



**NEWPORT NEWS
PUBLIC SCHOOLS**

IFB No. 015-0-2025/SNB

Yates Elementary School

Security Vestibule & Office Addition

and Alterations for the

Newport News Public Schools

Newport News, VA

PROJECT MANUAL

February 4, 2025



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PART 1 - GENERAL

1.1 GENERAL CONDITIONS

- A. Drawings and general provisions of Contract, including General Conditions and other Division 0 and Division 1 specification sections, apply to this section.

1.2 DEFINITIONS

- A. General Explanation: A substantial amount of specification language constitutes definitions for terms found in other Contract Documents, including drawings which must be recognized as diagrammatic in nature and not completely descriptive of requirements indicated thereon. Certain terms used in Contract Documents are defined generally in this article. Definitions and explanations of this section are not necessarily either complete or exclusive, but are general for the Work to the extent not stated more explicitly in another provision of Contract Documents.
- B. General Requirements: Drawings and general provisions and the requirements of Division 0 and Division 1 sections apply to the entire work of the Contract.
- C. Indicated: The term "Indicated" is a cross-reference to details, notes, or schedules on drawings, to other paragraphs or schedules in the specifications, and to similar means of recording requirements in the Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used in lieu of "indicated," it is for the purpose of helping the reader locate and cross-reference. No limitation of location is intended except as specifically noted.
- D. Directed, Requested, etc.: Where not otherwise explained, terms such as "directed," "requested," "authorized," "selected," "approved," "required," "accepted," and "permitted" mean "directed by Architect/Engineer," "requested by Architect/Engineer," etc. However, no such implied means will be interpreted to extend Architect's/Engineer's responsibility into Contractor's area of construction supervision.
- E. Approve: Where used in conjunction with Architect's/Engineer's response to submittals, requests, applications, inquiries, reports, and claims by Contractor, the meaning of term "approved" will be held to limitations of Architect's/Engineer's responsibilities and duties as specified in General Conditions. In no case will "approval" by Architect/Engineer be interpreted as a release of Contractor from responsibilities to fulfill requirements of the Contract Documents.
- F. Project Site: The space available to the Contractor for performance of the Work, either exclusively or in conjunction with others performing other Work as part of

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the project. The extent of project site is shown on drawings as construction limits, and may or may not be identical with description of land upon which project is to be built.

- G. Provide: Except as otherwise defined in greater detail, the term "provide" means furnish and install, complete and ready for intended use, as applicable in each instance.
- H. Furnish: Except as otherwise defined in greater detail, term "furnish" is used to mean supply and deliver to project site, ready for unpacking, assembly, installation, etc., as applicable in each instance. "Furnish" shall mean to be furnished by the Contractor unless specifically stated to be furnished by the Owner.
- I. Install: Except as otherwise defined in greater detail, the term "install" is used to describe operations at project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations, as applicable in each instance. Unless specifically stated otherwise, material and equipment to be installed by the Contractor shall be furnished by the Contractor.
- J. Installer: The entity, person, or firm engaged by the Contractor or its Subcontractor or Subcontractor for performance of a particular unit of Work at project site, including installation, erection, application, and similar required operations. Installers shall be expert in the operations they are engaged to perform.
- K. Testing Laboratory: An independent entity engaged to perform specific inspections or tests of the Work, either at project site or elsewhere; and to report, and when required, to interpret results of those inspections or tests.
- L. Including: Except as otherwise defined in greater detail, the term "including" means "including but not limited to."

1.3 FORMAT AND SPECIFICATION EXPLANATIONS

- A. Specification Production: None of these explanations will be interpreted to modify substance of requirements. Portions of these specifications have been produced by the Architect's/Engineer's standard methods of editing master specifications, and may contain minor deviations from traditional writing formats. Such deviations are a normal result of this production technique, and no other meaning will be implied or permitted.
- B. Format Explanation: The format of principal portions of these specifications can be described as follows; although other portions may not fully comply and no particular significance will be attached to such compliance or non-compliance.
- C. Sections and Divisions: For convenience, basic unit of specification text is a

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"section," each unit of which is named and numbered. These are organized into related families of sections, and various families of sections are organized into "divisions," which are recognized as the present industry-consensus on uniform organization and sequencing of specifications. The section title is not intended to limit meaning or content of section, nor to be fully descriptive of requirements specified therein, nor to be an integral part of text.

1. Each section of specifications has been subdivided into three (3) or less "parts" for uniformity and convenience. Part 1 – General; Part 2 – Products; and Part 3 - Execution. These do not limit the meaning of and are not an integral part of text which specifies requirements.
- D. Underscoring: Used strictly to assist reader of specification text in scanning text for key words in content. No emphasis on or relative importance of text is intended where underscoring is used.
- E. Imperative Language: Used generally in specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe responsibilities which must be fulfilled indirectly by Contractor, or when so noted, by others.
- F. Section Numbering: Used to facilitate cross-references in the Contract Documents. Sections are placed in the Project Manual in numeric sequence; however, numbering sequence is not complete, and listing of sections at beginning of Project Manual must be consulted to determine numbers and name of specification sections in the Contract Documents.
- G. Page Numbering: Numbered independently for each section; recorded in the Table of Contents in the Project Manual. Section number is shown with page number at bottom of each page, to facilitate location of text in the Project Manual.
- H. Project Identification: Project name and number are recorded at top of each page of specifications to minimize possible misuse of specifications, or confusion with other project specifications.
- I. Specification Content: Because of methods by which this project specification has been produced, certain general characteristics of content, and conventions in use of language are explained as follows:
- J. Minimum Quality/Quantity: In every instance, quality level or quantity shown or specified is intended as minimum for the Work to be performed or provided. Except as otherwise specifically indicated, actual work may either comply exactly with that minimum (within specified tolerances), or may exceed that minimum with reasonable limits. In complying with requirements, indicated numeric values are either minimums or maximums as noted or as appropriate for context of requirements. Refer instances of uncertainty to Architect/Engineer for

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decision before proceeding.

- K. Specialists, Assignments: In certain instances, specification text requires (or at least implies) that specific work be assigned to specialists or expert entities, who must be engaged for performance of those units of work. These must be recognized as special requirements over which Contractor has no choice or option. These assignments must not be confused with (and are not intended to interfere with) normal application of regulations, union jurisdictions, and similar conventions. One (1) purpose of such assignments is to establish which party or entity involved in a specific unit of work is recognized as "expert" for indicated construction processes or operations. Nevertheless, final responsibility for fulfillment of the entire set of requirements remains with the Contractor.
- L. Trades: Except as otherwise indicated, the use of titles such as "carpentry" in specification text, implies neither that the Work must be performed by an accredited or unionized tradesperson of corresponding generic name (such as "carpenter"), nor that specified requirements apply exclusively to work by tradesperson of that corresponding generic name.
- M. Abbreviations: The language of specifications and other Contract Documents is of the abbreviated type in certain instances, and implies works and meanings which will be appropriately interpreted. Actual work abbreviations of a self-explanatory nature have been included in texts. Specific abbreviations have been established, principally for lengthy technical terminology and primarily in conjunction with coordination of specification requirements with notations on drawings and in schedules. These are frequently defined in section at first instance of use. Trade association names and titles of general standards are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where full context of the Contract Documents so indicates.

1.4 DRAWING SYMBOLS

General: Except as otherwise indicated, graphic symbols used on drawings are those symbols recognized in the construction industry for purposes indicated. Refer instances of uncertainty to Architect/Engineer for clarification before proceeding.

1.5 INDUSTRY STANDARDS

- A. General Applicability of Standards: Applicable standards of the construction industry have same force and effect (and are made a part of Contract Documents by reference) as if copied directly into the Contract Documents, or as if published copies were bound herewith. No provisions of any referenced standard specification, manual, code, or instrumentation shall be effective to change the duties and responsibilities of the Owner, Contractor, or Architect/Engineer or employees from those set forth in the Contract Documents, nor shall it be effective to assign to Owner, Architect/Engineer, or

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any of the Architect/Engineer's consultants, agents, or employees, any duty or authority to supervise or direct the furnishing or performance of the work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract.

- B. Standards referenced directly in the Contract Documents or by governing regulations have precedence over non-referenced standards, which are recognized in industry for applicability to the Work.
- C. Non-referenced standards recognized in the construction industry are hereby defined, except as otherwise limited in the Contract Documents, to have direct applicability to the work, and will be so enforced for performance of the Work.
- D. Publications Dates: Except as otherwise indicated, where compliance with an industry standard is required, comply with standard in effect as of the date of Contract Documents.
- E. Copies of Standards: Provide where needed for proper performance of the work; obtain directly from publication sources.

PART 2 - PRODUCTS (not applicable)

PART 3 - EXECUTION (not applicable)

END OF SECTION 010950

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SECTION 011000 - SUMMARY OF WORK

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 PROJECT DESCRIPTION

- A. This project consists of constructing a one-story Vestibule and Office addition totaling approximately 1,810 S.F., at main entrance of the existing Yates Elementary School. Additionally, this project includes interior alterations at the existing, adjacent Lobby, Corridor, restrooms, Administrative Offices and storage areas, totaling approximately 2,340 S.F. Work includes clearing and partial demolition at the existing entry canopy and adjacent yard, preparation of building pad, grading and drainage, and restoration of the site. New construction includes a steel-framed, brick and EIFS-clad structure with windows and doors, plumbing, HVAC and electrical work. Interior work alters existing load-bearing and non-load-bearing masonry walls and partitions, and provides lintels for new openings, fire-rated HM storefronts and glass. Work includes interior demolition, provision of new interior wood casework, doors and frames, finishes, ceilings, plumbing, HVAC, lighting and electrical work. Work will include provision of a new electrical panel that is to be connected to the school's existing main electrical distribution switch (MDS) at the Main Electrical Room. **The completion schedule for this project is very demanding, and it is anticipated that extended workday hours and work on weekends will be necessary to complete this project by the scheduled completion date.** The Contract Documents prepared by Hudson + Associates Architects, PLLC are dated February 4, 2025.

- B. Project Directory

Project Name: Security Vestibule & Office Addition and Alterations for Yates Elementary School

Project Location: Yates Elementary School
73 Maxwell Lane
Newport News, VA 23606

Owner: The School Board of Newport News Public Schools
12465 Warwick Boulevard
Newport News, VA 23606

Architect: Hudson + Associates Architects, PLLC
120 West Queens Way, Suite 201
Hampton, VA 23669

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1.3 CONTRACTOR USE OF PREMISES

- A. General: Use of premises, work and storage areas shall be discussed at the pre-construction conference. In general, areas will be made available immediately adjacent to the building for the storage of materials and work may be carried on between the hours of 6:30 am and 9:00 pm.
- B. The building shall remain occupied and in use by the Owner for portions of construction contract period. All work inside the existing School shall be accomplished over Summer Break while the school is generally unoccupied and not in use.
- C. The Contractor shall have limited areas at the site designated by the Owner for its use and staging. The Owner shall designate parking for the Contractor's personnel and subcontractors' use during the work. Access to the site shall be gained from the driveway at south side of the school to front of the School.

1.4 OWNER OCCUPANCY

- A. Full Owner Occupancy: The Owner will occupy the building and use it throughout the school year, will vacate it from mid-June 2025 to mid-August 2025, and will re-occupy the building thereafter for the 2025-2026 school year. The Owner will make temporary provisions as needed to utilize alternative entrances to the building while the school is in use. Cooperate with the Owner during construction to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with the Owner's operations.

1.5 CONTRACT TIME

- A. The Contractor shall have access to the site commencing with the Notice to Proceed in order to take measurements and prepare for the Work.
- B. The Contractor shall commence work in the field **not before nor after June 13, 2025**, and shall work expeditiously to complete this project with minimal interference to the Owner and its operations.
 - 1. Substantial Completion:
 - a. All work in the existing school consisting of interior alterations and renovations shall be **substantially complete** and ready for the Owner's use not later than August 18, 2025.
 - b. All work in the new Addition, consisting of the Vestibule, Main office/Reception area, Lobby, Principal's Office, Administrative Office and Bathroom, exterior walkways and canopies shall be **substantially complete** and ready for the Owner's use not later than December 31, 2025.

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2. Final Completion:

- a. Final completion at all areas within the existing school shall be achieved not later than September 18, 2025.
- b. Final completion at all areas within the new Addition and all other areas of the project shall be achieved not later than January 30, 2026.
- c. Delivery of O&Ms, warranties and as-built drawings shall be achieved not later than March 1, 2026.

- C. The Contractor should plan on the following weather (rain and temperature) days for the project duration, including all time extensions made to the contract, up until final completion is given. **Time extensions for this Contract will only be given in any given month for the number of actual rain days that exceed the number of days listed below:**

January	6 Days	July	4 Days
February	5 Days	August	5 Days
March	5 Days	September	3 Days
April	3 Days	October	3 Days
May	4 Days	November	3 Days
June	4 Days	December	5 Days

- D. A day will be considered a weather day when, on a work day (Monday through Friday), it rains at the job site in such a way that *less than* 4 hours of production can occur or when the chance of rain exceeds 70% as reported by a source agreed upon at the pre-construction meeting or when the temperature does not rise above 40 degrees for more than 4 hours. Alternatively, a day may be considered a rain day IF the total recorded rainfall for that day at the Newport News-Williamsburg Airport equals or exceeds 0.1 inch. Weather delay claims must be made in writing or by e-mail on the day they occur – and agreed to by the Owner. Days that are weather days will be established by mutual agreement between the Owner and the Contractor **on the day they occur**, but the Owner will have final authority on that day to establish whether or not the day will be considered a weather day.

1.6 SCOPE OF WORK:

- A. General: Richard T. Yates Elementary School was originally constructed as a one-story building, opening in 1962, comprising approximately 39,940 SF. This project consists of constructing a small, one-story building addition that totals approximately 1,810 SF. Interior alterations of the existing building are also included that affect areas totaling approximately 2,340 S.F. Work at the Addition includes clearing and building pad preparation, spread-footing foundations and slab on grade, structural steel post-and-beam roof framing, metal stud-framed walls with sheathing, insulation, brick veneer and EIFS, storefront entrances, hardware, windows and glazing. Roof includes new decking, insulation and single-ply roof membrane at low-slope areas, and standing seam metal at pitched areas, exterior soffits and trim, metal gutters and downspouts. Interior work includes limited new partitions, doors, frames, hardware, finishes, painted

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soffits and suspended acoustical ceilings. Fire-rated windows, doors, frames and partitions are required at Corridors. HVAC, plumbing, electrical and special systems work are required. A special glass with integrally-laminated fragment retention interlayer shall be provided at all new exterior glazing. The existing school is un-sprinkled. Work includes demolition at exterior and interior of the existing building in preparation for the Addition and interior alterations. All work shall be constructed in accordance with the 2021 Virginia Uniform Statewide Building Code (VUSBC), now referred to as the Virginia Construction Code (VCC).

- B. Sequence of Work: Work shall generally proceed according to the following:
1. Following Award of Contract and Receipt of Notice to Proceed: The Contractor shall prepare and submit all construction submittals, commence ordering materials, plan the work and submit a schedule for work in the field.
 2. Prior to Work in the Field: Prior to commencing work in the field, the Contractor shall prepare all necessary temporary provisions for egress, secure the construction site, identify all subgrade utilities, and shall have a pre-construction meeting with the Owner and Design team. Work in the Field shall commence no earlier nor later than June 13, 2025.
 3. Substantial Completion: All work must be substantially complete, operational, clean and ready for the Owner's occupancy and use by the date stipulated above under the paragraph titled "Contract Time." School for the fall semester begins on Monday, August 25, 2025. School staff, including teachers and administrative staff shall return to work as early as Monday, August 11, 2025.
 4. Work Permitted After Substantial Completion: Punchlist work, TABs, HVAC system commissioning, and any other work approved by the Owner may be performed as needed after Substantial Completion, but all work must be performed after hours (as described below) once the school is re-occupied, subject to not conflicting with scheduled after-hours school activities.
- C. Existing Systems that Must Remain Operational during Course of the Work: The entire school shall remain in use and fully operational throughout the spring semester until June 13, 2025. All mechanical and electrical systems shall remain in use and fully functional throughout this period. The Owner may permit limited preparatory work inside the existing building after hours (6:00 PM- 6:00 AM), subject to prior approval.
- D. Bid Allowances: There are four (4) Bid Allowances to be included in the price for work under this Contract, listed as follows and addressed further under Specification Section 012100, Allowances:
1. Allowance No. 1 for Provision and Placement of off-site-sourced Control Fill (allowable quantity X fixed unit price.)
 2. Allowance No. 2 for Repair of Damaged CMU Wall (allowable quantity X fixed unit price)

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3. Allowance No. 3 for Provision of Technology Package (fixed price)

E. Unit Prices: There are two (2) Unit Prices to be included with the Bid price for work under this Contract, listed for completion on the Bid Form. These are also listed as follows and addressed further under Specification Section 012200, Unit Prices:

1. Item No. 1 for Provision and Placement of Control Fill (Off-site-sourced)
2. Item No. 2 for Repair of Damaged CMU Wall

Unit prices bid by the Contractor shall be used to adjust the Contract amount upward or downward as necessary to reflect any deviation in the installed quantities for items under the respective Bid Allowances.

F. Bid Options: There are no Bid Options, alternates or additive bid items identified for the work under this Contract. All work shown on the Contract Documents and identified in the Allowances and Unit Prices shall be awarded under the fixed-price Base Bid.

G. Basis for Award of Contract: Basis for award of this Contract shall be the to the *qualified* bidder that submits the lowest Lump Sum Base Bid price, inclusive of all work shown on the drawings *PLUS* the Allowances, including fixed price and allowances computed by multiplying bid unit price times the stated fixed quantity.

H. Closure of the School with No Indoor Work Permitted: The school shall be closed on June 19, 2025, July 4, 2025 and September 1, 2025 in observance of holidays, with no indoor access. Thus, no indoor work may be performed on those days. Exterior work that does not require indoor access will be permitted.

I. Coordination of Work to Handle, Store and Relocate Existing non-built-in Fixtures, Furniture and Equipment (FF&E): The Contractor shall be responsible for moving, storing and protecting the existing furniture in the existing school, where designated by the Owner, during all the work as follows:

1. This is limited to the existing office furniture (desks, chairs, file cabinets and side desks/credenzas), conference room table and chairs, lounge tables, chairs refrigerator and vending machine, teacher workroom tables, chairs and copier.
2. All loose items of office equipment, including phones and computers, other than aforementioned furniture shall be the responsibility of Newport News Public Schools to gather and box up. Loose, labeled boxes shall then be the responsibility of the Contractor to move and store with the furniture in a designated classroom or classrooms.
3. Furniture in the existing Principal's Office and Assistant Principal's Office shall be moved to existing Classroom 13 for duration of the work. The furniture shall be moved back to the new, respective offices upon completion of the work.
4. Furniture in the existing Lounge, Conference Room, Itinerant Office (Room 111) and Teacher Workroom shall be stored over the summer months in a classroom designated by the Owner and moved back into renovated

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respective spaces prior to the start of school at end of August 2025.

5. Furniture in the existing Administrative Office, including secretarial workstations, power poles, chairs, etc., along with six file cabinets, the salvaged Reception Desk and salvaged Mailbox cabinet, shall be relocated to existing Classroom 29 (in a portable structure outside the main school). This shall serve as the temporary Admin Office for duration of the work. The furniture, with exception of the salvaged Reception Desk, shall be moved back to the new, respective offices upon completion of the work. The existing Reception Desk shall be disposed of after move into the new Addition.
- J. Work by Preferred Sub-Contractor(s) Related to this Project: Certain subcontractors are preferred for performing work related to this project based on their prior work upon, and familiarity with, various systems as described below:
1. Hazardous Materials Abatement and Related Demolition: Newport News Public Schools, *not* the Contractor, shall be responsible for employing an independent, qualified contractor for removal of the existing CMU walls that at the Boys' and Girls' Restrooms that are covered in lead-containing tilework. The GC shall be responsible for removal of the non-hazardous exterior brick veneer at these walls. The GC shall also be responsible for removing painted portions of these walls that do not contain tilework. The Contractor shall clearly mark the extents of wall to be demolished by the independent HAZMAT contractor. This work shall be coordinated with the Owner's Representative.
 2. HVAC Controls Work: Installation of and connection to the building's energy controls and monitoring system shall be performed by Chesapeake Controls.
 3. Fire Alarm and Security Systems: Device installation, pulling of cables and fire alarm system testing shall be by Mid-Atlantic Security (MASEC).
 4. Data/I.T. Systems: Above-ceiling telecommunication and audio-visual system cabling, data systems and devices, including, but not limited to speakers, monitors and supports, wireless network transmitters, data outlets and faceplates, shall be by a subcontractor selected by Newport News Public Schools that is regularly engaged in installation of these types of systems.
 5. Short Circuit/Coordination Study/Arc-Flash Hazard Analysis: This study is required to be performed and submitted by the Contractor under the Building Code. The Contractor shall employ the SEAM Group as instructed on Sheet E0.02 of the Electrical Drawings to perform this work.
- K. Contractor's Waste and Disposal: Waste containers and disposal services shall be performed by the Contractor. Containers shall be placed at the north side of the site in the parking area or where otherwise directed by the Owner.
- L. Holes, Voids and Unfilled Openings: Fill in and/or patch holes resulting from the removal of unneeded conduit, wiring, piping and/or miscellaneous components.
- M. Patching: Patch walls, partitions, ceiling and soffits as indicated or to full extents as required in order to accomplish installation of systems. Additional requirements are specified under Section 017329, "Cutting and Patching."

