hour periods and have a sample frequency of not more than 10 minutes. The logs shall be provided in both printed and electronic formats.

9. Any tests that fail to demonstrate the operation of the system shall be repeated at a later date. The Contractor shall be responsible for any necessary repairs or revisions to the hardware or software to successfully complete all tests.

B. Acceptance:

1. All tests described in this Specification shall have been performed to the satisfaction of both the Engineer and Owner prior to the acceptance of the control system as meeting the requirements of completion. Any tests that cannot be performed due to circumstances beyond the control of the Contractor may be exempt from the completion requirements if stated as such, in writing, by the Engineer. Such tests shall then be performed as part of the warranty.
2. The system shall not be accepted until all forms and checklists completed as part of the demonstration are submitted and approved as required in PART 1, "Submittals."

3.14 TRAINING

A. The Contractor shall provide competent instructors to give full instruction to designated personnel in the adjustment, operation and maintenance of the system installed. Factory employed/ certified instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach. All training shall be held during normal work hours of 8:00 a.m. to 4:30 p.m. weekdays.

B. Provide a minimum of four (4) on-site, on-line, or classroom training sessions throughout the contract period for personnel designated by the Owner. Each session shall be a minimum of two (2) hours each.

END OF SECTION 230900

SECTION 232533 - WATER TREATMENT AND TEMPORARY SUB-MICRON FILTRATION HYDRONIC SYSTEMS

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. Section includes the following for hydronic systems:

1. Automatic chemical-feed equipment
2. Chemicals
3. Temporary hydronic sub-micron filtration

1.3 DEFINITIONS

A. TSS: Total suspended solids are solid materials, including organic and inorganic, that are suspended in the water.

B. TDS: Total dissolved solids consist of salts and other materials that combine with water as a solution.

1.4 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, installation diagrams, and furnished specialties and accessories for the following products:

1. Bypass feeders.
2. Water meters.
3. Wall mounted chemical feed and bleed panels.
4. Chemical injection pumps.
5. Chemical-treatment test equipment.
6. Chemical material safety data sheets.
7. Laser Particle Distribution (LPD) Water Analysis.
8. Spill containment.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For feed and bleed panels including sensors, injection pumps, and controllers to include in emergency, operation, and maintenance manuals.

B. Laser Particle Distribution (LPD) Water Analyses.

C. Chemical service reports for each hydronic system.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Provide and install all chemical, components and additional materials required to maintain proper water treatment in hydronic systems. The contents of this specification are written with the intention to control scale, corrosion and microbiological fouling and provide high quality water for high efficiency HVAC systems.

B. Provide and install temporary sub-micron filtration equipment. Sub-micron filtration should be provided for the duration of construction or a minimum of 90 days to ensure hydronic system is clean and free of TSS. Sub-micron filtration shall reduce TSS to the sub-micron level to reduce system fouling, clogged strainers, system down time, and prevent reduction in design efficiency.

2.2 CLOSED LOOP SYSTEMS

A. Provide and install on each closed water recirculating system, a 5-gallon bypass pot feeder. Feeder shall be of steel construction and shall have a working pressure of 300 psi. Provide inlet, outlet and drain valves. Feeder shall sit on stands and have a drain at the bottom.

B. Provide Jacklyn Industries WM 8588 Neutral pH pre-operation cleaner prior to system start-up to remove oil and mill-scale from system.

C. Provide Jacklyn Industries WM 8676 Nitrite corrosion inhibitor.

2.3 TEMPORARY HYDRONIC SUB-MICRON FILTRATION

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Waltz Engineered Sales Sub-Micron Filtration

B. The Hydronic Sub-Micron Filtration system shall be designed to filter water in closed HVAC hydronic loops. The filter system shall be installed in a side stream method to the hydronic loops to allow the removal of suspended solids down to 0.45 micron nominal. The filters shall be fully automated to perform continuous filtration and backwash cycles based on pressure differential and/or time.

C. Nominal continuous 0.45 sub-micron multi-media for removal of suspended solids. Must use Cross-Radial Flow Technology (percolation filtration is not acceptable), maximizing contact

between process water and the filter's media and not compressing the media with a direct downward force.

D. 16" filters are rated for 35 GPM filtrate capacity. Footprint dimension: 34" wide x 34" length x 65" height. Filter shall be mounted on a portable base.

E. Company supplying rental filtration shall have a minimum of 10 years' experience in sub-micron filtration rental.

F. Contractor shall hire a third-party sub-micron filtration specialist. Start filtration once the system is filled following the pre-clean process, and filter for a minimum of 90 days per system. Approved contractors listed below:

1. Waltz Engineered Sales Sub-Micron Filtration

G. Contractor must provide proof of sanitization proving filter has been properly sanitized to reduce system cross contamination risks.

H. Contact: Waltz Engineered Sales, Inc. (866) 829-0005.

PART 3 - EXECUTION

3.1 WATER ANALYSIS

A. Particle Distribution (LPD) Water Analysis: Filter supplier shall conduct two (2) LPD analyses for each filter to include an initial water sample from all hydronic water circulating loops at the filter inlet. At the end of the 90-day period, one (1) additional water sample will be taken from the filter inlet for performance evaluation. LPD analyses shall be conducted by an independent water analysis laboratory. Before filter is disconnected, contractor shall forward a copy of all documented results to the engineer for final review.

B. Perform an analysis of the domestic supply water on the project site to establish incoming water quality baseline.

3.2 WATER TREATMENT EQUIPMENT INSTALLATION

A. Install bypass piping around the main system pumps.

B. Install all equipment level and plumb.

C. Install Waltz TowerPro Cooling System Chemical Feed and Bleed System level on a wall within 25 feet of system pumps in bypass piping on open loop systems. Use MASON Industries PB mounts in between panel and wall. Install with pumps at a maximum height of 5 feet from the horizontal centerline of pump to the bottom of the chemical containers on the spill containment.

D. Install bleed piping routed to the nearest floor drain.

E. Install spill containment for open chemical containers that are fed to the system by Waltz TowerPro Cooling System Chemical Feed and Bleed System.

F. Line side power wiring shall be provided by Division 26 - Electrical. Provide certified wiring schematics to Division 26 - Electrical for associated equipment

G. Program water treatment controller to inject corrosion inhibitor based on system makeup water quantities. Program controller to feed dual biocides on a biweekly schedule, alternating biocides every week. Bleed system based on conductivity and incoming water quality to control parameters as described in section 3.4.D.

H. Install five gallon shot feeder in main pump bypass piping on closed loop systems (One for each closed loop system).

I. Install inlet and outlet shut-off valves for all hydronic water treatment equipment.

J. Allow enough space to service and use water treatment equipment.

3.3 TEMPORARY HYDRONIC SUB-MICRON FILTRATION INSTALLATION

A. Piping taps for the temporary filter shall be 1 1/2", with 1 1/2" ball valves for filter isolation. Taps shall be located at either 3:00 or 9:00 o'clock on either the supply or return header loop with a minimum distance of 6'– 0" apart. Unit shall be located within 20'-0" of piping taps. All piping to and from filter shall be provided by contractor. Contractor shall coordinate filter taps and location.

B. Backwash Supply: Filter systems shall require city water for backwash at a minimum of 20 GPM at 30-100 PSIG. Piping for backwash shall be minimum 3/4" diameter.

C. Backwash Drain: Filter systems shall require minimum 1" diameter to nearest drain.

D. Electrical: Filter system shall operate at 120V/1ph/60HZ. Electrical cord shall be supplied for receptacle connection.

E. Temporary Filter shall have all necessary components to provide a working sub-micron filtration system on each system for a minimum of 90 days.

3.4 WATER TREATMENT SERVICE

A. One sole contractor shall be responsible for administering the cleaning, flushing, filtering, and complete water treatment process.

B. Following initial fill and leak test by mechanical contractor, water treatment contractor shall install pre-treatment cleaner for the removal of oil, dirt, and mill-scale from the construction process. Allow cleaner to circulate for 24-48 hours. Mechanical contractor shall operate all system isolation valves and coordinate with the controls contractor to ensure all legs of the

hydronic system have been opened. All components shall be on-line with exception to the equipment utilizing flushing bypasses to prevent unit clogging during the startup and cleaning process.

C. After system has been circulated for the recommended amount of time, begin a running flush to remove the cleaner chemical from the system. Flush system until the pH of system is within 0.5 of the domestic water pH and 10% of the domestic conductivity.

D. Install corrosion inhibitor for all systems and maintain system parameters within the following limits:

1. Closed Loop Systems:

Parameter	Limit
Total Hardness (ppm)	30-500
Alkalinity (ppm)	30-500
Chlorides (ppm)	Less than 200
Conductivity (µS/cm)	Less than 3,000
pH	8-11
TDS (ppm)	Less than 2,000
Sodium Nitrite (ppm)	800-1200

E. Install and start sub-micron filters on all hydronic systems and perform initial LPD Analyses.

F. The water treatment contractor shall make regular visits to the site during the first year's operation (once a month). A report containing findings and recommendations shall be submitted to the Owner following each visit.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

END OF SECTION 232533

SECTION 260100 - ELECTRICAL GENERAL PROVISIONS

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 SCOPE OF WORK

A. This Section of the Specifications describes the material and installation procedures to be followed for furnishing and installing the electrical equipment and material as outlined and described on the contract drawings and as stated in this Division of the Specifications.

B. Where the word “Contractor” appears in this Division of the Specifications, it applies to the Contractor performing the electrical portion of the work, unless specifically indicated otherwise.

C. The Contractor shall install the systems as specified herein and indicated on the contract drawings and shall furnish all labor, material, tools, scaffolds, erection equipment, services and other items of expense as necessary as a part of this Contract. This Contract further includes placing the systems into operation and properly testing, adjusting, balancing and training the owner’s personnel on the use of all items of equipment as specified and as approved by the Architect.

1.3 SUPERVISION

A. The Electrical Contractor shall have a competent and English speaking designated Supervisor who is a Certified Master Electrician on the job site at all times that any electrical work is being performed. This shall include any and all electrical work being accomplished by contractors who are subcontractors to the prime Electrical Contractor.

1.4 DRAWINGS

A. General arrangements of the necessary conduits, feeders, light fixtures, devices, panels, and equipment are indicated on the drawings in diagrammatic form only. Due to the scale of the drawings, offsets, fittings, and accessories may not be shown. Work indicated but having details omitted shall be provided complete to an operating condition with all fittings, wiring, and ancillary equipment and material as required. Where rearrangement is necessary, submit drawings of proposed changes for approval and coordinate and arrange work with consideration to the architectural, structural, mechanical, plumbing, and sprinkler system drawings, the existing building conditions and to the work of the various other building trades. Equipment provided under this Division of the Specifications shall be installed in accordance with the recommendations of the equipment or material manufacturer.

1.5 COORDINATION

A. Coordinate the electrical work with the architectural, structural, mechanical, plumbing, and sprinkler system drawings and work in order to avoid omissions and to eliminate any interference. Report any discrepancies found, as soon as possible, after discovery, to the Architect.

B. The contractor shall be responsible for coordinating with the Division 23 Contractor for providing properly sized circuit breakers to serve mechanical equipment and motors furnished which differ from that specified or indicated. This shall be further understood to include branch circuit wiring, conduit, disconnect switches, etc., in accordance with the appropriate codes and specifications. The cost of providing this increased electrical service and related work shall be included under the applicable section under which the equipment and motors are being furnished, at no additional cost to Owner.

1.6 CODES AND STANDARDS

A. Various recognized codes and standards form a part of these Specifications the same as if written fully herein and shall be followed as minimum requirements. The codes and standards will be referred to by their abbreviated names and are listed below. Reference to these standards shall be understood to mean the latest edition and accumulative supplements which have been adopted by the "Authority Having Jurisdiction," unless noted otherwise.

ASAD	ADA Standards for Accessible Design
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
CBMA	Certified Ballast Manufacturers Association
IBC	International Building Code
ICC	International Code Council
ICEA	Insulated Cable Engineers Association
IECC	International Energy Conservation Code
IEEE	Institute of Electrical and Electronics Engineers
IESNA	Illuminating Engineering Society of North America
NEC 2014	National Electrical Code
NEMA	National Electrical Manufacturers Association
NESC	National Electrical Safety Code
NFPA	National Fire Prevention Association
NFPA 70E	Standard for Electrical Safety in the workplace
OSHA	The Occupational Safety and Health Act
UL	Underwriters Laboratories, Inc.
VUSBC	Virginia Uniform Statewide Building Code, 2015 Edition

B. All equipment, material, apparatus, and work shall conform to the requirements of the NEC. If the Contractor observes that the drawings and specifications are at variance therewith, the contractor shall notify the Architect in writing. If the Contractor performs such work contrary to the above referenced rules and regulations and without written acknowledgment or notice thereto, they shall correct this work and bear all cost arising therefrom.

1.7 NOTICES AND FEES

A. Give all required notices, obtain all necessary permits, and pay all required fees, including any fees associated with temporary electrical power services during construction. Utility company fees, which are for the permanent installation of electrical power services, shall be paid for by the Owner.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. Refer to Specification 013300 “Submittals”, for shop drawing submittal procedures. Submit shop drawings for materials required for this project as indicated herein. Obtain approval from the Architect before manufacture is started on any of same. The shop drawings shall show complete details of the various items, wiring diagrams, etc., and shall be submitted in a sufficient number of copies to allow the Engineer to retain one copy. Approved copies of all shop drawings shall be kept on the job site accessible to the Architect at all times. All new power distribution equipment (panelboards, disconnect switches, and other power related components) shall all be by the same manufacturer.

2.2 ACCEPTABLE MANUFACTURERS

A. The following list states specific names of acceptable manufacturers of particular equipment and indicates the types of material on which submittals shall be made:

	Submittal Information Required:
Power Distribution Equipment (Panelboards ……	Shop Drawings
General Electric / ABB Company	
Square D Company	
Eaton/Cutler-Hammer	
Siemens	
Disconnect Switches	Product Data
General Electric / ABB Company	
Square D Company	
Eaton/Cutler-Hammer	
Siemens	
Surge Protective Devices.....	Product Data
Liebert	
Square D	
Eaton	

Wiring Devices and Cover Plates ..... Product Data
Hubbell
Leviton
Arrow-Hart
Pass and Seymour

Surface Metal Raceway ..... Product Data
Wiremold
Hubbell Incorporated
Mono Systems

B. The following list states other materials for which product data submittals shall be made:

Circuit Breakers (each type)
Conductors (each type)
Conduit (each type)
Fuses (each type)
Surface Metal Raceway (including all accessory components)

C. Catalog numbers and manufacturers are listed as a guide for minimum requirements to be met. Material and equipment of manufacturers other than those listed will be given consideration by the Engineer providing the material meets the minimum requirements set forth in these Specifications and providing the material or equipment will provide satisfactory performance for the intended installation, does not exceed the dimensions and weight of the specified item and meets the aesthetic performance desired of the specified item. Submittals of other than specified equipment shall have indicated on the specification sheets in the shop drawing submittals each item called for in these Specifications by paragraph and subparagraph numbers and/or letters.

D. Refer to Specification Section 012500 for substitution requirements.

E. Any deviation from the manufacturers listed in the preceding list and /or of those stated in the Contract Documents shall be submitted to the Engineer for approval in accordance with Specification Section 260500, “Materials and Methods.” Facsimile transmission of data for review will not be accepted.

F. The Engineer will review for approval, only one substitute for each type of material specified in the Division 26 Contract Documents. If the substitute material is not approved, the Contractor shall provide the material by one of the specified manufacturers. Approval of substitute material is at the sole discretion of the Architect and Owner, and the Contractor shall bear all costs arising therefrom, including any design fees if additional design effort is deemed prudent or necessary by the Architect.

G. Only the types of materials specified herein are approved for use on this project. No other material types will be considered.

PART 3 - EXECUTION

3.1 INSTALLATION

A. "Provide," as used on the drawings and in these Specifications, shall mean furnish, install, connect, adjust, test, and place into operation, except where otherwise specifically stated in the contract documents.

B. Provide coordinated electrical systems, equipment, and material complete with auxiliaries and accessories as required for a complete and operable finished project.

C. Run all conduits concealed except where specifically indicated otherwise. Exposed conduit installation other than where indicated shall be approved by the Architect and Owner prior to installation.

3.2 CLEANING AND PAINTING

A. Remove all dirt, trash, and oil from all raceways, boxes, fittings, cabinets, and panelboards.

B. Protect, to the satisfaction of the Architect, all equipment provided against damage during construction. If damage does occur to any materials, refinish, repair, or replace the equipment or material as directed by the Architect.

3.3 REPAIR OF EXISTING WORK

A. Repair of existing work, demolition, and modification of existing electrical distribution systems shall be performed as follows:

1. Workmanship: Lay out work in advance.

    a. Exercise care when cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, or other surfaces as necessary for proper installation, support, or anchorage of conduit, raceways, or other electrical work. Repair damage to buildings and materials or equipment damaged using skilled craftsmen of the appropriate trades.

2. Existing Concealed Wiring to be Removed:

    a. Existing concealed wiring to be removed shall be disconnected from its source. Remove conductors and cut conduits flush with concrete floors, and top openings with non-shrink grout. Where wood floors are encountered, remove conduit to below wood floor. Where conduit that passes through walls is removed, seal opening in wall with a material that is equal to the fire rating of the material the wall is constructed from.

3. Continuation of Service:

a. Maintain continuity of existing circuits to remain. Existing circuits shall remain energized unless otherwise indicated. Circuits which are to remain but were disturbed during demolition shall have circuit wiring and power restored back to original condition as approved by the Architect. Only materials specified for this project may be used to affect repairs.

3.4 EXCAVATION

A. All excavations shall be made to the proper depth to assure a firm foundation for the work.

3.5 RECORD DRAWINGS

A. Refer to Specification Section 017839 “Project Record Documents”.

3.6 OPERATION AND MAINTENANCE MANUALS

A. Refer to Specification Section 017823 “Operation and Maintenance Data”.

The following list states materials for which Operation and Maintenance Data submittals shall be made:

Power Distribution Equipment (Panelboards, Lighting Contactors & Disconnect Switches)
Surge Protective Devices

3.7 EQUIPMENT INVENTORY

A. Provide a complete equipment inventory for all Electrical Equipment listed below. Refer to Appendix A in this section for the required template. A separate form shall be provided for each new piece of equipment provided.

B. Prior to substantial completion, submit the equipment inventory forms for review. Once approved, include the forms in the operation and maintenance manual.

The following list states materials for which equipment inventory shall be made:

Fire Alarm System Components
Power Distribution Equipment (Panelboards, Lighting Contactors & Disconnect Switches)

APPENDIX A

New Equipment Inventory

Project Name: **(Add Project Name)**

Project Address: **(Add Project Address)**

Description of Item: _____
(ex. Switchboard, Panelboards, Generator, Lighting, etc.)

Classification:

- ☐ Lighting
- ☐ Power Distribution
- ☐ Auxiliary Systems

Building: _____

Equipment Location (Room Number): _____

Date Purchased: _____

Date Placed in Service: _____

Original Cost: _____

Life Expectancy (years): _____

Estimated Replacement Date: _____

Estimated Replacement Cost: _____

Manufacturer: _____

Model/Serial #: _____

END OF SECTION 260100

SECTION 260500 - MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections, and Section 260100, “Electrical General Provisions,” apply to this Section.