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- N. Existing Soil Conditions: A geotechnical investigation has been performed in conjunction with design of this project; it is included under Section 023200, Geotechnical Investigation Report, for the Contractor's reference and use.
- O. Hazardous Materials: The existing building is known to contain limited hazardous materials, within the work area under this contract. **Newport News Public Schools is responsible for abating all known asbestos- and/or lead-containing materials under this contract.** If any additional suspicious materials are encountered, immediately notify the Owner's representative, who will expedite investigation and determination of any hazard(s). Hazardous Materials are identified and addressed further under Specification 022600, Hazardous Materials Assessment.
- P. Housekeeping, Site Clean-Up and Repair of Damage to Premises: Clean the site daily. Dispose of trash, rubble, and other construction waste in appropriate containers. Remove such containers from the site before they become overfilled. Prevent waste debris at the site or in containers from blowing in the wind or accumulating on the site or on neighboring properties. Clean the vicinity thoroughly upon completion of work prior to Owner occupancy. The Contractor shall be responsible for restoring the site fully prior to completion of work, including, but not limited to:
 - 1. Repair of all damage to existing sidewalks and pavement.
 - 2. Filling all holes or ruts, and regrading areas adjacent to the work impacted by Contractor's operations.
 - 3. Re-establishing turf in all areas of the site affected by Contractor's operations.
 - 4. The Contractor shall repair immediately any damage to sidewalks, building entrances or parking used by staff or the public during the work.

1.7 MISCELLANEOUS PROVISIONS

- A. The Contractor shall protect the existing facility and grounds at all times during the course of construction. Any damages caused or patching needed as a result of their activities shall be repaired at no additional cost to the Owner. In general, patching, repair, and renovation work is intended to match, compliment and align with existing conditions.
- C. The Contractor is to maintain the structural integrity of the existing building at all times. At no time is the removal or demolition of a structural element to occur without the approval of the Owner.
- D. The Contractor must have a minimum of five (5) years' experience and must have completed three (3) projects of a similar size and scope within the past three (3) years. Immediately after identifying the apparent low bidder that Contractor shall submit the names, addresses and phone numbers of the contact person, for each of these similar projects. These references may be used in determining the most qualified bidder irrespective of the low bid.
- E. Hours of School Operation/Student Arrival and Departure: When the Fall session of school resumes in Late August, the following events occur each day with

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regard to student arrival and departure:

1. Student Arrival: Students generally arrive between 9:00 AM and 9:20 AM. Buses may arrive earlier than 9:00 AM, but students will not depart the buses for entry into the building until 9:00 AM. Students arriving by bus shall use a separate, temporary entrance while work is underway at the schools primary entrance as shown on Sheet A0.01 of the Architectural Drawings.
 2. Student Dismissal: Students are dismissed at 3:45 PM each afternoon, except when dismissed earlier on special occasions. Buses depart between 4:00 PM and 4:15 PM. Students departing by bus shall exit the building using the same temporary entrance/exit when arriving.
 3. Students arriving and dismissing by personally-owned vehicles (Student Drop off and pick-up): Students traveling to and from school by car (instead of bus) arrive and depart at the same times as students on buses. Students arriving departing by car, however, shall use the southeast entrance/exit. The Contractor shall be responsible for renting, erecting and maintaining a tent to cover this end of the school for duration of the work after start of school at end of August.
 4. Generally, the Contractor may continue to work during hours when students are arriving and departing. **No deliveries**, however, may be scheduled during the periods when students are arriving and departing.
 5. The Contractor shall avoid interacting with students and the public during periods of student arrival and departure. The Contractor's personnel shall avoid going to and from personal vehicles or remote laydown areas (if across the bus loop) during the student arrival and departure periods.
- F. Temporary Entrance Cover: The Contractor shall include in its Base Bid provision for an outdoor tent, 20 feet by 20 feet in covered area, to be rented, assembled and erected and eventually demounted, in order to provide temporary weather cover at the school's southeast-facing entrance (facing toward Maxwell Lane) from August 22, 2025 until Substantial Completion of the proposed Building Addition, or until as such time that the new entrance is accepted by the Owner and put into service.
- G. The Contractor shall not have access to the existing building's lounges, vending machines, restrooms or telephones for its use in the existing building. See Section 015000 for Temporary Facilities requirements.
- H. Smoking and chewing of tobacco is not allowed on Owner's property at any time during the project except at designated areas approved by the Owner well removed from the building and new work site. Persons found smoking, vaping or chewing tobacco in areas than those designated may be removed from the construction site.
- I. Possession or Use of Drugs and/or Alcohol is illegal on Owner's property and severely punishable.
- J. Possession, Display or Use of firearms, tasers, crossbows, knives, nunchucks or other weapons, including arrows and ammunition, is illegal on Owner's property

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and severely punishable. This shall not apply to construction tools ordinarily employed in the type of work performed under this contract.

- K. Condition of the Existing Building and Grounds: The Contractor will be responsible for maintaining the building in a weathertight condition throughout the construction period and repair damage caused by construction operations. Take all precautions necessary to protect the building and its occupants during the construction period. Any damages caused to the Owner's property or property of any of the Owner's employees as a result of the Contractor's operations shall be repaired to the condition before the damage occurred, at the Contractor's expense.

- L. The existing facility is located in a predominantly suburban area. The Contractor and its personnel shall at all times conduct the work so as to be cognizant and respectful of the school's students, faculty, staff and administration, businesses, residences and families. Do not create undue noise or nuisances during course of the work. All contractor-owned, subcontractor-owned and labor force personally-owned vehicles, plus all delivery vehicles, shall be operated in a safe and lawful manner on streets and nearby areas, aware of children playing. Excessive noise, vulgar language by workers, or otherwise inappropriate behavior while on City or School Board property will not be tolerated and may be cause for removal of personnel from the project site. Contractor shall take care to identify construction entrance and observe/ maintain conditions that promote safety for all vehicles entering/existing the site.

1.8 FEES AND PERMITS

- A. Unless otherwise provided in the Contract Documents, the Contractor shall apply for and obtain all public permits, unless noted otherwise. Such permits include:
 - 1. Building permit
 - 2. Plumbing permit
 - 3. Mechanical permit
 - 4. Electrical permit
 - 5. Site/Land Disturbance permit (if required)
 - 6. Site Erosion & Sediment Control Permit (if required)

- B. The City of Newport News will forgive the permit cost for the permits they issue.

PART 2 - PRODUCTS (Not applicable).

PART 3 - EXECUTION (Not applicable).

END OF SECTION 011000

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SECTION 012100 – ALLOWANCES

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 includes administrative and procedural requirements governing allowances. Selected materials and equipment are specified in the Contract Documents by allowances. In some cases, these allowances include installation. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order. Adjustments to the Contract Amount shall be made in accordance with the unit prices bid for the allowance work as described under Section 012200, Unit Prices.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine products covered by an allowance promptly upon delivery for damage or defects.

3.2 PREPARATION

- A. Coordinate materials and their installation for each allowance with relative materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

- A. Construction allowances include the following:
 - 1. Allowance No. 1 for Provision and Placement of Control Fill (Off-site-sourced): Include in the Base Bid price the cost of importing and placing **225 cubic yards** of select fill soil materials beneath the Proposed

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Building Addition after stripping off unsuitable in-situ materials as described in the Geotechnical Investigation Report, as indicated on Architectural Drawing A0.01, and as specified under Section 312100, Earth Moving, in lieu of using available on-site stockpiled materials of unknown or suspected poor quality. If this allowance is not used, or only used in part, the Owner will be reimbursed by way of a credit change order based on the price bid for this work in the unit price section of the Contractor's bid, multiplied by the portion of 225 cubic yards not used. If a quantity of select fill in excess of 225 cubic yards is required to fill the volume beneath the Proposed Addition, and agreed to by the Owner, contract amount shall be increased, based on the unit price bid for placement of fill material multiplied by the quantity required in excess of 225 cubic yards.

2. Allowance No. 2 for Repair of Damaged CMU Wall: Bidders shall include in the Base Bid price the cost of providing **400 square feet** of metal wall furring (minimum depth of 3/4-inch) and one layer of 5/8-inch thickness gypsum wall board, plus finish painting, over damaged/defaced CMU wall surface or CMU wall surface that cannot be practically or feasibly cleaned of existing foreign materials such as adhesives, grout and other compounds. Such conditions, when known and indicated thus on the drawings shall be provided for separately in the Base Bid. This allowance is to be used strictly for repair of those unknown conditions where CMU wall surfaces are concealed or in unknown condition prior to start of demolition operations. The Contract amount shall be adjusted upward or downward as necessary to reflect the actual quantity of wall furring and GWB surface applied, multiplying the unit price bid for this work by the quantity deviation from 400 square feet.
3. Allowance No. 3 for Provision of Technology Package: Bidders shall include in the Base Bid price a fixed-price allowance of **\$65,000.00** for provision of **new** Auxiliary/Special Systems wiring and devices. These systems include data and telecommunication wiring, outlet devices and faceplates, security system devices (access control, intrusion detection, CCTV, etc.), wiring and faceplates, intercom, telephone and audio-visual devices with accompanying low-voltage wiring and terminations. The Technology Package shall be the General Contractor's responsibility to complete, using a subcontractor (or multiple vendors) as selected by Newport News Public Schools. Payment for the Technology Package work shall be made to the General Contractor, who, in turn, will pay the designated subcontractor and/or vendor(s). Additionally:
 - a) Bidders may add mark-up to the Technology Package as deemed appropriate prior to submitting bids; however,

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- b) The GC's mark-up shall on the Technology package shall be limited to 5% for extra work (if any) added to the Technology Package following award of contract.

Items to be included in the Base Bid (separately) that are responsibility of the General Contractor but NOT part of the Technology Package:

- c) All fire alarm devices and wiring, both new and existing, shall be provided for separately outside the Technology Package, as shown on Electrical drawings.
- d) Where indicated on the Electrical drawings, all **existing** Auxiliary/Special System devices and wiring shall be carefully removed, stored and reinstalled under the base Contract apart from Technology Package. This may include security devices, A/V equipment and other low-voltage components.

END OF SECTION 012100

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SECTION 012200 - UNIT PRICES

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 unit prices.
- B. A unit price is an amount proposed by Bidders and stated on the Bid Form as a price per unit of measurement for materials or services that will be added to or deducted from the Contract Sum by Change Order in the event the estimated quantities of Work required by the Contract Documents are increased or decreased.
- C. Unit prices include all necessary material, overhead, profit and applicable taxes.
- D. The Owner reserves the right to reject the Contractor's measurement of work-in-place that involves use of established unit prices, and to have this Work measured by an independent surveyor acceptable to the Contractor at the Owner's expense.
- E. **Contractor shall not proceed with work listed herein that will incur charges beyond what is included in the Original Contract Price of this job without written authorization by the Owner, or such method of approval as the Owner shall deem acceptable.**
- F. Schedule: A "Unit Price Schedule" is included below. Specification Sections referenced in the Schedule contain requirements for materials and methods described under each unit price.

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION

3.1 UNIT PRICE SCHEDULE

- A. Item No. 1 – Provision and Placement of Control Fill (Off-site-sourced): Includes Labor, Equipment and Material per Cubic Yard (C.Y.) to import controlled, select fill for earthwork that is sourced from off-site, i.e., not using materials

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stockpiled, mined or otherwise available at the site.

1. Description: The site requires off-site fill materials to be imported in order to raise grade of the site beneath and around the Proposed Building Addition due to poor quality in-situ soils. New finish floor of the Addition shall match that of the existing building, and this will allow proper grading and drainage around the Addition. The fill quantity will be determined by the Contractor and verified to the Owner's Representative by evidence of orders for material and, delivery tickets. Unit price for this item shall be by cubic yard, including extraction, transportation/delivery to the site. Dumping at the site, rough-grading and compaction are excluded, as these must be performed regardless of the source of material.
 - a. Unit of Measure: Per cubic yard (CY) of imported, delivered and placed select fill material *in excess of* the Contract requirement and the **225 C.Y. Base Bid allowance** required under Section 012100 Allowances.
 - b. Unit Price Adjustment: The Unit Price for material, labor and equipment shall be the basis for adjusting the contract price upward (if excess material is required) as well as downward if less material is required than the Base Bid Allowance quantity. The Contractor shall record all imported material by delivery ticket and track ALL off-site material imported onto the site as basis for contract adjustment. Failure to monitor and document the quantity of off-site-imported material may be reason to refuse payment or modification.

- B. Item No. 2 – Repair of Damaged CMU Wall Surfaces: Includes Labor, Equipment and Material per Square Foot (S.F.) for metal wall furring (minimum depth of 3/4-inch) and one layer of 5/8-inch thickness gypsum wall board, plus finish painting, placed directly over damaged/defaced CMU wall surface or CMU wall surface that cannot be practically or feasibly cleaned of existing foreign materials such as adhesives, grout and other compounds.
 1. Description: Existing CMU walls may have unknown surface conditions after existing features are removed, or where existing CMU walls are exposed to view after demolition operations. At the Owner's discretion and direction, existing CMU wall surfaces that are determined to be damaged or unsightly, and not suitable to remain exposed to view, shall be repaired by applying the described wall furring and finish systems over the damaged areas, from finish floor to a minimum of four inches above the finish ceiling. The extents of wall surface repair shall be determined and documented for management of the allowance.
 - a. Unit of Measure: Per square foot (SF) of metal furring GWB and painting *in excess of* the Contract requirement and the **400 S.F. Base Bid allowance** required under Section 012100 Allowances.

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- b. Unit Price Adjustment: The Unit Price for material, labor and equipment shall be the basis for adjusting the contract price upward (if excess wall repair is authorized) as well as downward if less wall repair is required than the Base Bid Allowance quantity. The Contractor shall record all wall surface area and come to agreement with the Owner over surfaces and quantity prior to undertaking the repair. Failure to record and agree on quantity of wall repair prior to undertaking the repairs may be reason to refuse payment or modification.

END OF SECTION 012200

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SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.

1.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
 - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

- A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use CSI Form 13.1A or suitable form of submittal transmittal with substitution request clearly identified and justified.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
 - b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.

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- c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
 - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES or other code entity such as ASHRAE, IESNA, etc.
 - j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - k. Cost information, including a proposal of change, if any, in the Contract Sum.
 - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
 - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

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1.5 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
 - 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Requested substitution provides sustainable design characteristics that specified product provided.
 - c. Substitution request is fully documented and properly submitted.
 - d. Requested substitution will not adversely affect Contractor's construction schedule.
 - e. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - f. Requested substitution is compatible with other portions of the Work.
 - g. Requested substitution has been coordinated with other portions of the Work.
 - h. Requested substitution provides specified warranty.
 - i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.

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1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - b. Requested substitution does not require extensive revisions to the Contract Documents.
 - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - d. Requested substitution provides sustainable design characteristics that specified product provided.
 - e. Substitution request is fully documented and properly submitted.
 - f. Requested substitution will not adversely affect Contractor's construction schedule.
 - g. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - h. Requested substitution is compatible with other portions of the Work.
 - i. Requested substitution has been coordinated with other portions of the Work.
 - j. Requested substitution provides specified warranty.
 - k. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 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. Architect will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
 - 2. Within 14 days after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to,

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changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

- B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to Architect.
 - 1. Include a statement outlining 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 the Contract Time.
 - 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - 4. Include costs of labor and supervision directly attributable to the change.
 - 5. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - 6. Comply with requirements in Division 01 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.

- C. Proposal Request Form: Use AIA Document G709 for Proposal Requests.

1.5 ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, base each Change Order proposal on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
 - 1. Include installation costs in purchase amount only where indicated as part of the allowance.
 - 2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
 - 3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
 - 4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the Purchase Order amount or Contractor's handling, labor, installation, overhead, and profit.

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Submit claims within 21 days of receipt of the Change Order or Construction Change Directive authorizing work to proceed. Owner will reject claims submitted later than 21 days after such authorization.

1.6 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.
- B. **Contractor shall not proceed with any work that will incur charges beyond what is included in the Original Contract Price of this job without written authorization by the Owner, or such method of approval as the Owner shall deem acceptable.** The Contractor shall obtain written approval or notice to proceed any proposed change orders or extra-cost work before commencing such work. If the Contractor fails to obtain such authorization, or commences extra work without Owner's approval, the Owner will be under no obligation to pay for such work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

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SECTION 012900 - 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.

1.3 SCHEDULE OF VALUES

- A. Contractor must coordinate preparation of the Schedule of Values with preparation of the Contractor's Construction Schedule.
- B. Each Sub-Contractor shall coordinate preparation of this Schedule of Values for its part of the Work with preparation of the General Contractors' Construction Schedule and Schedule of Values.
- C. 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.
- D. Submit the Schedule of Values to the Architect at the earliest feasible date, but in no case later than **14 days** before the date scheduled for submittal of the initial Application for Payment.
- E. Format and Content: The project Schedule of Values shall include but is not limited to the following line items; Provide separate lines for labor and material values for items w/ a asterisk before them:
 - 1. Division 01
 - a. Superintendent
 - b. Bond
 - c. Insurances
 - d. Equipment
 - e. Dumpster
 - f. Utilities
 - g. Temporary Facilities

*Provide separate material and labor values.

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- a. Demolition – Selective
 - b. Disposal Charges (including transport)

 - 3. Division 03
 - a. *Cast in place concrete for foundations
 - b. *Cast in place concrete for slabs on grade
 - c. Cast in place concrete for sidewalks and other site-related features such as curbs, driveways, aprons and equipment pads

 - 4. Division 04
 - a. *Grouting & Masonry Reinforcing
 - b. *Masonry

 - 5. Division 05
 - a. *Structural steel
 - b. *Cold-formed framing, bracing for exterior bearing and non-load-bearing walls, conventional roofs
 - c. Metal decking for roofs

 - 6. Division 06
 - b. Miscellaneous Wood Blocking

 - 7. Division 07
 - a. *Membrane Roof
 - b. *Building Insulation
 - c. *Exterior Wall Sheathing
 - d. *Exterior Insulation Finish System
 - e. *Flashing & Sheet Metal, including gutters and downspouts
 - f. *Wall and soffit panels
 - g. *Sealants

 - 8. Division 08
 - a. *Doors and frames
 - b. *Storefront windows and entrance doors
 - d. *Door Hardware
 - e. *Glass and glazing
 - f. *Fire Rated Glass

 - 9. Division 09
 - a. *Interior metal framing for partitions, soffits and ceilings
 - b. *Interior acoustical wall insulation
 - c. *GWB
 - d. *Wall Base
 - e. *Acoustical Panel Ceilings
 - f. *Painting
 - g. *Resilient Flooring
 - h. *Tiling
- *Provide separate material and labor values.

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- i. *Carpet
- j. *Resinous Terrazzo Flooring
- k. *Acoustical wall panels

10. Division 10

- a. Toilet accessories
- b. Fire extinguisher cabinets and accessories

11. Division 21

- a. Fire Alarm System

12. Division 22

- a. *Plumbing – Supply and DWV Piping
- b. *Plumbing – fixtures
- c. *Plumbing – HVAC System-related

13. Division 23

- a. *HVAC – Equipment & Units
- b. *HVAC – Ductwork and metalwork
- c. *HVAC – Piping
- d. *HVAC – Insulation
- e. *Hangers and Supports
- f. Exhaust Fans
- g. *Electric Unit Heaters
- h. *HVAC Diffusers and Grilles
- i. *Gas Piping
- j. *Fire Dampers
- k. *Electric Duct Heater
- l. *Condensation Drain Piping
- m. *Automatic Temperature Controls
- n. *Testing and Balancing (TABS) *Provide separate material and labor values.

16. Division 26

- a. *Electrical Distribution Panels and Breakers
- b. *Electrical Rough-in for indoor mechanical equipment
- c. *Lighting fixtures
- d. *Power distribution
- e. *Low-voltage and Special Systems rough-in and wiring

17. Division 31

- a. *Site Clearing and Grubbing
- b. *Earthwork, excluding fill materials
- c. *Earthwork, placement and compaction of fill materials
- d. *Erosion and sediment control
- e. *Placement of topsoil and final grading
- f. Soil poisoning

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18. Division 32

- a. *Concrete pavements, including sidewalks, curb and gutter
- b. *Fencing and gates
- c. Landscaping, including turf

19. Division 33

- a. Stormwater Utility Piping and underground structures
- b. Site electrical and telecommunication distribution
- c. Site lighting

*Provide separate material
and labor values.