1.2 SCOPE OF WORK

A. Provide all labor, material, tools, scaffolds, erection equipment, services and supplies to fabricate, install, connect, adjust, test, and place in operation the electrical and other systems as called for in these Specifications and as indicated on the Contract Drawings.

B. Properly store and protect all material and equipment until installed.

C. All material and equipment shall be new and of the quality noted or specified. Material, equipment, and work of inferior quality will be rejected and shall be removed from the job site immediately upon rejection and replaced. Unacceptable work shall be removed and replaced. All replacement material and work shall be done at the Contractor expense. The Engineer will decide upon the quality of material and equipment furnished and of the work performed.

1.3 WARRANTIES

A. The Contractor shall provide the Owner with a one-year, unlimited material and labor warranty on all work accomplished and materials provided under Division 26, including all components thereof except as otherwise noted herein. The warranty start date is the date of project “Substantial Completion” as determined by the Architect. All warranties shall be submitted as part of the shop drawing submittals.

B. Electronic LED drivers shall be free from defect in material and workmanship for a period of five (5) years from the date of project “Substantial Completion” as determined by the Architect.

C. Electronic LED drivers shall be free from defect in material and workmanship for a period of five (5) years from the date of project “Substantial Completion” as determined by the Engineer.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Electrical material furnished under these Specifications shall be new and listed by UL and shall bear the UL label where labeling service is available for the type of material provided for this project.

2.2 RACEWAYS

A. Raceways shall be of the size indicated or as required by the NEC; whichever is the larger; except where larger conduits are specified on the Contract Drawings. Raceways shall be 1/2" minimum

B. Raceways shall be provided for all electrical systems indicated on the drawings unless specifically indicated otherwise. Raceways shall be hot-dip galvanized rigid steel conduit (GRS), electrical metallic tubing (EMT), flexible steel conduit, or intermediate metallic conduit (IMC). Flexible steel conduit in and outdoors shall be liquid tight.

2.3 CONDUCTORS

A. Conductors shall be of the American Wire Gauge size indicated on the contract drawings or specified herein.

B. All conductors shall be copper.

2.4 OUTLETS

A. Outlet and junction boxes shall be of one-piece galvanized construction of a type and size applicable for use in the location indicated on the contract drawings and as required by the NEC.

B. Locations of outlets for lighting, devices, power, and equipment are indicated on the contract drawings. Owing to the small scale of the drawings, it is not possible to indicate the exact location. Examine the architectural, structural, mechanical, sprinkler system and plumbing drawings, and finish conditions and arrange work as required to meet such conditions to the approval of the Architect.

2.5 FUSES

A. All fuses shall be provided by the Electrical Contractor.

B. Fuses shall be as follows:

1. General: All fuses must carry the UL inspected label. All fuses shall be plainly marked with ampere rating, voltage rating, interrupting capacity when greater than 10,000 Amperes and current limiting where it applies.
2. Interrupting Capacity: Each fuse shall be capable of safely interrupting the maximum short-circuit current available at the point in the circuit where installed.

3. Coordination: Service fuses and the fuses installed in feeder circuits shall be coordinated to provide a selective system of over-current protection.

C. Main, feeder, and branch circuit fuses shall be as follows:

1. Circuits 0 to 600 amperes shall be protected by BUSSMANN Low-Peak, Limitron, or Fusetron (RK5, 200,000 I/C) Fuses rated as indicated on the drawings.
2. Motor Circuits: All motors rated 480 volts or less shall be protected by dual-element fuses rated not in excess of 175% and not less than 125% of motor nameplate rating or as indicated. Larger motors as indicated on drawings where fuse gaps are larger than size required for proper rating of fuse, install "all-metal" fuse reducers.

2.6 LABELING

A. Label all disconnect switches, panelboards and contactors, provided under Division 26 of these Specifications.

B. Labels shall be machine engraved, laminated, Bakelite, nameplate type. Labels shall have black faces with white letters.

C. Size of labels shall be based on the required lettering and lettering size. The following are the minimum requirements for each type of label:

1. Panelboards and Transformers: First lien of label shall state name of panel as shown on drawings. Second line shall state from where the panel is fed. Lettering shall be 3/8" high.

Example: Panel L-100
Fed from MDS
Circuit # _____
Voltage _____

2. HVAC equipment with integral disconnects shall be labeled on the outside of the equipment housing at the location of the disconnect in the same manner as Motor Controllers. The HVAC equipment shall be labeled in ¼" high letters. First lien shall state the name of the equipment as it appears on the electrical drawings. Second line shall state from what panel the equipment is fed.

Example: Roof Top Unit No. RTU-2
Fed from Panel 100
Circuit # _____
Voltage _____

3. Disconnect Switches/Lighting Contactors: Disconnect switches and lighting contactors shall be labeled in 1/4" high letters. First line shall state what the switch/contactor is feeding. Second line shall state from which circuit and panel the switch/contactor is fed.

D. Circuit breakers serving Fire Alarm Control Panels shall be provided with a red, Bakelite nameplate with white letters attached to the panel adjacent to the circuit breaker.

E. Attach labels with a minimum of two rivets or sheet metal screws. Adhesive-backed labeling will not be accepted.

2.7 PULL BOXES

A. Install pull boxes at all necessary points, whether indicated on the drawings or not, to prevent injury to conductor insulation or other damage that might result from pulling resistance or for other reasons necessary for proper installation. Minimum dimensions shall not be less than the NEC requirements and shall be increased if necessary for practical reasons or where required to fit the job condition.

B. Above grade pull boxes shall be constructed of galvanized sheet steel, code gauge, except that not less than 12-gauge shall be used for any box. Where boxes are used in connection with exposed conduit, plain covers attached to the box with a suitable number of countersunk flathead machine screws may be used.

C. All junction and pull box covers shall be labeled indicating the circuits contained therein in a manner that will prevent unintentional interference with circuits during testing and servicing. For example: “HE1-13.” See Specification Section 260534 for additional labeling requirements.

2.8 DISCONNECT SWITCHES

A. Disconnect switches shall conform to governing industry NEMA standards. They shall be listed by UL. Disconnect switches shall be NEMA standard HD, quick-make, quick-break type, and capable of being locked in the off position.

B. Where disconnect switches are indicated or required by the NEC to be weatherproof, furnish NEMA 3R enclosures.

C. Arc Flash Warning Labels: Provide all disconnect switches provided by this project with Arc Flash Warning Labels on the exterior of the switch.

2.9 BRANCH CIRCUITS

A. The branch circuit wiring has been designed to utilize the advantages of multi-wire distribution and shall be installed substantially as indicated on the drawings. Major changes in the grouping or general routing of the branch circuits require prior approval in writing from the Architect/Engineer.

B. The number of conductors in each run of conduit is indicated on the drawings, but where there is a conflict between the number of wires indicated and the actual number required as determined by the functional requirements of the connected load, or where the number of wires was inadvertently omitted from the drawings, the correct number and size of wires as

determined by the functional requirements of the connected load shall govern and be provided at no additional cost.

C. Where individual 120V or 277V homerun circuits are shown on the drawings, they may be combined as follows:

1. No more than three phase conductors plus three neutrals and one ground per conduit.
2. No two of the same phase conductor per conduit.
3. Provide 120V circuits with individual neutrals per circuit. Neutrals may not be shared.
4. Neutral sharing by 277V circuits is acceptable.

2.10 MOTOR DISCONNECTING MEANS

A. Provide a disconnecting means for each motor where indicated on the drawings. A circuit breaker in a panelboard or horsepower rated switch will be acceptable as a disconnecting means, if readily accessible and if located within sight of the motor and in compliance with all codes. A quick-make and quick-break general use tumbler or snap switch will be acceptable for capacities of 20 amperes or less and 300 volts and less, provided the ampere rating of the switch is at least double the rating of the equipment controlled. Switches of 30- to 400-ampere capacity shall be of the enclosed, quick-make and quick-break type, heavy duty, horsepower rated. Switches shall disconnect all ungrounded conductors and shall disconnect grounded conductors if required by the NEC or if called out on the drawings to do so. Switches shall be fusible type where indicated on the drawings.

2.11 CABLE TIES

A. Provide cable ties in the length required. Standard, indoor cable ties shall be 7.9 inches in length minimum, 0.19 inches in width and 0.47 inches thick. The tensile strength shall be 50 pounds minimum and the maximum bundle diameter shall be 2 inches. Standard cable ties shall be black in color. Plenum rated cable ties shall be 6 inches in length minimum, .075 inches in width and 0.1 inches thick. The tensile strength shall be 50 pounds minimum and the maximum bundle diameter shall be 1.5 inches. Plenum rated cable ties shall be maroon in color.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install material in a first-class and workmanlike manner to the satisfaction of the Architect.

END OF SECTION 260500

SECTION 260519 - CONDUCTORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections, and Section 260100, “Electrical General Provisions,” apply to this Section.

1.2 SCOPE OF WORK

A. Feeder and branch circuit wiring shall conform to the requirements of the NEC, and shall meet all relevant ASTM specifications.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Provide electrical wires, cables, and connectors of manufacturer’s standard materials, as indicated by published product information; designed and constructed as recommended by manufacturer for a complete installation and for the application indicated. Provide copper conductors with a conductivity of not less than 98% at a temperature of 20°C (68°F).

B. Provide factory-fabricated wires of sizes, ampacity ratings, and materials for applications and services indicated. Where not indicated, provide proper wire selection as determined by installer to comply with project’s installation requirements, the NEC, and NEMA standards. Select from the following UL types those wires with construction features which fulfill project requirements:

1. Type THWN or THHN: Max operating temperature not to exceed 90°C (194°F) (THHN) in dry locations, or 75°C (167°F) (THWN) in wet or dry locations. Insulation, flame-retardant, moisture- and heat-resistant, thermoplastic; outer covering, nylon jacket; conductor, annealed copper.
2. Type XHHW: For dry and wet locations; max operating temperature 90°C (194°F) for dry locations, and 75°C (167°F) for wet locations. Insulation, flame-retardant, cross-linked synthetic polymer; conductor, annealed copper.