1.4 Identification:

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

- 1. Project name and location.
- 2. Name of the Architect.
- 3. Project number.
- 4. Contractor's name and address.
- 5. Date of submittal.

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

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

1.5 APPLICATIONS FOR PAYMENT:

A. Each Application for Payment shall be consistent with previous applications and payments as certified by the Architect 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 Application for Payment shall be submitted by the first day of each month. The period of construction Work covered by each Application for Payment is the period from the first to the last day of each month for the duration of the construction period.

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

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Owner. Incomplete applications will be returned without action.

- F. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions have been made.
- G. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.
- H. Transmittal: Submit 4 executed copies of each Application for Payment to the Architect by means ensuring receipt within 24 hours; one copy shall be complete, including waivers of lien and similar attachments.
- I. Transmit each copy with a transmittal form listing attachments, and recording appropriate information related to the application in a manner acceptable to the Architect.
- J. Waiver Delays: Submit each Application for Payment with the Contractor's waiver of mechanics lien for the period of construction covered by the application.
- K. 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.
- L. Waiver Forms: Submit waivers of lien on forms, and executed in a manner, acceptable to Owner.
- M. Initial Application for Payment: Administrative actions and submittals that must precede submittal of the first Application for Payment include the following:
 - 1. List of subcontractors.
 - 2. List of principal suppliers and fabricators.
 - 3. Schedule of Values.
 - 4. Contractor's Construction Schedule (preliminary if not final).
 - 5. Copies of building permits
- N. 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.
- O. Administrative actions and submittals that shall precede this application include:
 - 1. Occupancy permits and similar approvals.
 - 2. Final cleaning.
 - 3. Application for reduction of retainage, and consent of surety.
 - 4. Advice on shifting insurance coverage.
 - 5. List of incomplete Work, recognized as exceptions to Architect's Certificate of

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Substantial Completion.

6. All warranties and guarantees.
- P. 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 taxes, fees and similar obligations have been paid.
 7. Removal of temporary facilities and services.
 8. Removal of surplus materials, rubbish and similar elements.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION 012900

SECTION 013100 - 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:
 - 1. Pre-Construction Meeting.
 - 2. Progress Meeting(s)
 - 3. Final Inspection Meeting
- B. Construction schedules are specified in Section 013300 - "Submittals"
- C. Pre-construction Conference - An organizational meeting will be held at the Project site prior to commencement of construction activities to clarify responsibilities and procedures as outlined below.
- D. Agenda: Topics will include items of significance that could affect progress of the job, such as:
 - 1. Contractor's schedule and work plan including staffing.
 - 2. Estimated time of completion and critical path items.
 - 3. Deliveries, site access, and storage of materials.
 - 4. Off-site fabrication issues.
 - 5. Site Utilization, Temporary Facilities.
 - 6. Hours of Work and Job Safety.
 - 7. Hazards and risks.
 - 8. Quality, Work standards and cleanup.
 - 9. Handling of deck replacement-quantification and approval.
 - 10. Change Orders and RFP procedures.
 - 11. Documentation for (and handling of) payment requests.
 - 12. Responsibility and Authority of Field Representatives
 - 13. Distribution of phone names and numbers of all present
 - 14. Substantial Completion, Rain Days, Liquidated Damages
- E. Attendees: The Owner, the Architect, the Contractor and his superintendent, shall, at minimum, each be at the conference. It is desired

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that representatives from major subcontractors also attend the Pre-Construction Conference where their work is expected to have significant impact upon schedule and/or work of other trades, including, but not limited to, the sitework subcontractor and steel fabricator/erector.

1.3 PROGRESS MEETINGS

- A. Progress meetings will be held at the Project Site twice a month for the purpose of reviewing job progress.
1. Attendees: The Architect, the Contractor and his superintendent, and any subcontractor or supplier whose performance will have an impact on the quality or timeliness of job completion will be present at this meeting. The Subcontractor's representative at these meetings shall be familiar with the project and authorized to make decisions on matters relating to job progress.
 2. Agenda: 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 or overtime work will be required to ensure that current and subsequent activities will be completed within the Contract Time.
 3. Review the present and future needs of each entity present, including such items as:
 - a. Time and Sequences
 - b. Deliveries and critical path items
 - c. Off-site fabrication issues
 - d. Access
 - e. Temporary facilities and services
 - f. Hours of Work
 - g. Hazards and risks
 - h. Quality, Work standards and cleanup
 - i. Change Orders and unit price work done to date
 - j. Documentation of information for payment requests
- B. Schedule Updating: Revise the construction schedule once a month after the mid-month progress meeting where revisions to the schedule have been made or recognized. Issue the revised schedule every month.
- C. Final Inspection Meeting: After the work is complete, there shall be a final meeting at the project site to examine and verify all work is complete and all requirements are met for issuing contractor and manufacturer's warranties to the Owner.

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1. Attendees: The Owner, the Architect, the Contractor and his superintendent, and any other representative required by the Owner and/or Contractor shall be at the meeting.

PART 1 - PRODUCTS (Not Applicable)

PART 2 - EXECUTION (Not Applicable)

END OF SECTION 013100

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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 01 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. Submittal Schedule
 - 2. Contractor's construction schedule
 - 3. Shop Drawings
 - 4. Product Data
 - 5. Samples
 - 6. Schedule of Values

1.3 Administrative Submittals: Refer to other Division-1 Sections and other Contract Documents for requirements for administrative submittals.

1.4 SUBMITTAL SCHEDULE

- A. The Contractor shall prepare a complete schedule of submittals. Submit the schedule within **10 days** of the date required for establishment of the Contractor's construction schedule.
 - 1. Coordinate submittal schedule with the list of subcontracts, schedule of values and the list of products as well as the Contractor's construction schedule.
 - 2. Prepare the schedule in Specification Division order using the schedule shown at the end of this section as a template. Provide the following information for each submittal:
 - a. Submittal reference number for each item.
 - b. Review Status
 - c. Name of subcontractor.
 - d. Description of the part of the Work covered.
 - 3. Scheduled date for resubmittal.

1.5 SUBMITTAL PROCEDURES

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- 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. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. 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 resubmittals.
- D. Allow two weeks for initial review. If possible, review will be done more quickly. 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. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing.
- E. Submittal Preparation: Place a permanent label, title block or cover sheet on each submittal for identification. Indicate the name of the entity that prepared each submittal.
 - 1. Provide a space approximately 4" x 5" on the label, title block or cover sheet on Submittal to record the Architect's review and approval markings and the action taken. Include the following information on the label, title block or cover sheet, for processing and recording action taken.
 - a. Project name and date
 - b. Name and address of Contractor and Supplier
 - c. Number and title of appropriate Specification Section
 - d. Drawing number and detail references, as appropriate
- F. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Architect 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 including submittal number and description (Note: Description should include whether it is product data or a shop drawing and what material it relates to, i.e. paint, roofing, sheet metal, etc.). 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. If submittal comes without this certification, it will be returned without review.**
- G. Transmittal Form: Use AIA Document G810 or an approved equal.

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1.6 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Submission before the Pre-Construction Meeting: Prepare a simple horizontal bar-chart type Contractor's construction schedule. Submit **before** the preconstruction conference.
 - 1. Provide a separate time bar for each significant construction activity. Provide continuous vertical line to identify the first working day of each week.
 - 2. Prepare the schedule on a sheet, of sufficient width to show data for the entire construction period.
 - 3. Show each activity in proper sequence, and highlight critical path items.
 - 4. Plan for completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Architect's procedures necessary for certification of Substantial Completion.
- B. Schedule Updating: Revise the schedule after the progress meeting or at times where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting or when submitting a Request for Payment.

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, schedules, 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: Submit Shop Drawings on sheets at least 8-1/2" x 11" but no larger than 24" x 36".
- D. Submittal: Submit all shop drawings electronically in .PDF format, preferably by e-mail with copies to both the Architect and Owner's Representative. The

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Architect will review the submittal, annotate the original .PDF file, and will return the submittal marked with action taken and corrections or modifications required. For submittals requiring review and comment by the project engineers, the Architect will be responsible for forwarding the submittals to the engineers for review, receiving the reviewed submittals and returning to the Owner and Contractor. The annotated .PDF file shall be returned via e-mail. Large files exceeding 10 MB in file size shall be exchanged via the Architect's web-based Sharefile site; and instructions will be furnished as to this system's use. The Contractor and subcontractors shall be responsible equipping home offices and field offices electronically to view, send, receive and print all submittals under this contract. See Section 017700, "Project Closeout" for additional information on Record Document requirements.

- E. Do not use Shop Drawings for construction unless they have been reviewed and approved by the Architect.

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, etc. 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. Submittal number
 - 2. Specification division
 - 3. Manufacturer's printed recommendations
 - 4. Compliance with recognized trade association standards
 - 5. Compliance with recognized testing agency standards
 - 6. Application of testing agency labels and seals
 - 7. Notation of dimensions verified by field measurement
- C. Do not submit Product Data until compliance with requirements of the contract Documents has been confirmed. Stamp and sign data after reviewing it for compliance to indicate that such a review has been made and that the data does indeed comply with the specified requirements.
- D. Submittals: Submit electronic copies in .PDF format of each required submittal. The Architect will review and annotate the .PDF files with action taken and corrections or modifications required. All product data submittals shall be exchanged and reviewed as described above under SHOP DRAWINGS.

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- E. Distribution: Furnish copies of approved submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms. Do not proceed with installation until an applicable copy of Product Data is in the installer's possession. Do not permit use of unmarked copies of Product Data in connection with construction.

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. Mount, display, or package Samples in the manner specified to facilitate review of qualities indicated. Prepare Samples to match the Architect's Sample. Include the following:
 - 1. Generic description of the Sample
 - 2. Product name or name of manufacturer
 - 3. Compliance with recognized standards
- B. 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. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, assembly details, connections, operation and similar construction characteristics.
- C. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, submit 4 sets; one will be retained marked with the action taken. Maintain at least one set of Samples, as returned, at the Project site, for quality comparisons throughout the course of construction.
- D. 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.

1.10 SCHEDULE OF VALUES

- A. Submit a schedule of values along with other product submittals consisting of a tabular breakdown of individual elements of the work in sufficient detail to be able to pay for individual items and see where the costs are. Include the project name and address, Contractor's name and address, Contract Purchase Order number, etc. and show the breakdown of what percentage of the total job cost is in each line item. This breakdown will be used for Applications for Payment. Include administrative items such as bond and supervision, insurance, etc. as applicable.

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- B. The Schedule of Values must be submitted a minimum of **two weeks** before the Contractor intends to submit their first application for payment. This is to allow time for the schedule of values to be reviewed and approved by the Owner before the initial invoice. Failure to comply with this requirement will be cause to refuse the application.
- C. Application for payment must be based upon the approved schedule of values and submitted on AIA Application for Payment Forms G702 and G703, only. State of Virginia forms will not be accepted.

1.11 ARCHITECT'S ACTION

- A. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Architect will review each submittal, mark to indicate action taken, and return promptly. **Compliance with specified characteristics is the Contractor's responsibility.**
- B. Action Stamp: The Architect will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, as follows, to indicate the action taken:
- C. Reviewed: Where submittals are marked "Reviewed" 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.
- D. Comments Attached: When submittals are marked "Comments Attached," 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. If resubmittal is also required, promptly respond, in order to acknowledge that requested changes will be made.
- E. Rejected: When submittal is marked "Rejected" and "Resubmit" 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. Do not permit submittals marked "Rejected" and "Resubmit" to be used at the Project Site, or elsewhere where Work is in progress.
- F. Confirm: Where a submittal is marked "Confirm" the comment indicates an "approved as noted" status and the Contractor must confirm to the Architect in writing that they will comply with the "as noted" comments before proceeding with that part of the Work.
- G. Other Action: Where a submittal is primarily for information or record purposes, special processing or other activity, the submittal will be returned, marked "Reviewed".

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PART 2 - PRODUCTS (Not Applicable)

PART 3 - PART 3 - EXECUTION (Not Applicable)

END OF SECTION 013300

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SECTION 013516 - ALTERATION PROJECT PROCEDURES

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 special procedures for alteration work.

1.3 DEFINITIONS

- A. Alteration Work: This term includes remodeling, renovation, repair, and maintenance work performed within existing spaces or on existing surfaces as part of the Project.
- B. Consolidate: To strengthen loose or deteriorated materials in place.
- C. Design Reference Sample: A sample that represents the Architect's prebid selection of work to be matched; it may be existing work or work specially produced for the Project.
- D. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.
- E. Match: To blend with adjacent construction and manifest no apparent difference in material type, species, cut, form, detail, color, grain, texture, or finish; as approved by Architect.
- F. Refinish: To remove existing finishes to base material and apply new finish to match original, or as otherwise indicated.
- G. Repair: To correct damage and defects, retaining existing materials, features, and finishes. This includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials.
- H. Replace: To remove, duplicate, and reinstall entire item with new material. The original item is the pattern for creating duplicates unless otherwise indicated.

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- I. Replicate: To reproduce in exact detail, materials, and finish unless otherwise indicated.
- J. Reproduce: To fabricate a new item, accurate in detail to the original, and from either the same or a similar material as the original, unless otherwise indicated.
- K. Retain: To keep existing items that are not to be removed or dismantled.
- L. Strip: To remove existing finish down to base material unless otherwise indicated.

1.4 COORDINATION

- A. Alteration Work Sub-schedule: A construction schedule coordinating the sequencing and scheduling of alteration work for entire Project, including each activity to be performed, and based on Contractor's Construction Schedule. Secure time commitments for performing critical construction activities from separate entities responsible for alteration work.
 - 1. Schedule construction operations in sequence required to obtain best Work results.
 - 2. Coordinate sequence of alteration work activities to accommodate the following:
 - a. Owner's continuing occupancy of portions of existing building.
 - b. Owner's partial occupancy of completed Work.
 - c. Other known work in progress.
 - d. Tests and inspections.
 - 3. Detail sequence of alteration work, with start and end dates.
 - 4. Utility Services: Indicate how long utility services will be interrupted. Coordinate shutoff, capping, and continuation of utility services.

1.5 MATERIALS OWNERSHIP

- A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered or uncovered during the Work, regardless of whether they were previously documented, remain Owner's property.
 - 1. Carefully dismantle and salvage each item or object in a manner to prevent damage and protect it from damage, then promptly deliver it to Owner where directed at Project site or as otherwise directed by Owner's Representative.

1.6 INFORMATIONAL SUBMITTALS

- A. Alteration Work Sub-schedule:

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1. Submit alteration work sub-schedule within 30 days of date established for commencement of work at the site, but not less than 14 days prior to commencement of interior alteration work.
- B. Preconstruction Documentation: Show preexisting conditions of adjoining construction and site improvements that are to remain, including finish surfaces, that might be misconstrued as damage caused by Contractor's alteration work operations.
- C. Fire-Prevention Plan: Submit 30 days before work begins.

1.7 STORAGE AND HANDLING OF SALVAGED MATERIALS

- A. Salvaged Materials:
 1. Clean loose dirt and debris from salvaged items unless more extensive cleaning is indicated.
 2. Pack or crate items after cleaning; cushion against damage during handling. Label contents of containers.
 3. Store items in a secure area until delivery to Owner.
 4. Transport items to Owner's storage area on-site or as designated by Owner.
 5. Protect items from damage during transport and storage.
- B. Salvaged Materials for Reinstallation:
 1. Repair and clean items for reuse as indicated.
 2. Pack or crate items after cleaning and repairing; cushion against damage during handling. Label contents of containers.
 3. Protect items from damage during transport and storage.
 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment unless otherwise indicated. Provide connections, supports, and miscellaneous materials to make items functional for use indicated.
- C. Existing Materials to Remain: Protect construction indicated to remain against damage and soiling from construction work. Where permitted by Architect, items may be dismantled and taken to a suitable, protected storage location during construction work and reinstalled in their original locations after alteration and other construction work in the vicinity is complete.
- D. Storage: Catalog and store items within a weathertight enclosure where they are protected from moisture, weather, condensation, and freezing temperatures.
 1. Identify each item for reinstallation with a nonpermanent mark to document its original location. Indicate original locations on plans, elevations, sections, or photographs by annotating the identifying marks.
 2. Secure stored materials to protect from theft.

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3. Control humidity so that it does not exceed 85 percent. Maintain temperatures 5 deg F (3 deg C) or more above the dew point.

E. Storage Space:

1. Arrange for off-site locations for storage and protection of salvaged material that cannot be stored and protected on-site.

1.8 FIELD CONDITIONS

- A. Survey of Existing Conditions: Record existing conditions that affect the Work by use of measured drawings and preconstruction photographs.
- B. Discrepancies: Notify Architect of discrepancies between existing conditions and Drawings before proceeding with removal and dismantling work.
- C. Owner's Removals: Before beginning alteration work, verify in correspondence with Owner responsibilities for items to be removed:
 1. Electronic audio-visual equipment.
 2. Computers, monitors, network devices and racks.
 3. Telephones.
 4. Shredders, photocopiers, fax machines and similar office equipment.
- D. Size Limitations in Existing Spaces: Materials, products, and equipment used for performing the Work and for transporting debris, materials, and products shall be of sizes that clear surfaces within existing spaces, areas, rooms, and openings, including temporary protection, by 12 inches (300 mm) or more.

PART 2 - PRODUCTS - (Not Used)

PART 3 - EXECUTION

3.1 PROTECTION

- A. Protect persons, motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm resulting from alteration work.
 1. Use only proven protection methods, appropriate to each area and surface being protected.
 2. Provide temporary barricades, barriers, and directional signage to exclude the public from areas where alteration work is being performed.
 3. Erect temporary barriers to form and maintain fire-egress routes.

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4. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during alteration work.
 5. Contain dust and debris generated by alteration work, and prevent it from reaching the public or adjacent surfaces.
 6. Provide shoring, bracing, and supports as necessary. Do not overload structural elements.
 7. Protect floors and other surfaces along hauling routes from damage, wear, and staining.
 8. Provide supplemental sound-control treatment to isolate demolition work from other areas of the building.
- B. Temporary Protection of Materials to Remain:
1. Protect existing materials with temporary protections and construction. Do not remove existing materials unless otherwise indicated.
 2. Do not attach temporary protection to existing surfaces except as indicated as part of the alteration work program.
- C. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.
- D. Utility and Communications Services:
1. Notify Owner, Architect, authorities having jurisdiction, and entities owning or controlling wires, conduits, pipes, and other services affected by alteration work before commencing operations.
 2. Disconnect and cap pipes and services as required by authorities having jurisdiction, as required for alteration work.
 3. Maintain existing services unless otherwise indicated; keep in service, and protect against damage during operations. Provide temporary services during interruptions to existing utilities.
- E. Existing Drains: Prior to the start of work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin work in an area until the drainage system is functioning properly.
1. Prevent solids such as adhesive or mortar residue or other debris from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from alteration work.
 2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.

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3.2 PROTECTION FROM FIRE

A. General: Follow fire-prevention plan and the following:

1. Comply with NFPA 241 requirements unless otherwise indicated.
2. Remove and keep area free of combustibles, including rubbish, paper, waste, and chemicals, unless necessary for the immediate work.
 - a. If combustible material cannot be removed, provide fire blankets to cover such materials.

B. Heat-Generating Equipment and Combustible Materials: Comply with the following procedures while performing work with heat-generating equipment or combustible materials, including welding, torch-cutting, soldering, brazing, removing paint with heat, or other operations where open flames or implements using high heat or combustible solvents and chemicals are anticipated:

1. Obtain Owner's approval for operations involving use of welding or other high-heat equipment. Use of open-flame equipment is not permitted. Notify Owner at least 72 hours before each occurrence, indicating location of such work.
2. As far as practicable, restrict heat-generating equipment to shop areas or outside the building.
3. Do not perform work with heat-generating equipment in or near rooms or in areas where flammable liquids or explosive vapors are present or thought to be present. Use a combustible gas indicator test to ensure that the area is safe.
4. Use fireproof baffles to prevent flames, sparks, hot gases, or other high-temperature material from reaching surrounding combustible material.
5. Prevent the spread of sparks and particles of hot metal through open windows, doors, holes, and cracks in floors, walls, ceilings, roofs, and other openings.
6. Fire Watch: Before working with heat-generating equipment or combustible materials, station personnel to serve as a fire watch at each location where such work is performed. Fire-watch personnel shall have the authority to enforce fire safety. Station fire watch according to NFPA 51B, NFPA 241, and as follows:
 - a. Train each fire watch in the proper operation of fire-control equipment and alarms.
 - b. Prohibit fire-watch personnel from other work that would be a distraction from fire-watch duties.
 - c. Cease work with heat-generating equipment whenever fire-watch personnel are not present.
 - d. Have fire-watch personnel perform final fire-safety inspection each day beginning no sooner than 30 minutes after conclusion of work in each area to detect hidden or smoldering fires and to ensure that proper fire prevention is maintained.
 - e. Maintain fire-watch personnel at each area of Project site until 60 minutes after conclusion of daily work.