C. Unless specified otherwise, power and lighting conductors shall be 600 volt, Type THWN/THHN, or XHHW.

D. Where light fixtures require 90°C (194°F) conductors, provide only conductors with 90°C (194°F) insulation.

E. Conductors shall be continuous from outlet to outlet with splices made only in pull boxes, junction boxes, and outlet boxes.

F. Do not use wire smaller than #12 AWG for power or lighting wiring.

G. Wiring sizes #12 and #10 AWG shall be solid. Larger sizes may be stranded.

H. Neutral conductors shall not be under sized.

I. Where the standard lug sizes on circuit breakers and the main lugs on a main lug only panelboard will not accept the conductor size specified, provide Burndy Compression Type "AYP" or "AYPO" HYPLUGS or approved equal.

PART 3 - EXECUTION

3.1 SPLICES

A. Splicing connectors must have a metal spring that is free to expand. The spring must be suitably coated to resist corrosion. Each connector size must be listed by UL for the intended purpose. The connectors must be suitably color coded to assure that the proper size is used on the wire combinations to be spliced. Each connector must be capable of withstanding 105°C ambient temperatures. The connectors must be compatible with all common rubber and thermoplastic wire insulations. They must also be capable of making copper-to-copper, copper-to-aluminum, and aluminum-to-aluminum splices. At the Contractor's option, self-strapping electrical tap connectors may be used in wire size and voltage range of the connector. When tape is required for splices, SCOTCHBRAND No. 33, or approved equal, shall be used. Use the plastic tape on PVC and its copolymers and rubber-based pressure-sensitive adhesive. The tape must be applicable at temperatures ranging from 0°F through 100°F without loss of physical or electrical properties. The tape must not crack, slip, or flag when exposed to various environments indoor or outdoor. The tape must also be compatible with all synthetic cable insulations as well as cable splicing compounds.

B. Make splices in conductors #8 AWG and larger with solderless connectors, with molded composition covers.

C. Connect conductor sizes #12 and #10 AWG with pre-insulated spring connectors rated at not less than 105°C. Connectors shall be UL approved for fixture and pressure work. Connectors shall be 3M CO. SCOTCHLOK, Type Y, R, and B, or approved equal.

D. Join or terminate conductors #8 AWG and larger with pressure-type copper connectors and properly tape.

E. All branch circuit, feeder, and control wiring shall be color coded. The color shall be integral with sheath for sizes #12, #10, and #8 AWG. Larger size wire and cable shall be color coded with a minimum 1/2" wide, colored, plastic tape strip. Place strips a minimum of 6" on center anywhere the conductors are accessible and visible. Wire and cable shall be color coded to

match the existing color coding if an existing color code is present. If there is no existing color code, provide the following:

120/208-Volt System	277/480-Volt System
Phase A - black	Phase A - brown
Phase B - red	Phase B - orange
Phase C - blue	Phase C - yellow
Neutral - white	Neutral - gray
Ground - green	Ground - green

F. After all wiring is pulled and ready for operation but prior to placing systems in service, conduct insulation resistance tests in all feeder circuits. Measure the insulation resistance between conductors and between each conductor and ground. Make measurements with an instrument capable of making measurements at an applied potential of 500 Volts.

G. Take readings after the voltage has been applied for a minimum of one minute. The minimum insulation resistance for circuits of #12 AWG conductors shall be 1,000,000 ohms. For circuits of #10 AWG or larger conductor, a resistance based on the allowable ampacity of the conductor shall be as follows:

25 through 50 Amperes	250,000 ohms
51 through 100 Amperes	100,000 ohms
101 through 200 Amperes	50,000 ohms
201 through 400 Amperes	25,000 ohms
401 through 800 Amperes	12,000 ohms
Over 800 Amperes	5,000 ohms

H. Advise the Engineer if the color-coding provided by the utility company differs from that indicated above.

3.2 TEMPORARY WIRING

A. Temporary wiring is not specified nor governed by this Division of the Specifications.

END OF SECTION 260519

SECTION 260525 - SURFACE METAL RACEWAY

PART 1 - GENERAL

1.1 REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections, and Section 260100, “Electrical General Provisions,” apply to this Section.

1.2 SCOPE

A. The work covered under this Section shall include furnishing and installing surface mounted metal raceways complete for all electrical systems as shown on the Drawings and herein specified. Surface raceway systems shall consist of raceway bases, covers, appropriate fittings, dividers, and device mounting plates necessary for a complete installation.

B. All material and equipment shall be new and of the quality noted or specified. Material, equipment, and work of inferior quality will be rejected and shall be removed from the job site immediately upon rejection and replaced. Unacceptable work shall be removed and replaced. All replacement material and work shall be done at the Contractor expense. The Architect will decide upon the quality of material and equipment furnished and of the work performed.

1.3 QUALITY ASSURANCE

A. All equipment, materials, and their installation shall conform to the requirements of the National Electrical Code (NEC), local code requirements, and these Specifications.

B. All equipment and materials shall be listed by Underwriters Laboratories, Inc. (UL) for their intended use and shall bear the UL label.

C. Equipment shall be constructed in accordance with National Electrical Manufacturer's Association (NEMA) standards.

D. Submittals are required in accordance with Section 260100 of these Specifications.

1.4 USES PERMITTED

A. Surface mounted metal raceway shall be used where indicated on the drawings where new wiring is required on existing walls and on new walls as also indicated on the Drawings.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver raceway systems in factory labeled packages.

B. Store and handle in strict compliance with manufacturer's written instructions and recommendations.

C. Protect from damage due to weather, excessive temperature, and construction operations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Surface metal raceways shall be as manufactured by The Wiremold Company, as described herein as the basis of design, or equal products as manufactured by Hubbell Incorporated and Mono Systems.

B. All components and fittings shall be of the same manufacturer, or UL listed as an assembly.

2.2 MATERIALS AND COMPONENTS

A. All surface metal raceways shall be galvanized steel, unless otherwise indicated. Finish shall be ivory in color having a scratch- resistant surface (a polyester topcoat over a colored base) and shall be suitable for field repainting to match surroundings.

B. A full complement of fittings must be available including but not limited to mounting clips and straps, couplings, flat, internal and external elbows, cover clips, tees, entrance fittings, wire clips, support clips, c-hangers, end caps, conduit connectors, bushings, and take-off fittings to adapt to flush wall boxes. The covers shall be painted with an enamel finish; colored to match the raceway. They shall overlap the raceway to hide uneven cuts. All fittings shall be supplied with a base where applicable to eliminate mitering. Transition fittings shall be available to adapt to other sizes and types of raceways of the same manufacturer. Provide all fittings, etc. for a complete installation.

C. Device Boxes shall be suitable for the type of raceways provided and for mounting standard devices and faceplates. Device boxes shall be provided in single- and multiple-gang configurations, up to six-gang. Single-gang boxes shall allow for snap-on and fastener applications. They shall range in depth from 0.94" to 2.75". Extension boxes shall be provided to adapt to existing standard flush switch and receptacle boxes.

D. The raceway manufacturer shall provide a complete line of connectivity outlets and modular inserts for UTP/STP, Fiber Optic, Coaxial and other cabling types with face plates and bezels to facilitate mounting. A complete line of preprinted station and port identification labels, snap-in icon buttons as well as write-on station identification labels shall be available. Provide as needed for a complete installation.

E. Raceways used for communications cabling shall have a complete line of full capacity corner elbows and tee fittings, and used where required or shown on the Drawings, to maintain a

controlled 2” cable bend radius which meets the specifications for Fiber Optic and UTP/STP cabling and exceeds the TIA 569 requirements for communications pathways.

2.3 SURFACE METAL RACEWAYS

A. Wiremold Series 500 or 700 raceway shall be one-piece design with a base and cover factory assembled. The total width shall be 3/4” x 17/32” high with a capacity of 0.19 square inches for 500 or 3/4" x 21/32” with a capacity of 0.26 square inches for 700. The raceway base and cover shall be a minimum thickness of 0.040”. The raceway shall be available in five (5) foot and ten (10) foot lengths.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions under which surface raceways, boxes, distribution systems, accessories, and fittings are to be installed and substrate that will support raceways. Notify the Architect/Engineer of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Surface raceways shall be installed in strict compliance with the manufacturer’s installation instructions and recommendations and approved shop drawings. Coordinate installation with adjacent work to ensure proper clearances and to prevent electrical hazards.

B. Surface raceways shall be installed parallel with or at right angles to building structure and at the mounting heights noted on Drawings.

C. Surface raceway systems shall be mechanically continuous and connected to all electrical outlets, boxes, device mounting brackets, and cabinets, in accordance with manufacturer’s installation sheets.

D. Metal raceways shall be electrically continuous and bonded in accordance with the National Electrical Code for proper grounding.

E. Surface raceway shall be supported at intervals not exceeding five (5) feet or in accordance with manufacturer’s installation sheets using appropriate anchors and screws. The use of drive pins and/or other methods using compressed air or gases are not acceptable.

F. Provide accessories as required for a compete installation, including insulated bushings and inserts where required by the manufacturer.

G. Close all unused raceway openings using manufacturer’s recommended accessories.

H. All surface raceway connections to outlet and/or junction boxes shall be made using adjustable offset connectors or combination connectors as detailed on the Drawings. The connectors shall be furnished by the manufacturer of the surface raceway.

I. Field cutting of surface raceways base and covers shall be accomplished by the use of the manufacturer's raceway cutters specifically designed for this purpose.