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- C. Fire-Control Devices: Provide and maintain fire extinguishers, fire blankets, and rag buckets for disposal of rags with combustible liquids. Maintain each as suitable for the type of fire risk in each work area. Ensure that nearby personnel and the fire-watch personnel are trained in fire-extinguisher and blanket use.
- D. Sprinklers: Where sprinkler protection exists and is functional, maintain it without interruption while operations are being performed. If operations are performed close to sprinklers, shield them temporarily with guards.
 - 1. Remove temporary guards at the end of work shifts, whenever operations are paused, and when nearby work is complete.

3.3 PROTECTION DURING APPLICATION OF CHEMICALS

- A. Protect motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm or spillage resulting from applications of chemicals and adhesives.
- B. Cover adjacent surfaces with protective materials that are proven to resist chemicals selected for Project unless chemicals being used will not damage adjacent surfaces as indicated in alteration work program. Use covering materials and masking agents that are waterproof and UV resistant and that will not stain or leave residue on surfaces to which they are applied. Apply protective materials according to manufacturer's written instructions. Do not apply liquid masking agents or adhesives to painted or porous surfaces. When no longer needed, promptly remove protective materials.
- C. Do not apply chemicals during winds of sufficient force to spread them to unprotected surfaces.
- D. Neutralize alkaline and acid wastes and legally dispose of off Owner's property.
- E. Collect and dispose of runoff from chemical operations by legal means and in a manner that prevents soil contamination, soil erosion, undermining of paving and foundations, damage to landscaping, or water penetration into building interior.

3.4 GENERAL ALTERATION WORK

- A. Have specialty work performed only by qualified specialists.
- B. Ensure that supervisory personnel are present when work begins and during its progress.
- C. Perform surveys of Project site as the Work progresses to detect hazards resulting from alterations.

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- D. Notify Architect of visible changes in the integrity of material or components whether from environmental causes including biological attack, UV degradation, freezing, or thawing or from structural defects including cracks, movement, or distortion.
 - 1. Do not proceed with the work in question until directed by Architect.

END OF SECTION 013516

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect and its consulting engineers, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
 - 4. Specific test and inspection requirements are not specified in this Section.
- C. Related Requirements:
 - 1. Section 019100, "Special Inspections" for third-party special inspection testing and inspecting services in accordance with Chapter 17 requirements of the 2018 Virginia Construction Code.

1.3 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into

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the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

- C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
 - 1. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.
 - 2. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
 - 3. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.
- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

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- J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 ACTION SUBMITTALS

- A. Shop Drawings: For integrated exterior mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.
 - 1. Indicate manufacturer and model number of individual components.
 - 2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.6 INFORMATIONAL SUBMITTALS

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- B. Qualification Data: For Contractor's quality-control personnel.
- C. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- D. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Entity responsible for performing tests and inspections.

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3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

1.7 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice of Award, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
 1. Project quality-control manager may also serve as Project superintendent.
 2. Provide a full-time, qualified roofing inspector during roofing demolition and reinstallation operations, who may also serve as construction manager for all roofing activity. Roof inspector shall be factory-qualified and -approved by the roofing system manufacturer to perform his duties. This qualification shall be furnished to the Owner in writing prior to commencement of any roofing work.
 3. Refer to Division 23 and 26 sections for additional factory-representatives and quality control personnel and procedural requirements.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
 1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
 2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
 3. Owner-performed tests and inspections indicated in the Contract Documents.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required

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to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.

- F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.8 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and re-inspecting.

- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

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- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
 - 1. Name, address, and telephone number of factory-authorized service representative making report.
 - 2. Statement that equipment complies with requirements.
 - 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - 4. Statement whether conditions, products, and installation will affect warranty.
 - 5. Other required items indicated in individual Specification Sections.

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

1.9 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

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1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
 - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
 - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
 - f. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project except as specifically permitted herein.
 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether

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tested and inspected work complies with or deviates from the Contract Documents.

- K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
 2. Notify Owner's Representative and Architect seven days in advance of dates and times when mockups will be constructed.
 3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
 4. Demonstrate the proposed range of aesthetic effects and workmanship.
 5. Obtain Owner's Representative's and Architect's approval of mockups before starting work, fabrication, or construction.
 - a. Allow three days for initial review and each re-review of each mockup.
 6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 7. Demolish and remove mockups when directed unless otherwise indicated.
- L. Integrated Exterior Mockups: Construct integrated exterior mockup as indicated on Drawings or otherwise permitted herein. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials.
- M. Room Mockups: Construct room mockups incorporating required materials and assemblies, finished according to requirements. Provide required lighting and additional lighting where required to enable Architect to evaluate quality of the Work. Provide one Wing C/F classroom mockup and one Wing E classroom mockup for ceiling, cabinetwork and lighting installation.

1.10 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
 2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
 3. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to

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Contractor, and the Contract Sum may be adjusted as stipulated in the Construction Contract.

- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
 - 1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 - 2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 - 3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 - 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 - 5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 - 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."
- D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in pre-installation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- E. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- F. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

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1. Notify Architect, Owner's Representative and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 6. Do not perform any duties of Contractor.
- G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 4. Facilities for storage and field curing of test samples.
 5. Delivery of samples to testing agencies.
 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.
1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

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1.11 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Owner will engage a qualified special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, as indicated in Statement of Special Inspections outlined in Section 019100, "Special Inspections."

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
 - 1. Date test or inspection was conducted.
 - 2. Description of the Work tested or inspected.
 - 3. Date test or inspection results were transmitted to Architect.
 - 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's and Owner Representative's reference during normal working hours.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

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SECTION 015000 - TEMPORARY FACILITIES

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.
- B. Temporary construction and support facilities required may include but are not limited to:
 - 1. Temporary dust and weatherproofing partitions.
 - 2. Water service and distribution.
 - 3. Temporary electric power and lights.
 - 4. Temporary cooling and dehumidification.
 - 5. Storage facilities for construction materials, including security fencing.
 - 6. Sanitary facilities, including drinking water.
 - 7. Waste disposal services.
- C. Power and water are available at the site, but may require temporary shut off by the Contractor at the Contractor's expense. Additionally:
 - 1. The Contractor shall make local shut off to water supply at control valves and power at electrical panels as necessary.
 - 2. The Contractor shall make all necessary connections and distribution to serve the project.
 - 3. The Contractor shall remove any temporary distribution and connection at the conclusion of the work.
 - 4. The Contractor shall not be charged for any of the Owner's utility services used in course of the work at the school site.
- D. Security and protection facilities required include but are not limited to:
 - 1. Temporary fire protection.
 - 2. Barricades, warning signs, lights.
 - 3. Environmental protection.

1.3 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and

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regulations of authorities having jurisdiction, including but not limited to:

1. Building Code requirements.
 2. Health and safety regulations.
 3. Police, Fire Department and Rescue Squad rules.
 4. 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".
- C. Refer to "Guidelines for Bid Conditions for Temporary Job Utilities and Services", prepared jointly by AGC and ASC, for industry recommendations.

1.4 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. Remove asphalt mops from roof at the end of each working day.
- B. An aerial view of the site is appended to this section. Locate staging and temporary laydown areas where indicated or otherwise agreed to with Owner. All ingress/egress to site is to be from the designated entrance off Maxwell Drive, and shall not be obstructed at any time.
- C. Coordinate deliveries of materials with the Owner and schedule deliveries or erection of major materials involving large trucks or cranes with the Owner to assist in availing the parking area in front of the building as needed. The Contractor is encouraged to schedule any such major deliveries or crane work that impedes traffic along neighborhood streets as little as possible, including bus traffic into and out of Richneck Elementary School.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Tarpaulins: Provide waterproof, fire-resistant, UL labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosures provide translucent nylon reinforced laminated polyethylene or polyvinyl chloride fire retardant tarpaulins.
1. For tarpaulins to protect from Asphalt spills on the interior of the building provide tarpaulins that resist melting when exposed to hot asphalt. These tarpaulins should only be used over critical care items i.e. Computers, Telephones Televisions, etc.

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- B. Drinking Water Facilities: Provide containerized tap-dispenser bottled-water type drinking water units, including paper cup supply.
- C. Temporary Toilet Units: Provide self-contained single-occupant toilet units of the chemical, aerated recirculation, or combustion type, properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar nonabsorbent material, and supply unit(s) with toilet tissue. Provide integral or separate hand-washing station(s). Use of the building's restroom facilities by contractor or subcontractor personnel is forbidden.
- D. First Aid Supplies: Comply with governing regulations.
- E. Fire Extinguishers: Provide hand-carried, portable, UL-rated, class "ABC" dry chemical extinguishers, or a combination of extinguishers of NFPA recommended classes for the exposures, Comply with NFPA 10 and 241 for classification, extinguishing agent and size required by location and class of fire exposure.

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. Temporary Electrical Power: Work under this Contract includes features of electrical work that may result in one or more brief outages of electrical power to the entire building. The Contractor shall obtain the Owner's permission for any power outages to the entire building for longer than two hours, and the Contractor shall obtain the Owner's permission and provide notice for a whole-building power outage a minimum of 48 hours prior to the outage. For any planned outages that must exceed four hours or go overnight, the Contractor shall be responsible to provide temporary power and lighting, including generators, fuel, fixtures, distribution cables, boxes and all necessary appurtenances throughout all work areas as needed to continue working inside and outside the building during the power outage(s), as well as temporary power to support the building fire alarm and security systems.
- C. Provide the Owner's representative **48 hours minimum** advance notice of any utility or system interruption. Do not proceed with such outage or related work until approved by Owner's representative.
- D. 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.
- E. Locate storage trailers, sanitary facilities and other temporary support facilities for easy access, and where approved by the Owner.

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- F. Maintain temporary support facilities until Substantial Completion, or until personnel will no longer be working on the roof.
 - 1. 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.
 - 2. Provide toilet tissue, paper towels, paper cups and similar disposable materials for each facility. Provide covered waste containers for used material.
- G. Toilets: Install self-contained toilet units in a location approved by the Owner. Shield toilets to ensure privacy. Use of pit-type privies will not be permitted. Have toilets regularly serviced to keep them clean and in good condition.
- H. Collection and Disposal of Waste and Demolition Debris: Collect 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 by containerizing properly. Dispose of material in a lawful manner.

3.2 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Temporary Fire Protection: Comply with NFPA 10 "Standard for Portable Fire Extinguishers," and NFPA 241 "Standard for Safeguarding Construction, Alterations and Demolition Operations." Locate fire extinguishers near tankers and kettles and on the roof during roofing operations.
- B. Barricades: Provide temporary barricades where roofing operations are going on to keep children away.
- C. Overhead and Underground Power and Telecommunication Lines: The Contractor shall be responsible for identifying and marking any aerial or underground power lines, telephone lines, coaxial cables and fiber optic cables to prevent hazards to personnel and equipment, and accidental damage to these utilities.
- D. Security: Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Remove all equipment from around the building at the end of each working day that would provide a means of egress to the roof, and lock up building at days end.
- E. 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

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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.

3.3 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.
- C. Termination and Removal: Unless the Architect requests that it be maintained longer, remove each temporary facility at Substantial Completion.

END OF SECTION 015000

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AERIAL VIEW: YATES ELEMENTARY SCHOOL (Not to Scale)

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 012500 "Substitution Procedures" for requests for substitutions.

1.3 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service

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performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

- A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
 - 2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
 - a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
 - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
 - 1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
 - 2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

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B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.
7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. **Manufacturer's Warranty:** Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. **Special Warranty:** Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

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1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 017700 "Project Closeout."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Architect will make selection.
 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
 6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
- B. Product Selection Procedures:
1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 3. Products:

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- a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
 - b. Non-restricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
4. Manufacturers:
- a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
 - b. Non-restricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
- C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

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2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
1. Evidence that the proposed product does not require revisions to the Contract Documents, which it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 3. Evidence that proposed product provides specified warranty.
 4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

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SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. Installation of the Work.
 - 4. Cutting and patching.
 - 5. Coordination of Owner-furnished products.
 - 6. Progress cleaning.
 - 7. Starting and adjusting.
 - 8. Protection of installed construction.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for limits on use of Project site.
 - 2. Section 013300 "Submittal Procedures" for submitting surveys.
 - 3. Section 017700 "Project Closeout" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
 - 4. Section 078413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

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- B. Patching: Fitting and repair work required to restore construction to its original conditions after installation of other work.

1.4 INFORMATIONAL SUBMITTALS

- A. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:
 - 1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
 - 2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
 - 3. Products: List products to be used for patching and firms or entities that will perform patching work.
 - 4. Dates: Indicate when cutting and patching will be performed.
 - 5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
 - a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

1.5 QUALITY ASSURANCE

- A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
 - 1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection
 - a. Roof deck.
 - b. Roof joists or beams.
 - c. Wall openings in CMU or brick veneer masonry that exceed two square feet or 1'-4" in width, whichever is less.
 - 2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:

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- a. Primary operational systems and equipment.
 - b. Fire separation assemblies.
 - c. Air or smoke barriers.
 - d. Fire-suppression systems.
 - e. Mechanical systems piping and ducts.
 - f. Control systems.
 - g. Communication systems.
 - h. Fire-detection and -alarm systems.
 - i. Conveying systems.
 - j. Electrical wiring systems.
 - k. Operating systems of special construction.
3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include, but are not limited to, the following:
- a. Water, moisture, or vapor barriers.
 - b. Through-wall flashings.
 - c. Equipment supports.
 - d. Piping, ductwork, vessels, and equipment.
 - e. Noise- and vibration-control elements and systems.
 - f. Wall and soffit panels.
4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- B. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.
- C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

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PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning site work, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
 - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
 - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
 - 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 - 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 - 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

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- C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
 - 1. Description of the Work.
 - 2. List of detrimental conditions, including substrates.
 - 3. List of unacceptable installation tolerances.
 - 4. Recommended corrections.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.
- B. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for

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mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

- C. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect and Owner's Representative.

3.4 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
 - 4. Maintain minimum headroom clearance of 96 inches (2440 mm) in occupied spaces and 90 inches (2300 mm) in unoccupied spaces.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and

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type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 2. Allow for building movement, including thermal expansion and contraction.
 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.5 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 011000 "Summary."
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

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- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 6. Proceed with patching after construction operations requiring cutting are complete.
- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over

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the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.6 OWNER-INSTALLED PRODUCTS

- A. Site Access: Provide access to Project site for Owner's construction personnel.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
 2. Pre-installation Conferences: Include Owner's construction personnel at pre-installation conferences covering portions of the Work that are to receive Owner's work. Attend pre-installation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.7 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 - a. Use containers intended for holding waste materials of type to be stored.

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4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
 1. Remove liquid spills promptly.
 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 015000 "Temporary Facilities."
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

- A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 230500 "Heating, Ventilating and Air Conditioning."

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- B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300

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SECTION 017329 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes procedural requirements for cutting and patching.
- B. Related Sections include the following:
 - 1. Division 01 Section "Selective Demolition" for demolition of selected portions of the building.
 - 2. Divisions 02 through 49 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operating elements include the following:
 - 1. Primary operational systems and equipment.
 - 2. Air or smoke barriers.
 - 3. Fire-suppression systems.
 - 4. Mechanical systems piping and ducts.

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5. Control systems.
 6. Communication systems.
 7. Conveying systems.
 8. Electrical wiring systems.
 9. Rooftop-mounted mechanical equipment, wiring or conduit.
- C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Miscellaneous elements include the following:
1. Water, moisture, or vapor barriers.
 2. Membranes and flashings.
 3. Exterior curtain-wall construction.
 4. Equipment supports.
 5. Piping, ductwork, vessels, and equipment.
 6. Noise- and vibration-control elements and systems.
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

1.5 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
 - 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
 - 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

3.3 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

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2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 4. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 5. Proceed with patching after construction operations requiring cutting are complete.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.
- D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 017329

SECTION 017400 - WARRANTIES AND BONDS

PART 1 - GENERAL

1.1 RELATED PRODUCTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division - 1 Specifications 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. General closeout requirements are included in Section "Project Closeout."
- C. 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 2 through 33.
- D. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product and installation 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. Acceptance of this Contract will constitute acceptance of the warranty and guarantee terms specified herein notwithstanding any printed information in the manufacturer's standard literature, or claims for exception expressed after signing of the Contract.

1.3 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 term and the conditions of the reinstated warranty shall be equal to the original warranty (the original terms shall apply).
- 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 full cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through

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- 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.

1.4 SUBMITTALS

- A. Submit written warranties to the Architect prior to the date certified for Substantial Completion. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Architect.
- B. Refer to individual Sections of Division 3 through 33 for specific content requirements, and particular requirements for submittal of special warranties.
- C. Form of Submittal: At Final Completion compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, 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, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper.
- E. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS, the project title, date of Substantial Completion, and the name of the Contractor.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 017400

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Salvaging nonhazardous construction waste.
 - 2. Recycling nonhazardous construction waste.
 - 3. Disposing of nonhazardous construction waste.

1.3 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- C. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- D. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- E. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 PERFORMANCE REQUIREMENTS

- A. General: The Owner has identified recycling and minimizing of landfill-destined waste as a goal of this project. This project is not to be LEED-certified; however, the Owner expects the Contractor to recycle and minimize landfill waste to the greatest practical extent. The Owner wishes to demonstrate efficient recycling and waste reduction methods as an educational experience for the local

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community and the School system. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:

1. Construction Waste:

- a. Masonry and CMU.
- b. Lumber.
- c. Wood sheet materials.
- d. Wood trim.
- e. Metals.
- f. Roofing.
- g. Insulation.
- h. Gypsum board.
- i. Piping.
- j. Electrical conduit.
- k. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
 - 1) Paper.
 - 2) Cardboard.
 - 3) Boxes.
 - 4) Plastic sheet and film.
 - 5) Polystyrene packaging.
 - 6) Wood crates.
 - 7) Plastic pails.

1.5 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 14 days of date established for the Notice of Award.

1.6 INFORMATIONAL SUBMITTALS

- A. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- B. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- C. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present

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was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.7 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
- B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

1.8 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification and waste reduction work plan.
- B. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include types of waste material, points of waste generation, procedures for waste segregation, waste and handling and transportation procedures.
 - 1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
 - 2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
 - 3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
 - 4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 - 5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
 - 6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.
- C. Cost/Revenue Analysis: Not required.

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PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
 - 1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. This may be a collateral duty of the site superintendent or an assistant.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
 - 1. Distribute waste management plan to everyone concerned, including subcontractors, within three days of submittal return.
 - 2. Review waste management plan goals with entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
 - 2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycle removed asphalt roof shingles with a local reclaimer or recycler as much as practical.
- C. Allowing Contractor to accrue some portion of the incentives in "Recycling Incentives" Paragraph below could result in better recovery rates than if Owner accrues all of the incentives.

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- D. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall be shared equally by Owner and Contractor.
- E. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.
- F. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
 - 1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - a. Inspect containers and bins for contamination and remove contaminated materials if found.
 - 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
 - 4. Store components off the ground and protect from the weather.
 - 5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.3 RECYCLING CONSTRUCTION WASTE

A. Packaging:

- 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
- 2. Polystyrene Packaging: Separate and bag materials.
- 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
- 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:

- 1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
- 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

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- a. Comply with requirements in Section 329300 "Plants" for use of clean sawdust as organic mulch.
 - C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
 - 1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.
 - a. Comply with requirements in Section 329300 "Plants" for use of clean ground gypsum board as inorganic soil amendment.
- 3.4 DISPOSAL OF WASTE
- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
 - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - B. Burning: Do not burn waste materials.
 - C. Contractor's Waste and Disposal: Waste containers and disposal services to be provided at no cost to the Contractor. Contractor must coordinate with Gloucester County for pickup and removal of containers. Containers shall be placed at front of the site.

END OF SECTION 017419

SECTION 017700 - PROJECT CLOSEOUT

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 specified administrative and procedural requirements for project closeout, including:
 - 1. Establishment of Substantial Completion
 - 2. Final Acceptance
 - 3. Inspection procedures
 - 4. Project record document submittal
 - 5. Submittal of warranties
 - 6. Final cleaning and Repairs
- B. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions 1 through 33.

1.3 SUBSTANTIAL COMPLETION

- A. General: It is the Contractor's responsibility to initiate procedures for obtaining a Certificate of Substantial Completion. This date of Substantial Completion must be before the expiration of the Contract Time, or liquidated damages will be assessed. At Substantial Completion, all work must be complete with the exception of punch list items. Notwithstanding any other definition of "Substantial Completion" in AIA A201, Substantial Completion shall be defined as the level of completion necessary for the Owner to occupy the renovated space and use it **fully** as intended. All required final inspections must be completed, and the local building official must have accepted all construction and issued its approval of all work. **Timely completion of the contract and obtaining the Building's Official approval of the final inspection is critical to the Owner's full use of this facility.**
- B. Preliminary Procedures: Before requesting inspection for Certificate of Substantial Completion, complete the following. List exceptions in the request.
- C. Make a "punchlist" of items needing corrective action. This list should be thorough and list all items required to achieve Final Completion. Failure to provide a complete punchlist will be grounds for the withholding of the

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Certificate of Substantial Completion. Punchlist items relate to work accomplished but requiring correction or modification to satisfy the project requirements. Work that is incomplete shall not be included on the punchlist for Substantial Completion and shall be completed prior to initiating substantial completion procedures.

- D. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. If not already provided, include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
- E. Submit specific warranties and guarantees, final certifications, and similar documents
- F. Advise Owner of pending insurance change over requirements.
- G. 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.
- H. Submit record drawings, and similar final record information.
- I. Complete final clean up requirements, including the restoration of any damage to the building or site which occurred during the course of construction.

1.4 INSPECTION PROCEDURES

- A. On receipt of a request for inspection, the Architect will either proceed with inspection or advise the Contractor of unfilled requirements. The Architect will prepare the Certificate of Substantial Completion following inspection, if aforementioned requirements are met, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued. The Architect will repeat inspection when requested and assured that the Work has been substantially completed. Results of the completed inspection will form the basis of requirements for final acceptance.

1.5 FINAL ACCEPTANCE

- A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.
- B. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include

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certificates of insurance for products and completed operations where required.

- C. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
- D. Submit a certified copy of the Architect's final inspection 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 Architect.
- E. Submit consent of surety to final payment.
- F. Submit a final liquidated damages settlement statement, if applicable.
- G. Re-inspection Procedures: The Architect will re-inspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Architect. Upon completion of re-inspection, the Architect 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. If necessary, re-inspection will be repeated. If more than one inspection is needed following the issuing of the Certificate of Substantial Completion, an amount of \$750.00 will be deducted from the amount owed the Contractor for each subsequent inspection required of the Architect to verify that the Contractor's work is completed.

1.6 RECORD DOCUMENT SUBMITTALS

- A. Record Documents: See Section 017839 for Record Documents requirements and procedures

1.7 SUBMITTAL OF WARRANTIES

- A. Submit two copies of the Roof Manufacturer's warranty and two copies of the Roof Contractor warranty.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 FINAL CLEANING AND REPAIRS

- A. General: General cleaning during construction is required by the General

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Conditions and included in Section "Temporary Facilities".

- B. Cleaning: Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion:
- C. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances caused by construction operations. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.
- D. Clean all exposed building components, whether existing or new of any stains or spills that occurred during construction.
- E. Repairs: Repair any damage to the property caused by construction operations to condition prior to start of construction in accordance with requirements of these specifications. Fill any holes or ruts created during construction with topsoil and reestablish grass in these and any other areas where grass has been damaged during the course of the work.
- F. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.
- G. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory.
 - 2. Emergency manuals.
 - 3. Operation manuals for systems, subsystems, and equipment.
 - 4. Maintenance manuals for the care and maintenance of products, materials, and finishes as well as systems and equipment.
- B. Related Sections include the following:
 - 1. Division 01 Section "Submittals" for submitting copies of submittals for operation and maintenance manuals.
 - 2. Division 01 Section "Project Closeout" for submitting operation and maintenance manuals.
 - 3. Division 01 Section "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
 - 4. Divisions 02 through 49 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 SUBMITTALS

- A. Initial Submittal: Submit 3 draft copies of each manual at least 15 days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory. Architect will return one copy of draft and mark whether general scope and content of manual are acceptable.

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- B. Final Submittal: Submit two copies of each manual in final form at least 15 days before final inspection. Architect will return copy with comments within 15 days after final inspection.
 - 1. Correct or modify each manual to comply with Architect's comments. Submit 3 copies of each corrected manual within 15 days of receipt of Architect's comments.

1.5 COORDINATION

- A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Organization: Include a section in the directory for each of the following:
 - 1. List of documents.
 - 2. List of systems.
 - 3. List of equipment.
 - 4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

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2.2 MANUALS, GENERAL

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 - 1. Title page.
 - 2. Table of contents.
 - 3. Manual contents.

- B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
 - 1. Subject matter included in manual.
 - 2. Name and address of Project.
 - 3. Name and address of Owner.
 - 4. Date of submittal.
 - 5. Name, address, and telephone number of Contractor.
 - 6. Name and address of Architect.
 - 7. Cross-reference to related systems in other operation and maintenance manuals.

- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
 - 1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
 - 1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.

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- b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch (215-by-280-mm) white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
 1. Type of emergency.
 2. Emergency instructions.
 3. Emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
 1. Fire.
 2. Flood.
 3. Gas leak.
 4. Water leak.
 5. Power failure.
 6. Water outage.
 7. System, subsystem, or equipment failure.
 8. Chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's

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operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions.
2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.

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7. Seasonal and weekend operating instructions.
 8. Required sequences for electric or electronic systems.
 9. Special operating instructions and procedures.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUAL

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Product Information: Include the following, as applicable:
1. Product name and model number.
 2. Manufacturer's name.
 3. Color, pattern, and texture.
 4. Material and chemical composition.
 5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
 2. Types of cleaning agents to be used and methods of cleaning.
 3. List of cleaning agents and methods of cleaning detrimental to product.
 4. Schedule for routine cleaning and maintenance.
 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

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2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - 1. Standard printed maintenance instructions and bulletins.
 - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - 3. Identification and nomenclature of parts and components.
 - 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
 - 1. Test and inspection instructions.
 - 2. Troubleshooting guide.
 - 3. Precautions against improper maintenance.
 - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - 5. Aligning, adjusting, and checking instructions.
 - 6. Demonstration and training videotape, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
 - 1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 - 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

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- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.
- B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
 - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
 - 1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

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- F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.
 - 1. Do not use original Project Record Documents as part of operation and maintenance manuals.
 - 2. Comply with requirements of newly prepared Record Drawings in Division 01 Section "Project Record Documents."
- G. Comply with Division 01 Section "Project Closeout" for schedule for submitting operation and maintenance documentation.
- H. Digital Copy: Furnish the Owner one (1) complete set of final, approved O&M Manuals archived directly to formatted DVD(s) in .PDF format. Provide original .PDF file materials in lieu of scanned documents where possible. Include .PDF bookmarks for all tables and sections, with hyperlinks connected to the Table of Contents.

END OF SECTION 017823

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SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
- B. Related Sections include the following:
 - 1. Division 01 Section "Project Closeout" for general closeout procedures.
 - 2. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 3. Divisions 02 through 48 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.3 SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit copies of Record Drawings as follows:
 - a. Initial Submittal: Submit one set of plots from corrected Record CAD Drawings and one set of marked-up Record Prints. Architect will initial and date each plot and mark whether general scope of changes, additional information recorded, and quality of drafting are acceptable. Architect will return plots and prints for organizing into sets, printing, binding, and final submittal.
 - b. Final Submittal: Submit one set of marked-up Record Prints, one set of Record CAD Drawing files, one set of Record CAD Drawing plots, and three copies printed from record plots. Plot and print each Drawing, whether or not changes and additional information were recorded.
 - 1) Electronic Media: CD-R.

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- B. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit one copy of each Product Data submittal.
 - 1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
 - 1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an understandable drawing technique.
 - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
 - 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations below first floor.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Construction Change Directive.
 - k. Changes made following Architect's written orders.
 - l. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically.

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3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Transparencies: Immediately before inspection for Certificate of Substantial Completion, review marked-up Record Prints with Architect and the Owner's Representative. When authorized, prepare a full set of corrected transparencies of the Contract Drawings and Shop Drawings.
1. Incorporate changes and additional information previously marked on Record Prints. Erase, redraw, and add details and notations where applicable.
 2. Refer instances of uncertainty to Architect for resolution.
 3. Owner will furnish Contractor one set of transparencies of the Contract Drawings for use in recording information.
 4. Print the Contract Drawings and Shop Drawings for use as Record Transparencies. Architect will make the Contract Drawings available to Contractor's print shop.
- C. Record CAD Drawings: Immediately before inspection for Certificate of Substantial Completion, review marked-up Record Prints with Architect. When authorized, prepare a full set of corrected CAD Drawings of the Contract Drawings, as follows:
1. Format: Same CAD program, version, and operating system as the original Contract Drawings.
 2. Format: DWG Version operating in Microsoft Windows operating system.
 3. Incorporate changes and additional information previously marked on Record Prints. Delete, redraw, and add details and notations where applicable.
 4. Refer instances of uncertainty to Architect for resolution.
 5. The Owner will furnish Contractor one set of CAD Drawings of the Contract Drawings for use in recording information.
 - a. Architect makes no representations as to the accuracy or completeness of CAD Drawings as they relate to the Contract Drawings.
 - b. CAD Software Program: The Contract Drawings are available in AutoCad 2018.

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- D. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing Record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
 2. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared Record Drawings into Record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.
- E. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Record Transparencies: Organize into unbound sets matching Record Prints. Place transparencies in durable tube-type drawing containers with end caps. Mark end cap of each container with identification. If container does not include a complete set, identify Drawings included.
 3. Record CAD Drawings: Organize CAD information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each CAD file.
 4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect.
 - e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.

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4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
5. Note related Change Orders and Record Drawings where applicable.

2.3 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

2.4 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.
- B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

END OF SECTION 017839

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SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Instruction in operation and maintenance of systems, subsystems, and equipment.

1.3 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. Qualification Data: For instructor. Identify the instructor and its role in the project to ensure familiarity with the installed systems to be examined and operated in presence of the Owner's personnel.

1.4 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Documents: Submit two copies within seven days of end of each training module.
 - 1. At completion of training, submit complete training manual(s) for Owner's use prepared in same paper and PDF file format required for operation and maintenance manuals specified in Section 017823 "Operation and Maintenance Data."

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1.5 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

1.6 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.7 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.

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- h. Performance curves.
2. Documentation: Review the following items in detail:
 - a. Emergency manuals (if any).
 - b. Systems and equipment operation manuals.
 - c. Systems and equipment maintenance manuals.
 - d. Product maintenance manuals.
 - e. Project Record Documents.
 - f. Identification systems.
 - g. Maintenance service agreements and similar continuing commitments.
 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
 4. Operations: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
 5. Adjustments: Include the following:
 - a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
 6. Troubleshooting: Include the following:

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- a. Diagnostic instructions.
 - b. Test and inspection procedures.
7. Maintenance: Include the following:
- a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning.
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
8. Repairs: Include the following:
- a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.
 - f. Method for procuring spare parts needed for operation and maintenance.

1.8 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

1.9 INSTRUCTION

- A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. The Instructor must be thoroughly familiar with installed systems and be capable of demonstrating their start-up, operation, shut-down and maintenance.
 - 2. Instructor may be a factory representative, or subcontractor's senior representative familiar with the equipment and operation.
 - 3. The Owner's key personnel required for routine operation and maintenance of these systems will be on hand; and the Owner will furnish Contractor with names and positions of participants.

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- B. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner through the Contractor's project manager, with at least seven days' advance notice.
- C. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- D. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION 017900

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SECTION 019100 - SPECIAL INSPECTIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Special inspections for earthwork, concrete, masonry and structural steel.

1.2 REFERENCES

- A. 2021 Virginia Construction Code (VCC), Chapter 17.
- B. 2021 Virginia Existing Building Code (VEBC), Chapter 8.

1.3 SUBMITTALS

- A. Submittals required for special inspections are included in the following specification sections:
 - 1. Earthwork and Subgrade compaction.
 - 2. Reinforced Concrete, including footings, slabs and sub-grade preparation.
 - 3. Reinforced Masonry foundation walls.
 - 4. Structural Steel.
 - 5. Cold-Formed Steel Structural Load-Bearing Systems.
 - 6. Exterior Insulation Finish System (EIFS).

1.4 TESTING AGENCIES AND SPECIAL INSPECTOR.

- A. Except where noted otherwise, the Owner will retain an independent testing agency to complete the testing where indicated in the specifications.

1.5 STATEMENT OF SPECIAL INSPECTIONS:

- A. Initial Submittal: The statement of special inspections is required by the International Building Code to be submitted by the permit applicant prior to obtaining building permit. Contractor shall obtain a signed copy of the statement of special inspection from the Structural Engineer of Record to be submitted to the County Building Official for review.
- B. Interim Submittals: Special inspector will submit quarterly interim submittals to the County Building Official as required by the VCC/IBC. Interim submittals will note which items have been completed and note any deficiencies.

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Yates Elementary School, Newport News Public Schools, Newport News, VA**

- C. Final Submittal: At the completion of the special inspections, and after all discrepancies noted have been corrected, the special inspector will submit a final report of special inspections to the County Building Official.

1.6 PAYMENT FOR ADDITIONAL SERVICES:

- 1.6.1 DISCREPANCIES: Contractor shall correct any discrepancies or non-conformance to the specified requirements identified during special inspections.

- A. RE-TESTING: Retesting required because of non-conformance to specified requirements shall be performed by the Owner's testing agency. Payment for retesting will be charged to the Contractor.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

1.1 SPECIAL INSPECTIONS

- A. Inspection and Testing Agencies: Special Inspections for the Owner shall be performed by the following:

- 1. Agent 1 (Structural Engineer of Record):
SPC Structural Engineers
1630 Donna Drive, Suite 105
Virginia Beach, VA 23451
(757) 417-0565
Point of Contact: Bobby Giovanelli
- 2. Agent 2 Testing and Inspection Agency:
GET Solutions, a Terracon Company (Williamsburg office)
701 Alexander Lee Pkwy
Williamsburg, VA 23185-5857
757-564-6452
Point of Contact: Kristopher Tweedy

1.2 REQUIRED SPECIAL INSPECTIONS

- A. Perform all Agent 1 and Agent 2 Special Inspections in accordance with the "Statement of Special Inspections" appended to this Section on the following pages.

END OF SECTION 019100

Appendix A

HAMPTON ROADS AREA STATEMENT OF SPECIAL INSPECTIONS

PROJECT

Yates Elementary School Security Vestibule & Office Addition and Alterations
73 Maxwell Lane, Newport News, VA 23606

PERMIT APPLICANT

[Blank lines for Permit Applicant information]

PRIMARY RDP OF RECORD

Hudson + Associates Architects, PLLC
120 West Queens Way, Suite 201
Hampton, VA 23669

STRUCTURAL ENGINEER OF RECORD

Sinclair-Pratt-Cameron Structural Engineers, P.C.
1630 Donna Drive, Suite 105
Virginia Beach, VA 23451

BUILDING PERMIT NO: [Blank line]

This Statement of Special Inspections is submitted as a condition for permit issuance in accordance with the International Building Code (IBC) as stated in the Virginia Uniform Statewide Building Code (USBC). It includes a Schedule of Special Inspections applicable to this project as well as the name of the Special Inspector and the identity of other testing laboratories or agencies intended to be retained for conducting these inspections or tests.

The Special Inspector shall keep records of all inspections and shall furnish inspection reports to the Building Official, appropriate Registered Design Professional(s) (RDP(s)), Owner, and Contractor. All discrepancies shall be brought to the immediate attention of the Contractor for correction. If the discrepancies are not corrected, the discrepancies shall be brought to the attention of the Building Official and appropriate RDP(s). Interim reports shall be submitted to the Building Official, Owner, Contractor, and the appropriate RDP(s) according to the Hampton Roads Regional Special Inspection Guidelines and Procedures.

Jobsite safety is solely the responsibility of the contractor. Materials and activities to be inspected are not to include the contractor's equipment and methods used to erect or install the materials listed. All fees/costs related to the performance of Special Inspections shall be the responsibility of the Owner. Additionally, the undersigned (RDP or SER) are only acknowledging that the items enumerated on the Schedule of Special Inspections are consistent with the required design elements, the applicable sections of the Uniform Statewide Building Code, and their area of expertise.

REVIEW, AUTHORIZATION & ACCEPTANCE:

SCHEDULE OF SI PREPARED BY:

Permit Applicant (General Contractor):

Signature / date: [Blank line]
Printed Name: [Blank line]

Owner's Authorization:

Signature / date: [Blank line]
Printed Name: Stephen W. Smith

Primary RDP of Record:(Review and Acceptance of Schedule)

Signature / date: [Signature] 01/21/2025
Printed Name: Richard S. Corner, AIA, CSI

Virginia RDP Seal of SSI Preparer

Christopher D. Sterne, P.E.

Printed Name of the Preparer of the Schedule (on line above)

Structural Engineer of Record:(Review and Acceptance of Schedule)

Signature / date: [Blank line]
Printed Name: Christopher D. Sterne, P.E.

Special Inspector:

Signature / date: [Blank line]
Printed Name: Robert B. Giovanelli
SI Company Name: Sinclair-Pratt-Cameron Structural Engineers, P.C.

Building Official's Acceptance:

Signature / date: [Blank line]
Printed Name: [Blank line]

SCHEDULE OF SPECIAL INSPECTIONS

MATERIAL/ACTIVITY	TYPE OF INSPECTION	APPLICABLE TO THIS PROJECT			
		Y/C/P/N	EXTENT/REFERENCE	AGENT	COMPLETED
GENERAL					
Pre-construction meeting	Meeting with parties listed in Section 9 of HRRSIGP to discuss Special Inspection procedures	Y/P	Scheduled by SI with the Contractor prior to commencement of work; VCC 113.4	1 & 2	
EARTHWORK					
Site preparation (structure)	Field testing and inspection	Y/P	Field Review; VCC 1705.6	2	
Fill material (structure)	Review submittals, field testing, and inspection	Y/P	Field Review; VCC 1705.6	2	
Fill compaction (structure)	In-place density tests, lift thickness	Y/P	Field Review; VCC 1705.6	2	
Excavation	Field inspection and verification of proper depth	Y/P	Field Review; VCC 1705.6	2	
Foundation subgrade (structure)	Field inspection of foundation subgrade prior to placement of concrete	Y/C	Field Review; VCC 1705.6	2	
DEEP FOUNDATION/HELICAL PILE FOUNDATION ELEMENTS					
Materials	Review product, sizes, and lengths	N	Submittal and Field Review; VCC 112.3, 1705.7, 1705.8, 1705.9, 1705.10		
Test piles	Monitor driving of test piles	N	Field Review; VCC 1705.7, 1705.8 or 1705.9		
Installation	Monitor drilling, placement, plumbness, driving of piles, including recording installation torque, pressure, blows per foot, cut off, and tip elevation	N	Field Review; VCC 1705.7, 1705.8, 1705.9		
Load test	Monitor pile load test	N	Field Review; VCC 1705.7, 1705.8 or 1705.9		
CONCRETE					
Materials	Review product supplied versus certificates of compliance and mix design	Y/P	Submittal & Field Review; ACI 318: Ch. 19, 26.4.3, 26.4.4; VCC 1705.3, 1903.2	1	
Installation of reinforcing steel, including welding, as well as prestress tendons, anchor bolts, and fiber-reinforcement	Field inspection of placement	Y/P	Submittal and Field Review; ACI 318: Ch. 20, 25.2, 25.3, 26.5.1-26.5.3; AWS D1.4; VCC 1705.3, 1705.3.1, 1705.3.2, 1901.3	1	
Formwork installation	Field inspection	Y/P	Field Review; ACI 318; VCC 1705.3	1	
Concreting operations and placement	Field inspection of placement/sampling	Y/C	Field Review; ACI 318: 26.5.2, 26.12.3; ASTM C 172, C 31; VCC 1705.3	2	
Concrete curing	Field inspection of curing process	Y/P	Field Review; ACI 318: 26.5.3, 26.5.4, 26.5.5; VCC 1705.3	2	
Concrete strength	Evaluation of concrete strength	Y/C	Laboratory Testing; ACI 318: 26.12; VCC 1705.3	1 & 2	
Application of forces for prestressed concrete	Field inspection	N	Field Review; ACI 318: 26.10.2(e); VCC 1705.3		
Grouting of prestress tendons	Field inspection	N	Field Review; ACI 318: 19.4.1, 20.5.6, 26.13.3.2(b); VCC 1705.3		