3.3 CLEANING AND PROTECTION

A. Clean exposed surfaces using non-abrasive materials and methods recommended by manufacturer.

B. Protect raceways and boxes until final acceptance by the Owner.

C. Repaint marred and scratched surfaces with touch-up paint to match original finish.

END OF SECTION 260525

SECTION 260526 - GROUNDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections, and Section 260100, “Electrical General Provisions,” apply to this Section.

1.2 SCOPE OF WORK

A. Provide grounding for service, conduits, motor frames, metal casings, receptacles, and solid neutral, and as required by NEC Article 250. Resistance to ground at service shall not exceed 25 ohms.

PART 2 - PRODUCTS

2.1 GROUND WIRE

A. Provide a green insulated ground wire, sized per the NEC, in all conduits, junction boxes, and pull boxes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Connect grounding conductors to the panelboard equipment ground bus and not to the panelboard neutral bus. Also connect grounding bushings to the ground bus. Connect the neutral bus only to the system neutral wire. Provide a bonding wire between the equipment ground bus and the neutral bus in the main distribution equipment only. The grounding system (conduit, cabinets, enclosures, and grounding conductors) and the grounded system (neutral conductors and service equipment ground) shall be separate and independent systems, except at the main distribution equipment.

B. Test resistance to ground and submit readings to the Architect for review. Include the date and time of the test and the name of the individual performing the test.

END OF SECTION 260526

SECTION 260529 - SUPPORTING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections, and Section 260100, "Electrical General Provisions," apply to this Section.

1.2 SCOPE OF WORK

A. Extent of supports, anchors, sleeves, and seals is indicated in other Division 26 Sections.

B. Types of supports, anchors, sleeves, and seals specified in this Section include the following:

C-clamps
I-beam clamps
One-hole conduit straps
Two-hole conduit straps
Round steel rods
Expansion anchors
Toggle bolts
Wall and floor seals

C. Supports, anchors, sleeves, and seals furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division 26 Sections.

1.3 QUALITY ASSURANCE

A. Furnish supporting devices manufactured by firms regularly engaged in manufacture of supporting devices of types, sizes, and ratings required.

B. Comply with the requirements of the NEC, as applicable to construction and installation of electrical supporting devices.

C. Comply with applicable requirements of ANSI/NEMA FB1, "Fittings and Supports for Conduit and Cable Assemblies."

D. Comply with NECA "Standard of Installation" pertaining to anchors, fasteners, hangers, supports, and equipment mounting.

E. Provide electrical components which are UL-Listed and labeled.

PART 2 - PRODUCTS

2.1 MANUFACTURED SUPPORTING DEVICES

A. Provide supporting devices complying with manufacturer's standard materials, design, and construction in accordance with published product information and as required for a complete installation, and as herein specified. Where more than one type of device meets indicated requirements, selection is installer's option.

B. Provide supporting devices of types, sizes, and materials required, and having the following construction features:

1. Reducing Couplings: Steel rod reducing coupling, 1/2" by 5/8"; galvanized steel; approx. 16 pounds per 100 units.
2. C-Clamps: Galvanized steel; 1/2" rod size; approx. 70 pounds per 100 units.
3. I-Beam Clamps: Galvanized steel, 1-1/4" by 3/16" stock; 3/8" cross bolt; flange width 2"; approx. 52 pounds per 100 units.
4. One-hole Conduit Straps: For supporting metal conduit through 3/4" galvanized steel; approx. 7 pounds per 100 units.
5. Two-hole Conduit Straps: For supporting metal conduit above 3/4" galvanized steel; 3/4" strap width; and 2-1/8" between center of screw holes.
6. Hexagon Nuts: For 1/2" rod size; galvanized steel; approx. 4 pounds per 100 units.
7. Round Steel Rod: Galvanized steel; 1/2" dia.; approx. 67 pounds per 100 feet.
8. Offset Conduit Clamps: For supporting 2" rigid metal conduit; galvanized steel; approx. 200 pounds per 100 units.

C. Provide anchors of types, sizes, and materials required and having the following construction features:

1. Expansion Anchors: 1/2"; approx. 38 pounds per 100 units.
2. Toggle Bolts: Springhead; 3/16" by 4"; approx. 5 pounds per 100 units.

D. Provide sleeves and seals of types, sizes, and materials required, and having the following construction features:

1. Provide factory-assembled, watertight wall and floor seals suitable for sealing around conduit, pipe or tubing passing through concrete floors and concrete block walls. Construct with steel sleeves, malleable-iron body, neoprene sealing grommets and rings, metal pressure rings, pressure clamps and cap screws.

E. Provide U-channel strut system for supporting electrical equipment, 16-gauge hot-dip galvanized steel of sizes required; construct with 9/16" dia. holes, 8" o.c. on top surface, and with the following fittings which mate and match with U-channel:

Fixture hangers
Channel hangers
End caps
Beam clamps

Wiring stud
Rigid conduit clamps
Conduit hangers
U-bolts

PART 3 - EXECUTION

3.1 INSTALLATION OF SUPPORTING DEVICES

A. Install hangers, anchors, sleeves, and seals as indicated in accordance with manufacturer's published instructions and with recognized industry practices to ensure supporting devices comply with the requirements of the NEC, NECA, and ANSI/NEMA for installation of supporting devices.

B. Coordinate with other electrical work, including outlet box, raceway and wiring work, as necessary to interface installation of supporting devices with other work.

C. Install hangers, supports, clamps, and attachments to support conduit and outlet boxes properly from building structure. Arrange for grouping of parallel runs of horizontal conduits to be supported together on trapeze-type hangers where possible. Install supports with maximum spacings indicated.

D. Tighten sleeve seal nuts until sealing grommets have expanded to form watertight seal.

END OF SECTION 260529

SECTION 260533 - RACEWAYS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections, and Section 260100, “Electrical General Provisions,” apply to this Section.

1.2 SCOPE OF WORK

A. Run all conduit concealed, except conduit may be run exposed in mechanical rooms, locations where specifically indicated, and spaces with exposed construction as approved by the Architect.

B. Provide a conduit system complete with fittings and hangers as specified herein and as required by the NEC. Run all electrical wiring systems above 24 Volts in conduit unless specifically indicated otherwise.

C. Install conduit as a complete system without wiring and continuous from outlet to outlet and from fitting to fitting, mechanically and electrically connected to all boxes, fittings, and wireways, and grounded in accordance with the NEC.

D. Cap ends of all conduit promptly upon installation with plastic pipe caps. Caps shall remain until wiring is ready to be installed. Taping the ends of conduits is not acceptable.

E. Size conduit to equal or exceed the minimum requirements of the NEC (except where sizes are specifically indicated on the drawings and in these specifications).

F. Coordinate the routing of conduit with other trades to avoid conflicts with structural members, piping, ductwork, and other job site conditions.

PART 2 - PRODUCTS

2.1 CONDUIT

A. Minimum size conduit shall be 1/2" unless noted or indicated otherwise on drawings. Use larger sizes as required by the NEC to accommodate the number and sizes of wires contained therein.

B. Conduit concealed in walls or above ceilings shall be rigid steel (GRS), electrical metallic tubing (EMT), or intermediate metallic conduit (IMC). Flexible steel conduit may be used above accessible ceilings only. Conduit installed below grade and under concrete floors and

slabs shall be Schedule 40 PVC, unless otherwise indicated. Conduit run vertically through concrete and into wall cavities shall be GRS or IMC starting at 6" below the bottom of the slab. Where conduits turn up inside a wall cavity, IMC and GRS may be converted to EMT at 6" above the top of the concrete slab. No portion of the conduit radius shall be within the concrete slab. The use of MC or BX cable is not permitted.

C. GRS, EMT and IMC shall be UL approved, hot-dip, high-strength, galvanized steel.

D. Rigid PVC conduit shall be Schedule 40 (or Schedule 80 if required by the NEC), extruded from high-grade PVC compound and shall be light gray in color. Rigid PVC conduit shall be UL approved for direct burial and concrete encasement.

E. Flexible steel conduit shall be galvanized, continuous spiral, single strip type. In areas subject to moisture and where specifically indicated, flexible steel conduit shall have a plastic covering in accordance with NEC Article 350. Fittings shall be standard UL approved with ground connector. Watertight connectors shall be used with plastic-covered conduit. All flexible steel conduit installed shall be plastic covered. The maximum length for flexible steel conduit is 72" unless as otherwise indicated.

F. Conduit may not be run in the flutes of metal roof decking, and may not be attached to any part of metal roof decking.

G. Bury conduit run below grade a minimum of 24" below finished grade or so the top of the conduit is 6" below the bottom of the concrete slab if run underneath concrete unless indicated or required to be deeper. Increase the burial depth as required so that no part of the conduit radius is within the concrete slab where conduits turn vertical. Coordinate conduit routings and depths with all other trades and any and all existing underground utilities.

2.2 FITTINGS

A. All conduit entering or leaving panelboards, cabinets, outlet boxes, pull boxes, or junction boxes shall have lock nuts and bushings, except provide insulated throat connectors on EMT conduit 3/4" and 1". Rigid steel conduit shall have a lock nut both inside and outside of the enclosure entered. Install bushings on the ends of IMC conduit and EMT conduit larger than 1". Insulating bushings shall be OZ Type A for GRS and IMC, and Type B for EMT. Conduit entering enclosures through concentric knockouts shall have grounding-type bushings with copper bond wire to enclosure.

B. Provide expansion fittings where conduits cross building expansion joints. Expansion fittings shall be OZ Type AX with OZ Type BJ bonding jumper. See Architectural drawings for location of expansion joints.

C. Fittings for rigid conduit shall be threaded type, except where IMC changes to EMT above floor slab, fittings shall be threadless type.

D. Fittings for EMT shall be UL-approved, steel set screw couplings.

2.3 JUNCTION BOXES

A. Use junction boxes on exposed conduit work for changes in direction of conduit runs and breaking around beams and columns.