Building Permit No: _____

MATERIAL/ACTIVITY	TYPE OF INSPECTION	APPLICABLE TO THIS PROJECT		
		Y/C/P/N	EXTENT/REFERENCE	AGENT
PRECAST CONCRETE				
Verify fabrication/quality control procedures	In-plant inspection of fabrication/quality control procedures**	N	Submittal or Field Review; VCC 1704.2.5, 1705.3	
Erection and installation	Review submittals and as-built assemblies; Field inspection of in-place precast	N	Submittal & Field Review; ACI 318; VCC Table 1705.3	
MASONRY (Level <u>B</u>; Building Risk Category <u>III</u>)				
Materials	Review of products supplied versus certificate of compliance and material submitted	Y/P	Submittal & Field Review; VCC 1705.4, 1709; TMS 402/602	1
Strength	Testing/review of strength	Y/C	Submittal & Field Review; VCC 1705.4, 2105; TMS 402/602	1 & 2
Mortar and Grout	Inspection of proportioning and mixing. Placement of mortar only	Y/P	Submittal & Field Review; VCC 1705.4; TMS 402/602	2
Grout placement, including prestressing grout	Verification to ensure compliance	Y/P	Field Review; VCC 1705.4; TMS 402/602	2
Grout space	Verification to ensure compliance	Y/P	Field Review; VCC 1705.4; TMS 402/602	1
Mortar, grout, and prism specimens	Observe preparation	N	Field Review; VCC 1705.4; TMS 402/602	
Reinforcement, prestressing tendons, and connections	Inspect condition, size, location, and spacing	Y/P	Field Review; VCC 1705.4; TMS 402/602	1
Welding of reinforcing bars	Inspection and testing of welds	N	Field Review; VCC 1705.3.1, 1705.4; TMS 402/602	
Prestressing force	Verify application and measurement	N	Field Review; VCC 1705.4; TMS 402/602	
Protection	Inspect procedures for protection during cold and hot weather	Y/P	Field Review; VCC 1705.4; TMS 402/602	2
Anchorage	Inspection of anchorages	Y/P	Field Review; VCC 1705.4; TMS 402/602	1
Masonry installation	Inspection of placement of masonry and joints	Y/P	Field Review; VCC 1705.4; TMS 402/602	1
STRUCTURAL STEEL				
Verify fabrication/quality control procedures	In-plant inspection of fabrication/quality control procedures** or submit Certificate of Compliance	N	Submittal or Field Review; VCC 113.5, 1704.2.5, 1704.2.5.1, 1705.2	
Bolts, nuts, and washers – materials	Material identification markings; Review of Certificate of Compliance	Y/P	Submittal & Field Review; VCC 1705.2.1; AISC 360 Section A3.3	2
Bolts, nuts, washers – installation	Inspection of in-place high-strength bolts, snug-tight joints, pre-tensioned and bearing type, and slip critical connections	Y/C	Submittal & Field Review; VCC 1705.2.1, 2204.2; AISC 360 Section M2.5	2
Structural steel – materials	Material identification markings and review of Certificate of Compliance	Y/P	Submittal & Field Review; VCC 1705.2.1; ASTM A6, A568; AISC 360 Section A3.1	1
Structural steel details – installation	Inspection of member locations, structural details for bracing, connections, and stiffening	Y/P	Submittal & Field Review; VCC 1705.2.1; AISC 360	1 & 2
Open-web steel joists and joist girders – installation	Inspection of end connections and bridging	N	Submittal & Field Review; VCC 1705.2.3; SJI-100	
Weld filler materials and welder certification	Review of identification markings, certificate of compliance, and welder certifications	Y/P	Submittal & Field Review; AISC 360 A3.5	2

MATERIAL/ACTIVITY	TYPE OF INSPECTION	APPLICABLE TO THIS PROJECT			
		Y/C/P/N	EXTENT/REFERENCE	AGENT	COMPLETED
Welds	Inspection and testing of welds	Y/C	Field Review; VCC 1705.2, 2204.1; AWS D1.1, D1.3	2	
Cold-formed metal deck – materials	Review of identification marking manufacturer's certified test results	Y/P	Submittal & Field Review; VCC 1705.2.2	1	
Cold-formed metal deck – installation	Review laps and welds	Y/P	Submittal & Field Review; VCC 1705.2.2; AWS D1.3; SDI	1	
Cold-formed light frame construction – welds	Review welding operation	Y/P	Field Review; VCC 1705.12.2, 1705.12.3	1	
Cold-formed light frame construction wind resistance – screws	Review screw attachment bolting, anchoring hold downs, bracing, diaphragms, struts	Y/P	Field Review; VCC 1705.12.2, 1705.12.3	1	
Cold-formed steel trusses spanning 60' or greater	Inspection of temporary and permanent restraints/bracing	N	Submittal & Field Review; VCC 1705.2.4		
WOOD					
Verify fabrication/quality control procedures	In-plant inspection of fabrication/quality control procedures** or submit Certificate of Compliance	N	Submittal or Field Review; VCC 113.5, 1704.2.5, 1704.2.5.1, 1705.5, 2303.4.7		
Metal plate connected wood/metal trusses spanning 60' or more	Review approved submittal and installation of restraint/bracing	N	Submittal & Field Review; VCC 1704.2.5, 1704.2.5.1, 1705.5, 1705.5.2		
Joist hangers – materials/installation	Review manufacturer's material and test standards	N	Field Review; ASTM D 1761		
High-load diaphragms - installation	Review submittal and as-built assemblies; Inspection of sheathing, framing size, nail and staple diameter and length, number of fastener lines, and fastener spacing	N	Submittal & Field Review; VCC 1705.5, 1705.5.1		
Wood shear walls – installation	Review nailing, bolting, anchoring, fastening, diaphragms, struts, braces, and hold downs when fasteners are ≤ 4" on center	N	Field Review; VCC 1705.12.1		
Mass timber – anchorage	Review installation of anchorage to timber deep foundation	N	Field Review; VCC 1705.3, Table 1705.5.3		
Mass timber – erection	Inspection of member locations and structural details for bracing	N	Submittal & Field Review; VCC 1705.3, Table 1705.5.3		
Mass timber – threaded fasteners	Inspection of installation equipment, pre-drilled holes, and screws, including diameter, length, head type, spacing, installation angle, and depth	N	Submittal & Field Review; VCC 1705.3, Table 1705.5.3		
Mass timber – adhesive anchors	Installation of drilled hole depth and preparation; Review material and installation of adhesive anchors	N	Submittal & Field Review; VCC 1705.3, Table 1705.5.3		
Mass timber – bolted connections	Review materials and installation of bolts, nuts, and washers	N	Field Review; VCC 1705.3, Table 1705.5.3		
Mass timber – concealed connections	Review materials and installation of fasteners in all concealed locations	N	Field Review; VCC 1705.3, Table 1705.5.3		
MAIN WIND FORCE RESISTING SYSTEM					
Wind requirements	Review of the system components and installation for wood construction, cold-formed steel light frame construction, components, and cladding	N	Submittal & Field Review; VCC 1609.2, 1705.12		

MATERIAL/ACTIVITY	TYPE OF INSPECTION	APPLICABLE TO THIS PROJECT		
		Y/C/P/N	EXTENT/REFERENCE	AGENT
SEISMIC FORCE RESISTING SYSTEMS				
Seismic requirements	Review of the designated seismic systems and seismic force resistance systems	N	Submittal & Field Review; VCC 1613, 1704.6, 1705.13, 1705.14; ASCE 7	
SMOKE CONTROL				
Special Inspection of smoke control systems	Leakage testing and recording of device location; Pressure difference testing, flow measurement and detection, and control verification	N	Field Review; VCC 1705.19, 1705.19.1, 1705.19.2	
SPRAYED FIRE RESISTIVE MATERIAL, FIRE RESISTANT PENETRATIONS; JOINTS, MASTIC AND INTUMESCENT FIRE RESISTANT COATING				
Structural member surface conditions	Field review of surface conditions prior to application	N	AWCI 12-B; VCC 1705.15, 1705.15.1, 1705.15.2	
Application/thickness/density/bond strength	Field review of application operations, thickness, and density	N	ASTM E605; AWCI 12-B; VCC 1705.15.1, 1705.15.2, 1705.15.3, 1705.15.4, 1705.15.5, 1705.15.6	
Mastic & intumescent fire resistant coating	Field review of application operations and thickness	N	AWCI 12-B; VCC 1705.16	
Mass timber sealant or adhesives	Field review of application of sealant or adhesives	N	ASTM C920, D3498; VCC 703.7, 1705.20	
EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS)				
Application	Field Review of application/installation	Y/P	ASTM E2570; VCC 1407.6, 1705.17	2
SPECIAL CASES				
Retaining walls	Field review of installation of pre-manufactured structural components, drainage, and compaction	N	Field Review; VCC 113.4, 1705.1.1	
MEP Sprinkler system hangers/supports	Field review of placement and anchorage	N	Field Review; VCC 903.3.1.1, 1705.1.1; NFPA 13; 9.2	
Alternative materials and systems	As requested by Building Official, review system and installation	Y/P	VCC 112.2, 112.3, 113.4, 1705.1.1	1 & 2
INSPECTION AGENTS				
INSPECTION AGENTS		FIRM		TELEPHONE
1. Special Inspector:		Sinclair-Pratt-Cameron Structural Engineers, P.C.		1630 Donna Drive, Suite 105, Virginia Beach, VA 23451 (757) 417-0565
2. Materials and Testing Laboratory:		TERRACON / GET Solutions		5465 Greenwich Road, Virginia Beach, VA 23462 (757) 518-1703
3. Special Inspector Smoke Control System:		N/A		
4. (Additional Agents)		N/A		

Note: * The Qualifications of the Special Inspector and Testing Laboratories are subject to the Approval of the Building Official.

** Inspection of quality control procedures required only if fabricator is not regularly inspected by an Approved independent inspection agency or a referenced standard that provides requirements for quality control. **See Section 5.**

***For construction projects in seismic regions, the Schedule of Special Inspections shall be expanded to include Architectural, Mechanical, and Electric components, as well as Storage Racks and Isolation Systems. Items in VCC Section 1705.13

Building Permit No: _____

FINAL REPORT OF SPECIAL INSPECTIONS

PROJECT

Yates Elementary School Security Vestibule &
Office Addition and Alterations
73 Maxwell Lane, Newport News, VA 23606

PERMIT APPLICANT

PRIMARY RDP OF RECORD

Richard S. Corner, AIA, CSI
Hudson + Associates Architects, PLLC
120 West Queens Way, Suite 201
Hampton, VA 23669

STRUCTURAL ENGINEER OF RECORD

Christopher D. Sterne, P.E.
Sinclair-Pratt-Cameron Structural Engineers, P.C.
1630 Donna Drive, Suite 105
Virginia Beach, VA 23451

BUILDING PERMIT NO: _____

To the best of my information, knowledge, and belief, the Special Inspections required for this project, as itemized in the Statement of Special Inspections submitted for permit, have been completed. Attached to this final report are the Certificates of Compliance for shop fabricated load bearing members and assemblies. (Include this statement only if applicable).

Interim reports submitted prior to this final report, and numbered _____ to _____, form a basis for, and are to be considered an integral part of this final report.

Respectfully submitted,

Signature

Date

Type or Print Name **(Agent 1)**

Seal of SI

Upon completion of all Special Inspections and testing, the SI shall submit a Final Report of Special Inspections to the Building Official for review and approval. The Building Official review and approval is required prior to final building inspection approval or issuance of a Certificate of Occupancy.

SECTION 022600 - HAZARDOUS MATERIALS ASSESSMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 PROJECT DESCRIPTION

- A. This Section includes a description of prior hazardous materials investigation at the subject project site, including:
 - 1. An Asbestos Investigation Report (No. 21-048S) by Marine Chemist Service, Inc. dated April 30, 2021.
 - 2. A Lead-Based Paint Investigation Report (No. 16-036X) by Marine Chemist Service, Inc. dated September 15, 2016.

The two Hazardous Materials Investigation Reports attached herewith are hereby made part of the Contract Documents. These reports are included for the Contractor's information and use.

- B. **There is no remediation work to be performed by the Contractor under this Contract.** All remediation or abatement work, if and where required, shall be undertaken by the Owner using an independent, third-party contractor. Such work, if and where required, shall be undertaken in a time and manner so as minimal impact on the work under this Contract. The Owner shall advise the Contractor of the scheduled days that any abatement work will be performed and in what areas.

1.3 SUMMARY OF INVESTIGATIVE REPORTS

- A. Asbestos: No ACM-positive samples were obtained within the work area under scope of this project.
- B. Lead-Containing Paint and Compounds: Lead was detected in actionable levels at limited surfaces of existing wood trim and wall or floor base tile. The Owner shall be responsible for demolishing the materials that contain LBP or lead within these areas prior to the Contractor performing any other demolition in the respective spaces. Specific items are highlighted within the report, and their locations are referenced.

**Security Vestibule & Office Addition and Alterations for
Yates Elementary School, Newport News Public Schools, Newport News, VA**

- 1.4 WHAT TO DO IF SUSPECTED HAZARDOUS MATERIALS ARE ENCOUNTERED DURING WORK UNDER THIS PROJECT
- A. Existing Conditions: Although it is not anticipated that the Contractor will encounter any hazardous materials during performance of the demolition or other work under this contract, surfaces and materials hidden from view or access will be exposed during demolition operations. It is conceivable, however unlikely, that suspicious and possible hazardous-material containing features or surfaces may be encountered.
 - B. Action: To the extent that any such suspicious features or surfaces are encountered, stop all work in the immediate area around the suspected area and contact the Owner's Representative immediately. Notify the Owner's representative in writing the same day any such areas are encountered.
 - C. Owner's Responsibility: The Owner will assume responsibility for any investigation and/or abatement or remediation action that is determined to be necessary. Such work will be conducted by an independent third-party contractor, and will be expedited as rapidly as possible so as to minimize any interference in work being performed under this contract. Contract time extension may be granted for any notable or significant delays incurred by unforeseen abatement work, pursuant to the contract clauses.

PART 2 - PRODUCTS (Not applicable).

PART 3 – EXECUTION (Not applicable).

END OF SECTION 022600



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	<u>Laboratory ID: 100551</u>
	ELLAP	Paint, Soil, Wipe & Air
	EMLAP	Direct Examination: Air & Tape
	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	<u>Laboratory Code: 200628-0</u>
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	<u>Laboratory No: 460257</u>
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	<u>License No.: 3333 000004</u>
		Asbestos: PLM & PCM

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

ASBESTOS INVESTIGATION REPORT

April 30, 2021

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

Attention: Pennie Boyack

Reference: (North Hall, South Hall and Music Room)
Yates Elementary School
73 Maxwell Lane
Newport News, Virginia
MCS Job #21-048S

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

**PARTIAL ASBESTOS INSPECTION REPORT
OF
YEATS ELEMENTARY SCHOOL
73 MAXWELL LANE
NEWPORT NEWS, VIRGINIA
(NORTH HALL, SOUTH HALL AND MUSIC ROOM)
MCS JOB #21-048S**



Marine Chemist Service, Inc.
11850 Tug Boat Lane, Newport News, VA 23606-2527
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Fax: (757) 873-1074 · Norfolk (757) 625-5696
www.MarineChemist.com



Marine Chemist Service, Inc.

Partial Asbestos Inspection Report

of

**Yates Elementary School
73 Maxwell Lane
Newport News, Virginia
(North Hall, South Hall and Music Room)**

on

March 31st and April 21st of 2021

Prepared For:

**Pennie Boyack
Newport News Public Schools
12580 Patrick Henry Boulevard
Newport News, Virginia, 23606
MCS Job #21-048S**

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 30, 2021

Date

Inspector Signature

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Marine Chemist Service, Inc.

SECTION 1

Partial Asbestos Inspection Report

**PARTIAL ASBESTOS INSPECTION OF YATES ELEMENTARY SCHOOL
73 MAXWELL LANE
NEWPORT NEWS, VIRGINIA
(NORTH HALL, SOUTH HALL AND MUSIC ROOM)**

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 north hall, south hall and music room at, Yates Elementary School, 73 Maxwell Lane, located in Newport News, Virginia on March 31st and April 21st of 2021.

General Information

Marine Chemist Service, Inc. was hired by Pennie Boyack, on March 31, 2021 to conduct asbestos bulk sampling for suspect asbestos-containing building materials at Yates Elementary School, 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 March 26, 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. 2' x 2' Ceiling Tile | 2. Brick and Mortar |
| 3. 4" Pipe Insulation | 4. Mudded Elbow |
| 5. 2" Pipe Insulation | 6. 1' x 4' Fiberglass Ceiling Tile |
| 7. Plaster Ceiling | 8. 2'x 4' 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

**Yates Elementary School
73 Maxwell Lane
Newport News, Virginia
(North Hall, South Hall and Music Room)**

Sample #	Lab Sample #	Material Location and Description	% Asbestos	Friable Y/N
YES-1	0132662-001	Main Entrance Hall, 2' x 2' White Pitted Ceiling Tile	0	N/A
YES-2	0132662-002	Main Entrance Hall, 2' x 2' White Pitted Ceiling Tile	0/0	N/A
YES-3	0132662-003	North Hall, 2' x 2' White Pitted Ceiling Tile	0	N/A
YES-4	0132662-004	Main Hall, Brick and Mortar	0	N/A
YES-5	0132662-005	Main Hall, Brick and Mortar	0	N/A
YES-6	0132662-006	North Hall A-4, Exit Intersection, 2' x 2' White Wormed Ceiling Tile	0	N/A
YES-7	0132781-001	North Hall, A-4, Exit Intersection, 2' x 2' White Wormed Ceiling Tile	0	N/A
YES-8	0132662-007	South Hall, Next to Room 6, 2' x 2' White Wormed Ceiling Tile	0	N/A
YES-9	0132662-008	North Hall, 4" Brown Pipe Insulation	0/0	N/A
YES-10	0132662-009	North Hall Outside Room 17, 4" Brown Pipe Insulation	0/0	N/A
YES-11	0132662-010	South Hall Outside Room 6, 4" Brown Pipe Insulation	0/0/0	N/A
YES-12	0132662-011	North Hall A-4, Exit Intersection, Mudded Elbow	0/0	N/A
YES-13	0132662-012	North Hall A-4, Exit Intersection, Mudded Elbow	0/0	N/A
YES-14	0132662-013	North Hall, next to Flood Light, 2" Brown Pipe Insulation	0/0	N/A
YES-15	0132662-014	North Hall, next to Flood Light, 2" Brown Pipe Insulation	0/0	N/A
YES-16	0132781-002	North Hall, next to Flood Light, 2" Brown Pipe Insulation	0/0	N/A
YES-17	0132662-015	North Hall, outside Room 17, 4" Black Pipe Insulation	0/0/0	N/A
YES-18	0132662-016	North Hall, outside Room 17, 4" Black Pipe Insulation	0/0/0	N/A
YES-19	0132662-017	North Hall, outside Room 15, 4" Black Pipe Insulation	0/0/0	N/A
YES-20	0132781-003	South Hall, inside Room 1, 1' x 4' Fiberglass Ceiling Tile	0	N/A
YES-21	0132662-018	South Hall, inside Room 9, 1' x 4' Fiberglass Ceiling Tile	0	N/A



Sample #	Lab Sample #	Material Location and Description	% Asbestos	Friable Y/N
YES-22	0132662-019	South Hall, inside Room 1, 1' x 4' Fiberglass Ceiling Tile	0	N/A
YES-23	0132662-020	South Hall, inside Room 1, 1' x 4' White-Wormed Ceiling Tile	0	N/A
YES-24	0132662-021	South Hall, inside Room 9, 1' x 4' White-Wormed Ceiling Tile	0	N/A
YES-25	0132662-022	North Hall, inside Room 15, 1' x 4' White-Dotted Ceiling Tile	0	N/A
YES-26	0132662-023	South Hall, inside Room 1, Plaster Ceiling	0/0	N/A
YES-27	0132662-024	North Hall, Boys' Bathroom, Plaster Ceiling	0/0	N/A
YES-28	0132662-025	North Hall, Girls' Bathroom, Plaster Ceiling	0/0	N/A
YES-29	0132662-026	Clinic, Plaster Ceiling	0/0	N/A
YES-30	0132662-027	South Hall Boys' Bathroom, Plaster Ceiling	0/0	N/A
YES-31	0132662-028	South Hall Outside Room 10, 2' x 2' White-Dotted Ceiling Tile	0	N/A
YES-32	0132662-029	Teachers' Lounge Inside, 2' x 2' White-dotted Ceiling Tile	0	N/A
YES-33	0132662-030	Main Hall, 2' x 2' White-Dotted Ceiling Tile	0	N/A
YES-34	0132662-031	Music Room Inside, 2' x 4' White-Wormed Ceiling Tile	0	N/A
YES-35	0132662-032	Music Room Inside, 2' x 4' White-Wormed Ceiling Tile	0	N/A
YES-36	0132662-033	Music Room Inside, 2' x 4' White-Wormed Ceiling Tile	0	N/A
YES-37	0132662-034	Music Room Inside, 2' x 4' White-Wormed Ceiling Tile	0/0/0	N/A
YES-38	0132662-035	Music Room Inside, 2' x 4' White-Wormed Ceiling Tile	0	N/A
YES-39	0132662-036	North Hall Inside Room 15, 1' x 4' White-Wormed Ceiling Tile	0	N/A
YES-40	0132662-037	Music Room Inside, 2' x 4' White-Wormed Ceiling Drywall	0/0	N/A
YES-41	0132662-038	Music Room Inside, 2' x 4' White-Wormed Ceiling Drywall	0/0	N/A

Comments

1. None of the sampled materials tested positive for asbestos.
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.



Marine Chemist Service, Inc.

SECTION 3 General Legend and Notes

GENERAL LEGEND

O - Sample number/location - non-asbestos

△ - 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

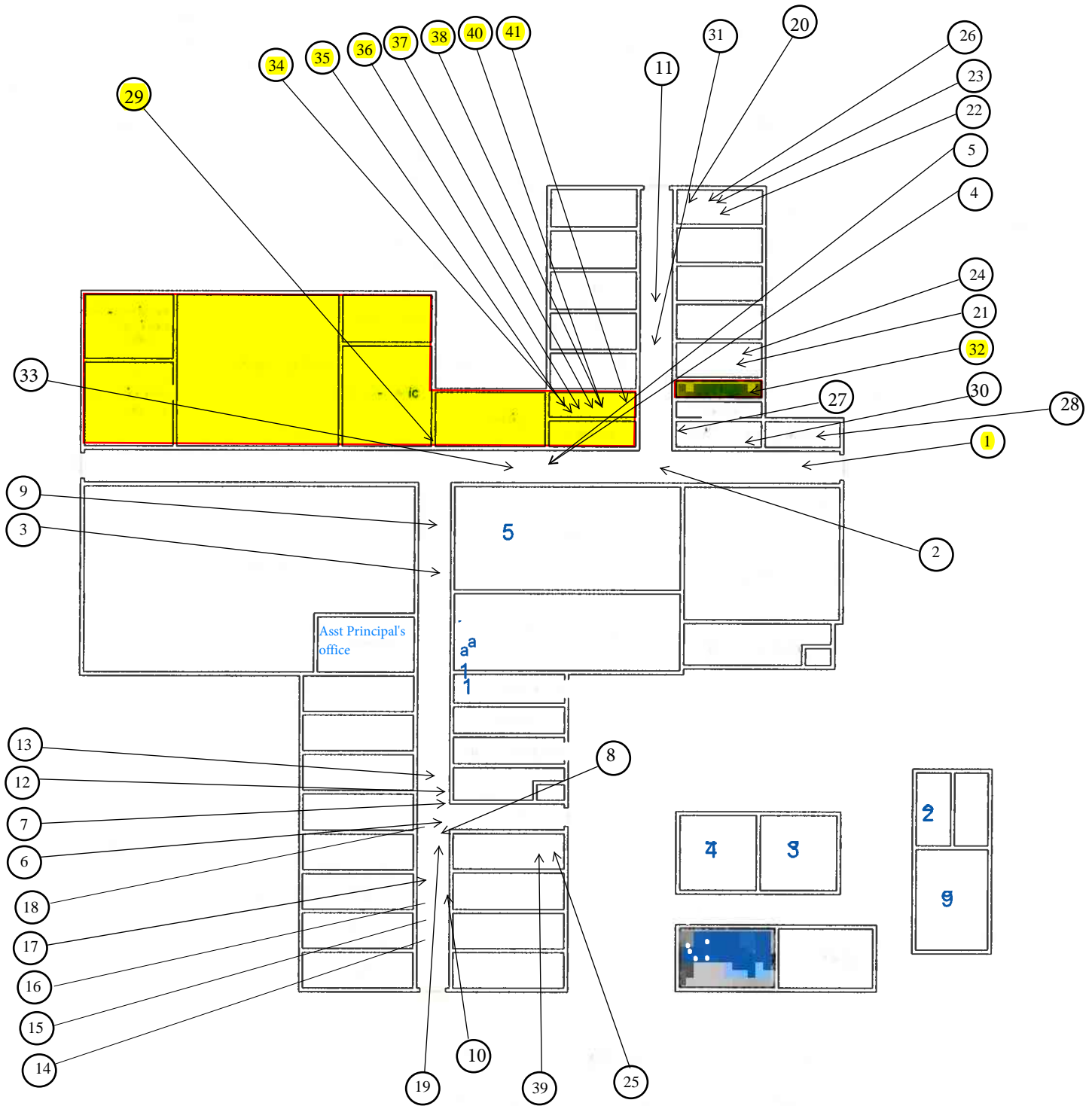
No Positive Materials



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SECTION 5

Survey Sample Location Sketches



Asbestos Sample Locations
 Yates Elementary School
 73 Maxwell Lane
 Newport News, Virginia

HIGHLIGHTED AREAS REPRESENT APPROXIMATE SCOPE OF WORK ZONE FOR ALTERATIONS AND RENOVATIONS UNDER THE SECURITY VESTIBULE / OFFICE ADDITION PROJECT.



Marine Chemist Service, Inc.

SECTION 6 Reports of Analysis



Marine Chemist Service, Inc.
 11850 TUG BOAT LANE
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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	<u>Laboratory ID: 100551</u>
	ELLAP	Paint, Soil, Wipe & Air
	EMLAP	Direct Examination: Air & Tape
	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	<u>Laboratory Code: 200628-0</u>
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	<u>Laboratory No: 460257</u>
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	<u>License No.: 3333 000004</u>
		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.: 0132662
Report Date: 04/20/2021
MCS Job No.: 21-048S
Customer PO No.:

Date Sampled: 03/31/2021
Sampled By: Ryan Stanley
Job Location: Yates Elementary School

Date Received: 04/06/2021
Received By: JAS
Sample Matrix: BULK
Date Analyzed: 04/18/2021

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	(%)
0132662-001	Main Entrance Hall, 2'x2' White Pitted Ceiling Tile					
YES-1	Ceiling Tile, Gray	LAYER 1 100%	None Detected		Cellulose Fiber Fibrous Glass Non-Fibrous Material	40% 40% 20%
Asbestos Present: No		Total % Asbestos:		No Asbestos Detected		
0132662-002	Main Entrance Hall, 2'x2' White Pitted Ceiling Tile					
YES-2	Ceiling Tile, Gray	LAYER 1 90%	None Detected		Cellulose Fiber Fibrous Glass Non-Fibrous Material	40% 40% 20%
	Tar, Black	LAYER 2 10%	None Detected		Cellulose Fiber Non-Fibrous Material	5% 95%
Asbestos Present: No		Total % Asbestos:		No Asbestos Detected		
0132662-003	North Hall, 2'x2' White Pitted Ceiling Tile					
YES-3	Ceiling Tile, Gray	LAYER 1 100%	None Detected		Cellulose Fiber Fibrous Glass Non-Fibrous Material	40% 40% 20%
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	<u>Laboratory ID: 100551</u>
	ELLAP	Paint, Soil, Wipe & Air
	EMLAP	Direct Examination: Air & Tape
	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	<u>Laboratory Code: 200628-0</u>
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	<u>Laboratory No: 460257</u>
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	<u>License No.: 3333 000004</u>
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REPORT OF ANALYSIS

MCS Sample No. Field Sample ID	Sample Location Description	Layer No. Layer %	Asbestos Type (%)	Non-Asbestos Components (%)
0132662-004 YES-4	Main Hall, Brick and Mortar Cementitious Material, Gray	LAYER 1 100%	None Detected	Non-Fibrous Material 100%
Asbestos Present: No		Total % Asbestos: No Asbestos Detected		
0132662-005 YES-5	Main Hall, Brick and Mortar Cementitious Material, Gray	LAYER 1 100%	None Detected	Non-Fibrous Material 100%
Asbestos Present: No		Total % Asbestos: No Asbestos Detected		
0132662-006 YES-6	North Hall A-4 Exit Intersection, 2'x2' White Wormed Ceiling Tile Ceiling Tile, Gray	LAYER 1 100%	None Detected	Cellulose Fiber 40% Fibrous Glass 40% Non-Fibrous Material 20%
Asbestos Present: No		Total % Asbestos: No Asbestos Detected		
0132662-007 YES-8	South Hall next to Room 6, 2'x2' White Wormed Ceiling Tile Ceiling Tile, Gray	LAYER 1 100%	None Detected	Cellulose Fiber 40% Fibrous Glass 40% Non-Fibrous Material 20%
Asbestos Present: No		Total % Asbestos: No Asbestos Detected		



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Approval	DOD-US Navy	Resin
Accreditation	ABS	Hull Thickness
Accreditation	AIHA-LAP, LLC	<u>Laboratory ID: 100551</u>
	ELLAP	Paint, Soil, Wipe & Air
	EMLAP	Direct Examination: Air & Tape
	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	<u>Laboratory Code: 200628-0</u>
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	<u>Laboratory No: 460257</u>
	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	(%)
0132662-008 YES-9	North Hall, 4" Brown Pipe Insulation Jacket, White	LAYER 1 50%	None Detected		Cellulose Fiber Fibrous Glass Organic Material	40% 40% 20%
	Insulation, Orange	LAYER 2 50%	None Detected		Fibrous Glass Non-Fibrous Material	90% 10%
Asbestos Present: No		Total % Asbestos:		No Asbestos Detected		
0132662-009 YES-10	North Hall Outside Room 17, 4" Brown Pipe Insulation Jacket, White	LAYER 1 50%	None Detected		Cellulose Fiber Fibrous Glass Organic Material	40% 40% 20%
	Insulation, Orange	LAYER 2 50%	None Detected		Fibrous Glass Non-Fibrous Material	90% 10%
Asbestos Present: No		Total % Asbestos:		No Asbestos Detected		



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Accreditation	AIHA-LAP, LLC	<u>Laboratory ID: 100551</u>
	ELLAP	Paint, Soil, Wipe & Air
	EMLAP	Direct Examination: Air & Tape
	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	<u>Laboratory Code: 200628-0</u>
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	<u>Laboratory No: 460257</u>
	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	(%)
0132662-010	South Hall Outside Outside Room 6, 4" Brown Pipe Insulation					
YES-11	Jacket, White	LAYER 1 40%	None Detected		Cellulose Fiber Fibrous Glass Non-Fibrous Material	40% 40% 20%
	Insulation, Orange	LAYER 2 50%	None Detected		Fibrous Glass Non-Fibrous Material	90% 10%
	Tar-Like Material, Black	LAYER 3 10%	None Detected		Cellulose Fiber Non-Fibrous Material	5% 95%
	Asbestos Present: No	Total % Asbestos:	No Asbestos Detected			
0132662-011	North Hall A-4 Exit Intersection, Mudded elbow					
YES-12	Jacket and Paint, White	LAYER 1 40%	None Detected		Cellulose Fiber Fibrous Glass Wollastonite Non-Fibrous Material	40% 40% 10% 10%
	Insulation, Yellow	LAYER 2 60%	None Detected		Fibrous Glass Non-Fibrous Material	90% 10%
	Asbestos Present: No	Total % Asbestos:	No Asbestos Detected			



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	ELLAP	Paint, Soil, Wipe & Air
	EMLAP	Direct Examination: Air & Tape
	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	<u>Laboratory Code: 200628-0</u>
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	<u>Laboratory No: 460257</u>
	NELAC	RCRA 8 Metals: TCLP & NPW
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0132662-012	North Hall A-4 Exit Intersection, Mudded elbow					
YES-13	Jacket and Paint, White	LAYER 1 50%	None Detected		Fibrous Glass Wollastonite Non-Fibrous Material	40% 10% 50%
	Insulation, Yellow	LAYER 2 50%	None Detected		Fibrous Glass Non-Fibrous Material	90% 10%
Asbestos Present: No		Total % Asbestos:		No Asbestos Detected		
0132662-013	North Hall next to Flood Light, 2" Brown Pipe Insulation					
YES-14	Jacket, Brown	LAYER 1 50%	None Detected		Fibrous Glass Non-Fibrous Material	50% 50%
	Insulation, Yellow	LAYER 2 50%	None Detected		Fibrous Glass Non-Fibrous Material	90% 10%
Asbestos Present: No		Total % Asbestos:		No Asbestos Detected		



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Accreditation	AIHA-LAP, LLC	<u>Laboratory ID: 100551</u>
	ELLAP	Paint, Soil, Wipe & Air
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		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	<u>Laboratory Code: 200628-0</u>
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Virginia Certification	VELAP	<u>Laboratory No: 460257</u>
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REPORT OF ANALYSIS

MCS Sample No. Field Sample ID	Sample Location Description	Layer No. Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132662-014	North Hall next to Flood Light, 2" Brown Pipe Insulation					
YES-15	Jacket, Brown	LAYER 1 50%	None Detected		Fibrous Glass Non-Fibrous Material	50% 50%
	Insulation, Yellow	LAYER 2 50%	None Detected		Fibrous Glass Non-Fibrous Material	90% 10%
Asbestos Present: No		Total % Asbestos:		No Asbestos Detected		
0132662-015	North Hall Outside Room 17, 4" Black Pipe Insulation					
YES-17	Tar Paper, Black	LAYER 1 40%	None Detected		Cellulose Fiber Non-Fibrous Material	80% 20%
	Mastic, Yellow	LAYER 2 20%	None Detected		Cellulose Fiber Non-Fibrous Material	5% 95%
	Insulation, Orange	LAYER 3 40%	None Detected		Fibrous Glass Non-Fibrous Material	90% 10%
Asbestos Present: No		Total % Asbestos:		No Asbestos Detected		



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Accreditation	ABS	Hull Thickness
Accreditation	AIHA-LAP, LLC	<u>Laboratory ID: 100551</u>
	ELLAP	Paint, Soil, Wipe & Air
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		Dust: Gravimetry
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	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	<u>Laboratory No: 460257</u>
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REPORT OF ANALYSIS

MCS Sample No. Field Sample ID	Sample Location Description	Layer No. Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132662-016	North Hall Outside Room 17, 4" Black Pipe Insulation					
YES-18	Tar Paper, Black	LAYER 1 40%	None Detected		Cellulose Fiber Non-Fibrous Material	80% 20%
	Mastic, Yellow	LAYER 2 20%	None Detected		Cellulose Fiber Non-Fibrous Material	5% 95%
	Insulation, Orange	LAYER 3 40%	None Detected		Fibrous Glass Non-Fibrous Material	90% 10%
Asbestos Present: No		Total % Asbestos:		No Asbestos Detected		
0132662-017	North Hall Outside Room 15, 4" Black Pipe Insulation					
YES-19	Tar Paper, Black	LAYER 1 40%	None Detected		Cellulose Fiber Non-Fibrous Material	80% 20%
	Mastic, Yellow	LAYER 2 20%	None Detected		Cellulose Fiber Non-Fibrous Material	5% 95%
	Insulation, Orange	LAYER 3 40%	None Detected		Fibrous Glass Non-Fibrous Material	90% 10%
Asbestos Present: No		Total % Asbestos:		No Asbestos Detected		



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	<u>Laboratory ID: 100551</u>
	ELLAP	Paint, Soil, Wipe & Air
	EMLAP	Direct Examination: Air & Tape
	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	<u>Laboratory Code: 200628-0</u>
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	<u>Laboratory No: 460257</u>
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR,	<u>License No.: 3333 000004</u>
		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.: 0132662
Report Date: 04/20/2021
MCS Job No.: 21-0485
Customer PO No.:

Date Sampled: 03/31/2021
Sampled By: Ryan Stanley
Job Location: Yates Elementary School

Date Received: 04/06/2021
Received By: JAS
Sample Matrix: BULK
Date Analyzed: 04/18/2021

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	(%)
0132662-018	South Hall Inside Room 9, 1'x4' Fiberglass Ceiling Tile					
YES-21	Brown Ceiling Tile, White Paint	LAYER 1 100%	None Detected		Fibrous Glass Non-Fibrous Material	90% 10%
Asbestos Present: No		Total % Asbestos:		No Asbestos Detected		
0132662-019	South Hall Inside Room 1, 1'x4' Fiberglass Ceiling Tile					
YES-22	Brown Ceiling Tile, White Paint	LAYER 1 100%	None Detected		Fibrous Glass Non-Fibrous Material	90% 10%
Asbestos Present: No		Total % Asbestos:		No Asbestos Detected		
0132662-020	South Hall Inside Room 1, 1'x4' White-Wormed Ceiling Tile					
YES-23	Ceiling Tile, Gray	LAYER 1 100%	None Detected		Cellulose Fiber Fibrous Glass Non-Fibrous Material	40% 40% 20%
Asbestos Present: No		Total % Asbestos:		No Asbestos Detected		



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

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MCS Report No.: 0132662
Report Date: 04/20/2021
MCS Job No.: 21-0485
Customer PO No.:

Date Sampled: 03/31/2021
Sampled By: Ryan Stanley
Job Location: Yates Elementary School

Date Received: 04/06/2021
Received By: JAS
Sample Matrix: BULK
Date Analyzed: 04/18/2021

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	(%)
0132662-021 YES-24	South Hall Inside Room 9, 1'x4' White-Wormed Ceiling Tile Ceiling Tile, Gray	LAYER 1 100%	None Detected		Cellulose Fiber Fibrous Glass Non-Fibrous Material	40% 40% 20%
Asbestos Present: No		Total % Asbestos:		No Asbestos Detected		
0132662-022 YES-25	North Hall Inside Room 15, 1'x4' White-Dotted Ceiling Tile Brown Ceiling Tile, White Paint	LAYER 1 100%	None Detected		Fibrous Glass Non-Fibrous Material	90% 10%
Asbestos Present: No		Total % Asbestos:		No Asbestos Detected		
0132662-023 YES-26	South Hall Inside Room 1, Plaster Ceiling White Plaster, Yellow Paint Cementitious Material, Gray	LAYER 1 60% LAYER 2 40%	None Detected None Detected		Non-Fibrous Material Non-Fibrous Material	100% 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	<u>Laboratory ID: 100551</u>
	ELLAP	Paint, Soil, Wipe & Air
	EMLAP	Direct Examination: Air & Tape
	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	<u>Laboratory Code: 200628-0</u>
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	<u>Laboratory No: 460257</u>
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	<u>License No.: 3333 000004</u>
		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.: 0132662
Report Date: 04/20/2021
MCS Job No.: 21-048S
Customer PO No.:

Date Sampled: 03/31/2021
Sampled By: Ryan Stanley
Job Location: Yates Elementary School

Date Received: 04/06/2021
Received By: JAS
Sample Matrix: BULK
Date Analyzed: 04/18/2021

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	(%)
0132662-024 YES-27	North Hall Boys Bathroom, Plaster Ceiling					
	White Plaster, Yellow Paint	LAYER 1 60%	None Detected		Non-Fibrous Material	100%
	Cementitious Material, Gray	LAYER 2 40%	None Detected		Non-Fibrous Material	100%
Asbestos Present: No		Total % Asbestos:		No Asbestos Detected		
0132662-025 YES-28	North Hall Girls Bathroom, Plaster Ceiling					
	White Plaster, Yellow Paint	LAYER 1 60%	None Detected		Non-Fibrous Material	100%
	Cementitious Material, Gray	LAYER 2 40%	None Detected		Non-Fibrous Material	100%
Asbestos Present: No		Total % Asbestos:		No Asbestos Detected		
0132662-026 YES-29	Clinic, Plaster Ceiling					
	Plaster and Paint, White	LAYER 1 60%	None Detected		Non-Fibrous Material	100%
	Cementitious Material, Gray	LAYER 2 40%	None Detected		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	<u>Laboratory ID: 100551</u>
	ELLAP	Paint, Soil, Wipe & Air
	EMLAP	Direct Examination: Air & Tape
	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	<u>Laboratory Code: 200628-0</u>
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	<u>Laboratory No: 460257</u>
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	<u>License No.: 3333 000004</u>
		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.: 0132662
Report Date: 04/20/2021
MCS Job No.: 21-048S
Customer PO No.:

Date Sampled: 03/31/2021
Sampled By: Ryan Stanley
Job Location: Yates Elementary School

Date Received: 04/06/2021
Received By: JAS
Sample Matrix: BULK
Date Analyzed: 04/18/2021

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	(%)
0132662-027 YES-30	South Hall Boys Bathroom, Plaster	LAYER 1 60%	None Detected		Non-Fibrous Material	100%
	Plaster and Paint, White					
	Cementitious Material, Gray	LAYER 2 40%	None Detected		Non-Fibrous Material	100%
Asbestos Present: No		Total % Asbestos:		No Asbestos Detected		
0132662-028 YES-31	South Hall Outside Room 10, 2'x2' White-Dotted Ceiling Tile	LAYER 1 100%	None Detected		Cellulose Fiber Fibrous Glass Non-Fibrous Material	40% 40% 20%
	Ceiling Tile, Gray					
Asbestos Present: No		Total % Asbestos:		No Asbestos Detected		
0132662-029 YES-32	Teachers Lounge Inside, 2'x2' White-Dotted Ceiling Tile	LAYER 1 100%	None Detected		Cellulose Fiber Fibrous Glass Non-Fibrous Material	40% 40% 20%
	Ceiling Tile, Gray					
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	<u>Laboratory ID: 100551</u>
	ELLAP	Paint, Soil, Wipe & Air
	EMLAP	Direct Examination: Air & Tape
	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	<u>Laboratory Code: 200628-0</u>
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	<u>Laboratory No: 460257</u>
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	<u>License No.: 3333 000004</u>
		Asbestos: PLM & PCM