B. Furnish covers and gaskets with the junction boxes where installed in damp or wet locations.

C. Label all junction and pull box covers indicating the circuits contained therein in a manner that will prevent unintentional interference with circuits during testing and servicing. For example: "HE1-13." See Specification Section 260534 for labeling requirements.

2.4 PIPE SLEEVES

A. Provide pipe sleeves where conduits larger than 2" pass through walls. Contractor shall be responsible for proper and permanent location. Conduit shall not be permitted to pass through footings, beams, or ribs, unless indicated and/or approved. Coordinate pipe sleeve locations with all other trades affected.

B. Install pipe sleeves and properly secure in place with grout where conduit passes through masonry or concrete and at all fire-rated assemblies. Pipe sleeves shall be of a sufficient diameter to provide approximately 1/4" clearance all around the conduit. Fill void between conduit and sleeve with mineral wool to prevent sound transmission. Pipe sleeves in foundation walls shall be cast iron, 2" larger in diameter than the conduit installed. Pipe sleeves in walls, floors, and partitions shall be Schedule 40 black steel pipe. Extend sleeves above floor at least 1", pack space around conduit with fireproof material, and make watertight. Pipe sleeves passing through firewalls, smoke partitions, fire partitions, or floors shall be sealed with a UL-rated system appropriate for the specified rating.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install conduit concealed in walls, below floor slabs, and above ceilings, except conduit may be run exposed in mechanical and electrical equipment rooms. Maintain a minimum clear distance of 6" from parallel runs of flues, steam, or hot water pipes. Do not run conduit horizontally in concrete slabs.

B. Use flexible steel conduit (minimum 18" in length, maximum 72" in length) for connections to all motors, dry-type transformers, water heaters, and any equipment subject to vibration.

C. Group conduit so it is uniformly spaced, where straight and at turns. Make bends and offsets (where unavoidable) with a hickey or bending machine.

D. Ream GRS and IMC conduit after threading to remove all burrs.

E. Securely fasten conduit to outlets, junction boxes, and pull boxes to affect firm electrical contact. Join conduit with approved couplings. Running threads are not allowed.

F. Exercise care to avoid condensation pockets in the installations. Keep conduit, fittings, and boxes free from foreign matter of any kind, before, during, and after installation.

G. Do not use EMT below grade, outdoors and in wet locations.

H. Support exposed runs of conduit in accordance with N.E.C. 342, 344, 348, 350 and 358 and parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings with right angle turns consisting of fittings or symmetrical bends. Support conduit within one foot of all changes in direction and on each side of the change.

I. Supports shall be wall brackets, trapeze, strap hanger, or pipe straps, secured to hollow masonry with toggle bolts; to brick and concrete with expansion bolts; to metal surfaces with machine screws; and to wood with wood screws.

J. Use explosive drive equipment to make connections where the use of this equipment is beneficial, and is subject to strict compliance with safety regulations and approved by the Owner.

K. Wooden plugs inserted in masonry and the use of nails as fastening media are prohibited.

L. Do not support conduit from lay in tile ceilings grids, ceiling grid hangers, or lay on ceiling tiles.

M. Prime conduit with a surface conditioner “GalvaGrip” or approved equal and paint to match the surface on which attached. Conduit installed in mechanical and electrical rooms need not be painted.

N. Install and support conduit from the underside of the upper chord in bar joist construction.

O. Do not support conduit from or attach outlet or junction boxes to metal roof decks.

P. Seal openings in floors where conduits penetrate vertically through with a clear silicon sealant to prevent liquids and insects from passing through.

Q. Where conduits penetrate vertically through fire-rated floors, or walls seal the conduits with a UL-Listed, water-resistant firestop material with a rating equal to or greater than the rating of the penetrated floors.

R. Metal conduit installed in earth shall be painted with two coats of bitumastic paint.

END OF SECTION 260533

SECTION 260534 - ELECTRICAL BOXES AND FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections, and Section 260100, “Electrical General Provisions,” apply to this Section.

1.2 SCOPE OF WORK

A. Furnish and install all junction boxes of a type and size applicable for use in the location indicated on the drawings and where required by the NEC.

B. Exercise special care in the location of outlet and junction boxes in order that the hanging or recessing of light fixtures will not be obstructed by piping or ductwork installed by other trades. To this end, coordinate the work with representatives of the other trades involved and by reference to the architectural, structural, mechanical, plumbing and sprinkler drawings.

PART 2 - PRODUCTS

2.1 OUTLET BOXES

A. Outlet boxes shall be sheet steel, zinc coated, or cadmium plated.

B. Provide existing and new outlet boxes installed but not used, including data outlets, with blank coverplates matching those provided on adjacent outlets.

C. Size boxes as follows:

1. Switch and Receptacle Outlet Boxes: Provide single gang outlet boxes 1-1/2" deep unless required to be larger. Provide extra deep boxes where required.
2. Fixture Outlets in Ceiling: 4" octagonal, minimum. Where required to accommodate larger conduit or a larger number of wires: 4-11/16" by 2-1/8" deep.
3. One-piece multi-gang boxes for use where two or more switches or receptacles are located side by side: 2-1/8" deep. Sectionalized boxes will not be allowed.
4. Where larger size boxes are required or called for, they shall be similar in all other respects to the types specified above.

D. Light fixture outlet boxes, where fixtures are to be mounted on the box, shall have suitable studs and supports for carrying the weight of the fixture. Increase box depth, as required, for additional wires and conduits.

E. Boxes in new finished walls shall be flush mounted and have flush coverplates and proper type extension rings or plaster covers where required. Provide blank Series 302 stainless-steel coverplates on boxes not scheduled to receive coverplates of an otherwise specified type.

F. Provide boxes located above suspended ceilings with galvanized steel covers, with openings or knockouts as required for type of service.

G. Boxes installed in concrete construction shall be galvanized concrete type at all locations except where condulet or cast-iron boxes are required for watertight or vaportight outlets.

H. Boxes installed in the floor shall be as specified on the drawings and shall comply with the requirements indicated on the drawings. Provide brass carpet flanges where boxes are installed in carpeted areas.

2.2 PULL BOXES AND JUNCTION BOXES

A. Install pull boxes and junction boxes where required for changes in direction, at junction points, and where needed to facilitate wire pulling.

B. Size boxes in accordance with the requirements of the NEC.

C. Boxes shall be constructed of 12-gauge minimum hot-rolled sheet steel and shall be hot-dip galvanized inside and outside to match the conduit. Boxes shall have removable covers.

D. Label the front face of the cover on each box with indelible black marker indicating the number of each circuit contained in or running through the box. In areas where exposed construction is the final finished condition and conduit and junction boxes are called out to be painted, label the inside face of the covers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Check all door swings and coordinate with all furniture, built-in equipment, and cabinetry prior to roughing-in conduit and boxes for switches, receptacles, and auxiliary system devices. Make necessary adjustments in the location of same to avoid conflicts as approved by the Engineer and at no additional cost to the Owner.

B. Install all outlet boxes flush with wall or ceiling finish.

C. Mounting heights of outlets in tile or unplastered masonry shall be varied plus or minus to the nearest block joint so the bottom or top of the box rests on a block joint. Install outlet boxes in the same space at the same height above finished floor unless indicated or required to be otherwise.

D. Check the location of all wall outlets prior to roughing-in conduit to verify that the outlet will clear any wall fixtures, shelving, work tables, etc., that exist or will be installed. Make necessary adjustments in the location of wall outlets to avoid conflicts as approved by the Architect and at no additional cost to the Owner.

E. Prior to roughing-in conduit, coordinate with other trades and the Owner regarding all equipment requiring electrical connections. Required adjustments to the conduit and wire sizes shall be made at no additional cost.

F. Conduit installation shall be rigid and secure, and, where necessary, angle iron (1" by 1" by 1/4" or larger) shall be provided to facilitate adequate mounting.

G. Install electrical boxes and fittings in accordance with manufacturer's published instructions, applicable requirements of the NEC and NECA "Standard of Installation," and in accordance with recognized industry practices to fulfill project requirements.

H. Coordinate installation of electrical boxes and fittings with wire/cable, wiring devices, and raceway installation work.

I. Provide "weatherproof-while-in-use" rated outlet covers for interior and exterior locations exposed to weather or moisture.

J. Provide knockout closures to cap unused knockout holes where blanks have been removed in panel cans, terminal cabinet backboxes, junction boxes, outlet boxes and pull boxes.

K. Install electrical boxes in those locations which ensure ready accessibility to enclosed electrical wiring.

L. Fasten electrical boxes firmly and rigidly to substrates or structural surfaces to which attached or solidly embed electrical boxes in concrete or masonry.

M. Subsequent to installation of boxes, protect boxes from construction debris and damage.

N. Upon completion of installation work, properly ground all electrical boxes.

O. Do not mount boxes to metal roof decking.

END OF SECTION 260534

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections, and Section 260100, “Electrical General Provisions,” apply to this Section.

1.2 SCOPE OF WORK

A. Extent of panelboard, load center, and enclosure work, including cabinets and cutout boxes, is indicated by drawings and schedules.

B. Refer to other Division 26 Sections for cable/wire, connectors, and electrical raceway work required in conjunction with panelboards and enclosures; not work of this Section.

1.3 QUALITY ASSURANCE

A. Comply with the requirements of the NEC, as applicable to installation of panelboards, cabinets, and cutout boxes. Comply with the NEC requirements pertaining to installation of wiring and equipment in hazardous locations.

B. Comply with applicable requirements of UL 67, “Electric Panelboards,” and UL 50, UL 869, UL 486A, UL 486B, and UL 1053 pertaining to panelboards, accessories, and enclosures. Provide units which are UL-Listed and labeled.

C. Comply with NEMA 250, “Enclosures for Electrical Equipment (1,000 Volts Maximum),” and NEMA PB1, “Instructions for Safe Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.”

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Except as otherwise indicated, provide panelboards, enclosures, and ancillary components of types, sizes, and ratings indicated, which comply with manufacturer’s standard materials; design and construction in accordance with published product information; equip with proper number of unit panelboard devices as required for complete installation. Where types, sizes, or ratings are not indicated, comply with the NEC, UL, and established industry standards for those applications indicated. Series rating is not acceptable for circuit breakers serving life safety equipment.

B. Provide dead-front, safety-type, power distribution panelboards as indicated, with panelboard switching and protective devices in quantities, ratings, types, and arrangement shown; with mechanical type conductor connectors for Main, Neutral, and Ground lugs approve for copper or aluminum conductors. Specific circuit breaker placement is required in panelboards to match the circuit breaker placement indicated in the panelboard schedule on the drawings. Equip with aluminum busbars with not less than 98% conductivity and with neutral bus. Provide suitable lugs on neutral bus for outgoing circuits requiring neutral connections. Provide bolt-on molded-case main and branch circuit breaker types for each circuit, with toggle handles that indicate when tripped. Where multiple-pole circuit breakers are indicated, provide with common trip so an overload on one pole will trip all poles simultaneously. Provide panelboards with bare uninsulated grounding bars suitable for bolting to enclosures. Select enclosures fabricated by same manufacturer as panelboards, which mate properly with panelboards. Branch mounted main circuit breakers are not acceptable. Provide bottom mounted main circuit breakers for panelboards fed from below. Provide top mounted main circuit breakers for panelboards fed from above. All spaces shall have bus fully extended and drilled for the future installation of breakers.

C. Provide galvanized sheet-steel cabinet-type enclosures, in sizes and NEMA types as indicated, code gauge, minimum 16-gauge thickness. Construct with multiple knockouts and wiring gutters. Provide fronts with adjustable trim clamps, and doors with flush locks and keys. All panelboard enclosures shall be keyed alike. Equip with interior circuit directory frame and card with clear plastic covering. Provide baked gray enamel finish over a rust-inhibitor coating. Design enclosures for flush mounting unless otherwise indicated. Provide enclosures which mate properly with panelboards to be enclosed.

D. Provide panelboard accessories and devices, including but not necessarily limited to circuit breakers and ground-fault protection units, as recommended by panelboard manufacturer for ratings and applications indicated. Circuit breakers serving permanently connected appliances rated over 300 volt-amperes shall be capable of being locked in the “OFF” position. Provide HACR rated circuit breakers for all heating and air conditioning equipment. Provide GFCI circuit breakers where indicated. GFCI circuit breakers shall be Class A ground-fault protection (5-mA trip). Provide GFEP circuit breakers where indicated. GFEP circuit breakers shall be Class B ground-fault protection (30-mA trip).

E. Provide panelboards UL Service Entrance rated when required.

F. Provide panelboards with weatherproof NEMA 3R enclosures with air flow, whether indicated or not, when installed outdoors.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which panelboards and enclosures are to be installed, and notify the General Contractor, in writing, of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Install panelboards and enclosures as indicated, in accordance with manufacturer's published instructions, applicable requirements of the NEC and NECA "Standard of Installation," and in compliance with recognized industry practices to ensure that products fulfill requirements.

C. Coordinate installation of panelboards and enclosures with raceway installation work.

D. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torqueing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A and UL 486B.

E. Anchor enclosures firmly to walls and structural surfaces, ensuring that they are permanently and mechanically secure.

F. Provide properly wired electrical connections within enclosures.

G. Provide a typed circuit index card for each panelboard upon completion of installation work. Indicate load served and room number(s). Use final room numbers obtained from the Architect or Owner, not construction room numbers as shown on the drawings.

3.2 GROUNDING

A. Provide equipment grounding connections for all panelboards. Tighten connections to comply with tightening torques specified in UL 486A and UL 486B to assure permanent and effective grounding.

3.3 FIELD QUALITY CONTROL

A. Keep panelboards clean and free from foreign matter of any kind, before, during, and after installation.

B. Prior to energization of circuitry, check all accessible connections to manufacturer's tightening torque specifications.

C. Prior to energization of panelboards, check with ground resistance tester phase-to-phase and phase-to-ground insulation resistance levels to ensure requirements are fulfilled.

D. Prior to energization, check panelboards for electrical continuity of circuits and for short-circuits.

E. Subsequent to wire and cable hook-ups, energize panelboards and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

F. Infrared Scanning: After Substantial Completion, but not more than 60 days from Final Acceptance, perform an infrared scan of each panelboard. Remove panel fronts so joints and connections are accessible to portable scanner.

1. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
2. Record of Infrared Scanning: Prepare a certified report that identifies panelboards checked and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.4 GROUND FAULT EQUIPMENT TESTING

A. Ground fault equipment provided with panelboards shall be tested when first installed on the site in accordance with the requirements of NEC Article 230.95.

B. A written record of the test shall be made available to the authority having jurisdiction.

END OF SECTION 262416

SECTION 262420 - MOTORS AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections, and Section 260100, “Electrical General Provisions,” apply to this Section.

1.2 SCOPE OF WORK

A. Furnish and install disconnect switches as indicated on the drawings and specified herein.

B. Provide all power wiring, disconnect switches and electrical connections to all equipment provided and requiring electrical connections. Starters and/or magnetic contactors; including Variable Frequency Drives (“VFD”) for HVAC equipment that is not integral with the HVAC equipment; shall be furnished by Division 23 Contractor, installed where and as indicated on the electrical drawings by the Electrical Contractor and provided with power wiring by the Electrical Contractor unless otherwise indicated. Power wiring between magnetic contactors and the final connection point on the HVAC equipment shall be provided under Division 26. Division 23 Contractor shall provide the proper number and size of auxiliary contacts in the magnetic contactors required for the proper operation and control of the HVAC equipment.

C. All control wiring and conduits between control instruments and the magnetic contactor or VFD serving a piece of mechanical equipment shall be provided by Division 23 Contractor and installed in accordance with the requirements of Division 26, unless otherwise indicated on the electrical drawings or in the electrical specifications.

D. Review the mechanical drawings and specification sections for exhaust fans requiring control by wall switch, solid state speed controller, or line voltage thermostat and provide same where indicated on the electrical drawings.

PART 2 - PRODUCTS

2.1 DISCONNECT SWITCHES

A. Disconnect switches shall be rated for the voltage of the equipment being served with number of poles and current rating as indicated. Disconnect switches shall be non-fusible or fusible type as indicated on the drawings.

B. Switches shall be NEMA standard HD type.

C. Switches shall be horsepower rated when used for motor disconnect means.

D. Provide fused disconnect switches complete with appropriately sized fuses for the circuits controlled.

PART 3 - EXECUTION

3.1 INSTALLATION OF DISCONNECT SWITCHES

A. Examine area and conditions under which electrical connections for equipment are to be installed. Notify the General Contractor; in writing; of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

B. Coordinate locations of disconnect switches and magnetic starters furnished under Division 23 with the locations of mechanical equipment, piping, electrical equipment and any and all other building elements such that all NEC requirements, including working clearances, are met. Adjust locations from those shown on the drawings as required to comply with NEC working clearance requirements at no additional cost to the project.

C. Secure disconnects switches to building elements or equipment housings where indicated on the drawings. Where building walls or equipment housings do not provide suitable mounting surfaces, provide a galvanized unistrut frame or rack satisfactory in size to securely support the disconnect switch, magnetic contactor and /or VFD. Where racks are required to be roof mounted, secure the rack to the roof in a method that does not compromise the roof membrane in any way. Submit the roof attachment method to the Architect/Owner for approval prior to construction or installation.

3.2 ELECTRICAL CONNECTIONS TO EQUIPMENT

A. Provide electrical connections to equipment indicated in accordance with equipment manufacturer’s published instructions and recognized industry practices. Comply with applicable requirements of UL, the NEC and the NECA “Standard of Installation,” to ensure that products fulfill requirements.

B. Coordinate with other work, including wires/cables, raceway and equipment installation as necessary to properly interface installation of electrical connections to equipment with other work.

C. Connect electrical power supply conductors to equipment in accordance with equipment manufacturer’s published instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.

D. Cover splices with electrical insulating material equivalent to or greater than the electrical insulation rating of the conductors being spliced.

E. Prepare cables and wires by cutting and stripping covering, armor, jacket, and insulation properly to ensure uniform and neat appearance where cables and wires are terminated. Exercise care to avoid cutting through tapes which will remain on conductors. Avoid "ringing" conductors while skinning wire.

F. Trim cables and wires as short as practicable and arrange routing to facilitate inspection, testing and maintenance.

G. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Accomplish tightening by utilizing proper torqueing tools, including torque screwdriver, beam-type torque wrench, and ratchet wrench with adjustable torque settings. Where manufacturer's torqueing requirements are not available, tighten connectors and terminals to comply with torqueing values contained in UL 486A.

H. Provide flexible steel conduit for motor connections and other electrical equipment connections where subject to movement and vibration.

I. Provide liquid-tight flexible steel conduit for connection of motors and other electrical equipment where subject to movement and vibration and where connections are located where subject to any of the following conditions:

1. All exterior locations
2. Moist or humid atmosphere where condensation can be expected to accumulate (Example: sump pump and elevator pits)
3. Corrosive atmosphere (Example: battery charging rooms)
4. Water spray
5. Dripping oil, grease, or water
6. Kitchens and Sculleries

3.3 FIELD QUALITY CONTROL

A. Upon completion of installation of electrical connections and after circuitry has been energized with rated power source, test connections to demonstrate capability and compliance with requirements. Ensure that direction of rotation of each motor fulfills requirement. Correct malfunctioning units at site, then retest to demonstrate compliance.

3.4 GROUND FAULT EQUIPMENT TESTING

A. Ground fault equipment provided with motor control centers shall be tested when first installed on the site in accordance with the requirements of NEC Article 230.95.

B. A written record of the test shall be made available to the authority having jurisdiction.

END OF SECTION 262420

SECTION 262710 - SERVICE AND DISTRIBUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specifications Sections, and Section 260100, “Electrical General Provisions,” apply to this Section.

1.2 ELECTRICAL SERVICE

A. The electrical service for the building shall be 208/120 Volts, 3-phase, 4-wire, grounded neutral.

B. Install current transformer equipment and a meter base furnished by Dominion Energy or the local electrical utility company where indicated on the drawings except the final location of the meter base shall be as directed by Dominion Energy or the local electrical utility company. Provide a 1-1/4" empty conduit (with pull wire) between the current transformer equipment and the meter base. Make all provisions necessary for metering equipment and install as directed by Dominion Energy or the local electrical utility company.

C. Consult with Dominion Energy or the local electrical utility company for color coding of cables when service lateral is provided by this Contract and color code cables as directed by Dominion Energy or the local electrical utility company. Advise the Engineer if the color coding provided by Dominion Energy or the local electrical utility company differs from that indicated in Specification Sections 260519.

1.3 SERVICE CONDUIT AND CONDUCTORS

A. The service lateral will originate from a pad-mounted transformer furnished by Dominion Energy or the local electric utility company. Provide conduit of the size and quantity indicated on the drawings. Consult with Dominion Energy or the local electrical utility company before commencement of electrical service work.

PART 2 - PRODUCTS

2.1 ELECTRICAL SERVICE EQUIPMENT

A. Electrical service equipment shall comply with the requirements of the NEC.

PART 3 - EXECUTION

3.1 SERVICE AND DISTRIBUTION

A. Arrangement shall be as indicated on the drawings and as required by Dominion Energy or the local electrical utility company, including exact point of service and metering requirements.

END OF SECTION 262710

SECTION 262713 - SERVICE ENTRANCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections, and Section 260100, "Electrical General Provisions," apply to this Section.

1.2 SCOPE OF WORK

A. Extent of service entrance work is indicated by drawings and schedules.

B. Switchboards used for service entrance equipment are specified in other Division 26 Sections, and are work of this Section.

C. Refer to other Division 26 sections for wires/cables, raceways, and electrical boxes and fittings work required in connection with service entrance equipment; not work of this Section.

1.3 QUALITY ASSURANCE

A. Comply with the requirements of the NEC, as applicable to construction and installation of service entrance equipment and accessories.

B. Comply with construction and installation requirements of the following NEMA standards for service entrance equipment and accessories where applicable:

Std Pub No. AB1	Molded Case Circuit Breakers
Std Pub No. PB1.2	Application Guide for Ground-fault Protective Devices for Equipment
Std Pub No. PB2	Dead-front Distribution Switchboards

C. Comply with construction and installation requirements of the following UL standards for service entrance equipment and accessories:

UL 50 Electrical Cabinets and Boxes
UL 489 Molded Case Circuit Breakers and Circuit Breaker Enclosures
UL 854 Service Entrance Cables
UL 869 Electrical Service Equipment

D. Provide service entrance rated equipment and accessories which are UL-Listed and labeled and marked, "SUITABLE FOR USE AS SERVICE ENTRANCE EQUIPMENT."

E. Comply with applicable requirements of IEEE 241 pertaining to service entrances.

F. Comply with ANSI C2, “National Electrical Safety Code,” installation requirements for above ground service entrance conductors.

PART 2 - PRODUCTS

2.1 SERVICE ENTRANCE EQUIPMENT

A. Provide service entrance equipment and accessories of types, sizes, ratings, and electrical characteristics indicated, which comply with manufacturer’s standard materials, design, and construction in accordance with published product information, and as required for complete installation and as herein specified.

B. All electrical service entrance equipment, dry-type transformers, panelboards, disconnect switches, lighting contactors, and magnetic contactors provided under Division 26 of these Specifications shall be by the same equipment manufacturer.

2.2 RACEWAYS

A. Provide raceways complying with Specification Section 260533, “Raceways.”

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install service entrance equipment as indicated in accordance with equipment manufacturer’s published instructions, and with recognized industry practices, to ensure that service entrance equipment fulfills requirements. Comply with applicable installation requirements of the NEC and NEMA standards.

B. Coordinate with other electrical work, including utility company wiring, as necessary to interface installation of service entrance equipment work with other work.

C. Set field-adjustable GFP devices and circuit breakers for pickup and time-current sensitivity ranges subsequent to installation of devices and circuit breakers.

3.2 GROUNDING

A. Provide equipment bonding and grounding connectors, sufficiently tight to assure a permanent and effective grounding, for service entrance equipment and wiring/ cabling as required by the NEC.

3.3 ADJUST AND CLEAN

A. Adjust operating mechanisms for free mechanical movement.

B. Repair scratched or marred enclosure surfaces to match original finishes to the satisfaction of the Engineer.

3.4 FIELD QUALITY CONTROL

A. Upon completion of installation of service entrance equipment and electrical circuitry, energize circuitry and demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

END OF SECTION 262713

SECTION 262726 - WIRING DEVICES AND DEVICE PLATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections, and Section 260100, “Electrical General Provisions,” apply to this Section.

1.2 SCOPE OF WORK

A. The extent of wiring device work is indicated by drawings and schedules. Wiring devices are defined as single discrete units of the electrical distribution systems which are intended to carry but not utilize electric energy.

B. Types of electrical wiring devices in this Section include the following:

Receptacles
Ground-fault circuit interrupters
Switches
Cover plates

C. Comply with the requirements of the NEC, as applicable to installation and wiring of electrical wiring devices.

D. Comply with applicable requirements of UL 20, 486A, 498, 943, and 1472 pertaining to installation of wiring devices. Provide wiring devices which are UL-Listed and labeled.

E. Comply with applicable portions of NEMA WD1, “General-purpose Wiring Devices, and WD5, “Wiring Devices, Specific Purposes.”

PART 2 - PRODUCTS

2.1 FABRICATED WIRING DEVICES

A. Provide factory-fabricated wiring devices in types and electrical ratings for applications indicated and which comply with NEMA WD1. Provide ivory colored-devices, except as otherwise indicated.

2.2 RECEPTACLES

A. Ground-fault Circuit Interrupters: Provide Industrial/Institutional, Specification-Grade, “feed-thru”-type ground-fault circuit interrupters, with heavy-duty duplex receptacles, capable of being installed in a 2-3/4" deep outlet box without adapter, grounding type UL-rated Class A, Group 1, rated 20 amperes, 120 Volts, 60 Hz; with solid-state ground-fault sensing and signaling; with 5 mA ground-fault trip level; equipped with NEMA configuration 5-20R. LEVITON model 7899 Series, or approved equal.

B. Ground-fault Weather Resistant Circuit Interrupters; Provide Industrial/Institutional, Specification-Grade, “feed-thru”-type ground-fault circuit interrupters, with heavy-duty duplex receptacles, capable of being installed in a 2-3/4" deep outlet box without adapter, grounding type UL-rated Class A, Group 1, rated 20 amperes, 125 Volts, 60 Hz; with solid-state ground-fault sensing and signaling; with 5 mA ground-fault trip level; equipped with NEMA configuration 5-20R. LEVITON model WR899-W or approved equal.

2.3 SWITCHES

A. Snap: Provide Specification-Grade, flush, single-pole toggle switches, 20 amperes, 120/277 Volts AC, with mounting yoke insulated from mechanism, equipped with plaster ears, switch handle, equipment grounding screw, and side-wired screw terminals. LEVITON 1221-2 Series, or approved equal. Provide for key operation where indicated on drawings.

2.4 WIRING DEVICE ACCESSORIES

A. Cover plates: Provide mid-size (JR Jumbo) stainless steel cover plates for single and combination wiring devices of types and with ganging and cutouts as required. Provide metal screws for securing plates to devices; screw heads colored to match color of plates. Provide stainless-steel cover plates in mechanical and electrical equipment rooms.

B. Provide “extra duty weatherproof-while-in-use” rated cover plates for receptacles installed outdoors where exposed to weather.

PART 3 - EXECUTION

3.1 INSTALLATION OF WIRING DEVICES

A. Install wiring devices where indicated in Contract Documents in accordance with manufacturer’s published instructions, applicable requirements of the NEC and NECA “Standard of Installation,” and in accordance with recognized industry practices to fulfill project requirements.

B. Coordinate with other work, including painting, electrical boxes and wiring work, as necessary to interface installation of wiring devices with other work.

C. Install wiring devices only in electrical boxes which are clean, free from building materials, dirt, and debris.

D. Install wiring devices after wiring work is completed.

E. Install cover plates after painting work is completed. Label the inside face of each cover plate with indelible black marker indicating the number of each circuit contained in or running through the outlet box.

F. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for wiring devices. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A and UL 486B. Use properly scaled torque indicating hand tool.

G. Terminate all switch and receptacle wiring on side screw terminals. Back terminations are not permitted.

H. Install all switches and receptacles with sufficient wiring length such that the device may be extracted from the outlet box a minimum of 6" while still connected.

3.2 PROTECTION OF COVER PLATES AND RECEPTACLES

A. Upon installation of cover plates and receptacles, take caution regarding use of convenience outlets. At time of Substantial Completion, replace all cover plates and receptacles which have been damaged; during the execution of this project; including those painted over, burned, or scored by faulty plugs.

3.3 GROUNDING

A. Provide equipment grounding connections for wiring devices, unless otherwise indicated. Tighten connections to comply with tightening torques specified in UL 486A to assure permanent and effective grounding.

3.4 TESTING

A. Prior to energizing circuitry, test wiring for electrical continuity and for short-circuits. Ensure proper polarity of connections is maintained. Subsequent to energization, test wiring devices to demonstrate compliance with requirements.

END OF SECTION 262726