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MCS Report No.: 0132662
Report Date: 04/20/2021
MCS Job No.: 21-0485
Customer PO No.:

Date Sampled: 03/31/2021
Sampled By: Ryan Stanley
Job Location: Yates Elementary School

Date Received: 04/06/2021
Received By: JAS
Sample Matrix: BULK
Date Analyzed: 04/18/2021

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	(%)
0132662-030 YES-33	Main Hall, 2'x2' White- Dotted Ceiling Tile Ceiling Tile, Gray	LAYER 1 100%	None Detected		Cellulose Fiber Fibrous Glass Non-Fibrous Material	40% 40% 20%
Asbestos Present: No		Total % Asbestos:		No Asbestos Detected		
0132662-031 YES-34	Music Room Inside, 2'x4' White-Wormed Ceiling Tile, Gray	LAYER 1 100%	None Detected		Cellulose Fiber Fibrous Glass Non-Fibrous Material	40% 40% 20%
Asbestos Present: No		Total % Asbestos:		No Asbestos Detected		
0132662-032 YES-35	Music Room Inside, 2'x4' White-Wormed Ceiling Tile, Gray	LAYER 1 100%	None Detected		Cellulose Fiber Fibrous Glass Non-Fibrous Material	40% 40% 20%
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	<u>Laboratory ID: 100551</u>
	ELLAP	Paint, Soil, Wipe & Air
	EMLAP	Direct Examination: Air & Tape
	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	<u>Laboratory Code: 200628-0</u>
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	<u>Laboratory No: 460257</u>
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	<u>License No.: 3333 000004</u>
		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.: 0132662
Report Date: 04/20/2021
MCS Job No.: 21-048S
Customer PO No.:

Date Sampled: 03/31/2021
Sampled By: Ryan Stanley
Job Location: Yates Elementary School

Date Received: 04/06/2021
Received By: JAS
Sample Matrix: BULK
Date Analyzed: 04/18/2021

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	(%)
0132662-033	Music Room Inside, 2'x4' White-Wormed Ceiling Tile					
YES-36	Ceiling Tile, Gray	LAYER 1 100%	None Detected		Cellulose Fiber Fibrous Glass Non-Fibrous Material	40% 40% 20%
	Asbestos Present: No	Total % Asbestos:	No Asbestos Detected			
0132662-034	Music Room Inside, 2'x4' White-Wormed Ceiling Drywall					
YES-37	Joint Compound, White	LAYER 1 40%	None Detected		Non-Fibrous Material	100%
	Paper, Brown	LAYER 2 40%	None Detected		Cellulose Fiber Non-Fibrous Material	90% 10%
	Drywall, Gray	LAYER 3 50%	None Detected		Cellulose Fiber Non-Fibrous Material	5% 95%
	Asbestos Present: No	Total % Asbestos:	No Asbestos Detected			
0132662-035	Music Room Inside, 2'x4' White-Wormed Ceiling Tile					
YES-38	Ceiling Tile, Gray	LAYER 1 100%	None Detected		Cellulose Fiber Fibrous Glass Non-Fibrous Material	40% 40% 20%
	Asbestos Present: No	Total % Asbestos:	No Asbestos Detected			



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Approval	DOD-US Navy	Resin
Accreditation	ABS	Hull Thickness
Accreditation	AIHA-LAP, LLC	<u>Laboratory ID: 100551</u>
	ELLAP	Paint, Soil, Wipe & Air
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Accreditation	NIST	<u>Laboratory Code: 200628-0</u>
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	<u>Laboratory No: 460257</u>
	NELAC	RCRA 8 Metals: TCLP & NPW
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MCS Report No.: 0132662
Report Date: 04/20/2021
MCS Job No.: 21-048S
Customer PO No.:

Date Sampled: 03/31/2021
Sampled By: Ryan Stanley
Job Location: Yates Elementary School

Date Received: 04/06/2021
Received By: JAS
Sample Matrix: BULK
Date Analyzed: 04/18/2021

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	(%)
0132662-036 YES-39	North Hall Inside Room 15, 1'x4' White-Wormed Ceiling Tile Ceiling Tile, Gray	LAYER 1 100%	None Detected		Cellulose Fiber Fibrous Glass Non-Fibrous Material	40% 40% 20%
Asbestos Present: No		Total % Asbestos:		No Asbestos Detected		
0132662-037 YES-40	Music Room Inside, 2'x4' White-Wormed Ceiling Drywall Paper, Brown Drywall, Gray	LAYER 1 50% LAYER 2 50%	None Detected None Detected		Cellulose Fiber Non-Fibrous Material Cellulose Fiber Non-Fibrous Material	90% 10% 5% 95%
Asbestos Present: No		Total % Asbestos:		No Asbestos Detected		
0132662-038 YES-41	Music Room Inside, 2'x4' White-Wormed Ceiling Drywall Paper, Brown Drywall, Gray	LAYER 1 50% LAYER 2 50%	None Detected None Detected		Cellulose Fiber Non-Fibrous Material Cellulose Fiber Non-Fibrous Material	90% 10% 5% 95%
Asbestos Present: No		Total % Asbestos:		No Asbestos Detected		



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Credentials	Agency	Scope
Approval Accreditation	DOD-US Navy	Resin
Accreditation	ABS	Hull Thickness
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		Metals: Air
Accreditation	NIST	<u>Laboratory Code: 200628-0</u>
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	<u>Laboratory No: 460257</u>
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	<u>License No.: 3333 000004</u>
		Asbestos: PLM & PCM

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 Attn: Pennie Robbins Boyack
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MCS Report No.: 0132662
Report Date: 04/20/2021
MCS Job No.: 21-0485
Customer PO No.:

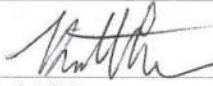
Date Sampled: 03/31/2021
Sampled By: Ryan Stanley
Job Location: Yates Elementary School

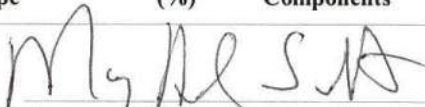
Date Received: 04/06/2021
Received By: JAS
Sample Matrix: BULK
Date Analyzed: 04/18/2021

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	(%)
-----------------------------------	--------------------------------	----------------------	------------------	-----	----------------------------	-----


 Analyst - Ruth Elkins


 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.



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 Page 1 of 3

Address:

Email: Pennie.Boyack@nn.k12.va.us

Attention: Pennie Boyack

Phone: (757) 503-1192 Fax: (757) 249-5638

MCS Job #: 21-048S Customer PO:

BULK Chain of Custody Form

(use separate form for each matrix)

Job Location: Yates Elementary School

- Building Material
Paint
Snail
Other

Requested Turnaround Time (markup)

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

RESULTS DUE BY: 04-07-21

ANALYSIS: PLM

MCS Use Only
Special Instructions:
MCS Project Manager:
DO NOT MAIL Give Report To:
Email: @
MCS Lab Report No. 0132662 2 4/6/21
Samples Acceptable to Lab Yes No
Date If "No" Reason

Table with 4 columns: Field ID, Sample Location, Sample Description, MCS Sample No. Contains 20 rows of sample data.

Ryan Stanley
Sampled by (Print)

[Signature]
Signature

3/31/21
Date/Time

OFFICE USE ONLY:

Ryan Stanley
Transported by (Print)

[Signature]
Signature

3/31/21
Date/Time

Verbal

Jennie Swai
Received by (Print)

[Signature]
Signature

4/6/21 7:22
Date/Time

Faxed

Copied

Emailed

Mailed Billing



Marine Chemist Service, Inc.

11850 Tug Boat Lane • Newport News, VA 23606

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Customer: Newport News Public Schools Page 2 of 3

Address:

Email: Pennie.Boyack@nn.k12.va.us

Attention: Pennie Boyack

Phone: (757) 503-1192 Fax: (757) 249-5638

MCS Job #: 21-0485 Customer PO:

BULK Chain of Custody Form

(use separate form for each matrix)

Job Location: Yates Elementary School

- 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%)
5-Day (standard)

RESULTS DUE BY: 04-07-21

ANALYSIS: PLM

MCS Use Only
Special Instructions:
MCS Project Manager:
DO NOT MAIL Give Report To:
Email: @
MCS Lab Report No. 0132662
Samples Acceptable to Lab Yes No By
Date If "No" Reason

Table with 4 columns: Field ID, Sample Location, Sample Description, MCS Sample No. Rows include YES-21 to YES-40 with details on room locations and ceiling tile descriptions.

Ryan Stanley
Sampled by (Print)
Ryan Stanley
Transported by (Print)
Jennie Swan
Received by (Print)

Signature
Signature
Signature

3/31/21
Date/Time
3/31/21
Date/Time
4/6/21 7:22
Date/Time

OFFICE USE ONLY:
Verbal
Faxed
Copied
Emailed
Mailed
Billing



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

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

Date Sampled: 04/21/2021
Sampled By: Ryan Stanley
Job Location: Yates Elementary School

MCS Report No.: 0132781
Report Date: 04/28/2021
MCS Job No.: 21-048S
Customer PO No.:

Date Received: 04/21/2021
Received By: SGH
Sample Matrix: BULK
Date Analyzed: 04/28/2021

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.

Credentials	Agency	Scope
Approval	DOD-US Navy	Resin
Accreditation	ABS	Hull Thickness
Accreditation	AIHA-LAP, LLC	<u>Laboratory ID: 100551</u>
	ELLAP	Paint, Soil, Wipe & Air
	EMLAP	Direct Examination: Air & Tape
	IHLAP	Asbestos: PCM
		Dust: Gravimetry
		Metals: Air
Accreditation	NIST	<u>Laboratory Code: 200628-0</u>
	NVLAP	Asbestos Bulk: PLM
Virginia Certification	VELAP	<u>Laboratory No: 460257</u>
	NELAC	RCRA 8 Metals: TCLP & NPW
Virginia Laboratory	DGS - DPOR	<u>License No.: 3333.000004</u>
		Asbestos: PLM & PCM

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

REPORT OF ANALYSIS

MCS Sample No. Field Sample ID	Sample Location Description	Layer No. Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0132781-001	North Hall A-4 Exit Intersection, 2'x2' White Wormed Ceiling Tile					
YES-7	Ceiling Tile, Gray	LAYER 1 100%	None Detected		Cellulose Fiber Fibrous Glass Non-Fibrous Material	50% 40% 10%
Asbestos Present: No		Total % Asbestos:		No Asbestos Detected		
0132781-002	North Hall Next to Floodlight, 2" Brown Pipe Insulation					
YES-16	Jacket, White	LAYER 1 40%	None Detected		Cellulose Fiber Fibrous Glass Non-Fibrous Material	50% 40% 10%
	Insulation, Brown	LAYER 2 60%	None Detected		Fibrous Glass Non-Fibrous Material	90% 10%
Asbestos Present: No		Total % Asbestos:		No Asbestos Detected		
0132781-003	South Hall Inside Room 1, 1'x4' Fiberglass Ceiling Tile					
YES-20	Brown Ceiling Tile, White Paint	LAYER 1 100%	None Detected		Fibrous Glass Cellulose Fiber Non-Fibrous Material	50% 40% 10%
Asbestos Present: No		Total % Asbestos:		No Asbestos Detected		



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

Date Sampled: 04/21/2021
Sampled By: Ryan Stanley
Job Location: Yates Elementary School

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

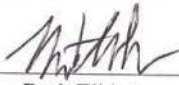
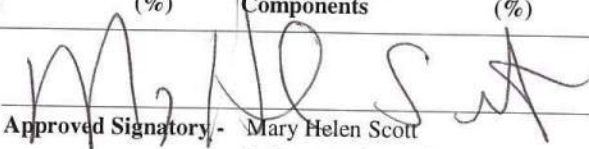
NOTE: Laboratory Credentials cover only to the scopes listed above.

MCS Report No.: 0132781
Report Date: 04/28/2021
MCS Job No.: 21-048S
Customer PO No.:

Date Received: 04/21/2021
Received By: SGH
Sample Matrix: BULK
Date Analyzed: 04/28/2021

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	(%)
 Analyst - Ruth Elkins		 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.



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: _____

Email: Pennie.Boyack@n.n.k12.va.us

Attention: Pennie Boyack

Phone: (757) 603-1192 Fax: _____

MCS Job #: 21-0485 Customer PO: _____

BULK Chain of Custody Form

(use separate form for each matrix)

Job Location: Yates Elementary School

- 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%)
- 5-Day (standard)

RESULTS DUE BY: 4/28/21

ANALYSIS: PLM

MCS Use Only

Special Instructions: _____

MCS Project Manager: _____

DO NOT MAIL Give Report To: _____

Email: _____ @ _____

MCS Lab Report No. 0132781 4/21/21 SCG

Samples Acceptable to Lab Yes No By _____

Date _____ If "No" Reason _____

Field ID	Sample Location	Sample Description	MCS Sample No.
<i>example</i>	<i>room or area</i>	<i>size / color / material</i>	<i>lab use only</i>
YES-7	North hall A-4 Exit intersection	2'x2' White Wormed ceiling tile	0132781001
YES-16	North hall next to Floodlight	2" Brown Pipe Insulation	0132781002
YES-20	South hall inside Room 1	2'x4 Fiberglass ceiling tile	0132781003

Ryan Stanley
Sampled by (Print)

[Signature]
Signature

4/21/21
Date/Time

OFFICE USE ONLY:

Christina Robbins
Transported by (Print)

[Signature]
Signature

4/21/21
Date/Time

Verbal _____

Shenem Hollend
Received by (Print)

[Signature]
Signature

4/21/21 1458
Date/Time

Faxed _____

Copied _____

Emailed _____

Mailed Billing



Marine Chemist Service, Inc.

SECTION 7 Inspection Information

Inspection Information

The survey contractor for the inspection of Yates Elementary School, 78 Maxwell Lane, 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**

**Adrian Bailey
Virginia Environmental Inspector**

**Christina Robbins
Virginia Environmental Inspector**

The Industrial Hygiene Inspectors are employed by:

**Marine Chemist Service, Inc.
11850 Tug Boat Lane
Newport News, Virginia 23606**



Marine Chemist Service, Inc.

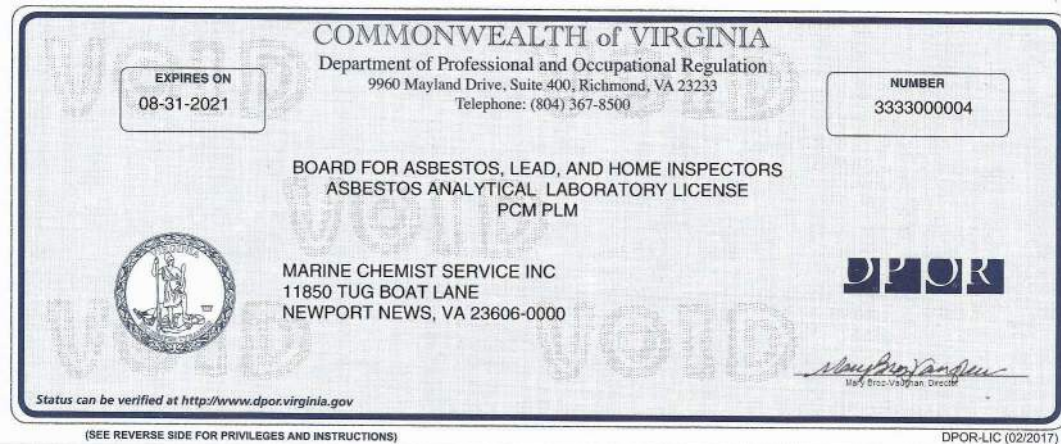
SECTION 8 Credentials

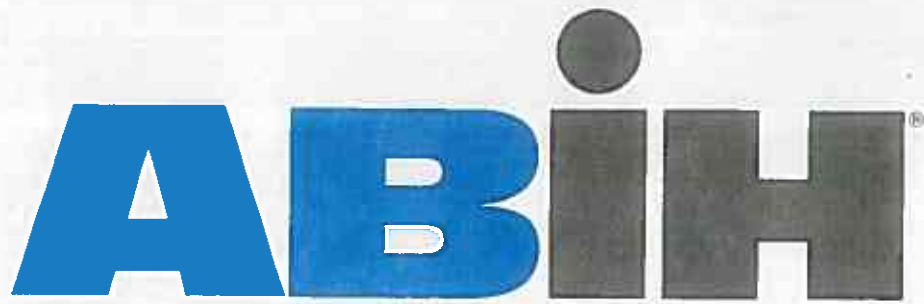


Marine Chemist Service, Inc.

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

The license information in this application was last updated at Thu Apr 22 02:50:18 EDT.





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





Marine Chemist Service, Inc.

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

<i>Credentials</i>	<i>Agency</i>	<i>Program (Scope)</i>
Accreditation	ABS	(Hull Thickness)
Accreditation	NIST	NVLAP
		Bulk Asbestos (PLM)
Accreditation	AIHA-LAP, LLC	ELLAP (Lead)
		(Paint, Soil, Wipe & Air)
		EMLAP
		Air (Direct Examination)
		IHLAP
		Asbestos (PCM)
		Dust (Gravimetry)
	VELAP	Metals (Air)
		NELAC
		TCLP-RCRA 8 Metals
Approval	DOD-	NPW-RCRA 8 Metals
	US Navy	Resin
Laboratory accreditations cover only to the scopes listed above.		
AIHA Laboratory No: 100551		
NVLAP Lab Code: 200628-0		
Virginia Asbestos Lab License No: 3333 000004		
VELAP ID: 460257		

LEAD INVESTIGATION REPORT

September 15, 2016

Newport News Public Schools
761 Hogan Drive
Newport News, VA 23606

Attention: Mrs. Pennie Boyack
Supervisor Environmental Health & Safety

Reference: Yates Elementary School
73 Maxwell Lane
Newport News, Virginia
MCS Job #16-036X

Dear Mrs. Boyack:

Please find enclosed the XRF Lead Based Paint report for the above referenced location. This inspection was not performed in accordance to HUD Guidelines, which requires testing of all walls and every painted surface/substrate combination per room location. Lead-based paint was identified in the all base cabinets, HVAC unit casings, book shelves and some walls. On September 1, 2016 additional XRF samples were taken of the walls to confirm that the walls contain lead based paint. It was confirmed all walls do contain lead based paint. The black baseboards ceramic tiles are lead containing and can be found throughout the school. Detectable levels of lead were also found on components throughout the building.

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

Sincerely,

Angela Mulleano
Virginia Lead Risk Assessor
License #3356-000460

**LIMITED LEAD BASED PAINT INSPECTION REPORT
OF
YATES ELEMENTARY SCHOOL
73 MAXWELL LANE
NEWPORT NEWS, VIRGINIA**



Marine Chemist Service, Inc.

11850 Tug Boat Lane, Newport News, VA 23606-2527

Phone: (757) 873-0933 • Norfolk (757) 640-1122

Fax: (757) 873-1074 • Norfolk (757) 625-5696

www.MarineChemist.com



Marine Chemist Service, Inc.

XRF Lead Based Paint Inspection

of

Yates Elementary School
73 Maxwell Lane
Newport News, Virginia

on

July 18, 2016

And

Additional Samples

on

September 1, 2016

Prepared for

Mrs. Pennie Boyack
Environmental Health & Safety
761 Hogan Drive
Newport News, Virginia 23606

Prepared by

Angela Mulleano
Lead Risk Assessor Virginia State License No. 3356-000460
Marine Chemist Service, Inc
11850 Tug Boat Lane
Newport News Virginia 23606
Office (757) 873-0933
MCS Job #16-036X

September 15, 2016

Date

Lead Risk Assessor



XRF INSPECTION FOR LEAD CONTAINING PAINT

Inorganic lead has been identified by the US Department of Health and Human Services (H.H.S) as the number one environmental pollutant that threatens public health in the United States. In an effort to address this danger, the US Congress, EPA, CPSC, OSHA, NIOSH and HUD have enacted various legislation, regulations and recommendations.

In 1978 the Consumer Product Safety Commission, recognizing the dangers of lead exposure especially for children, promulgated regulations limiting the amount of lead permissible in residential paint to 600 parts per million (0.06%).

To protect families from exposure to lead in paint, dust and soil, Congress passed the Residential Lead-Based Hazard Reduction Act of 1992, also known as Title X. Under Title X, EPA and other federal agencies are developing a national program and policies to prevent and reduce lead-based paint exposures and hazards.

The HUD Guidelines of June 1995 and EPA Guidance of July 14, 1994 provide directions on inspections and sampling of paint, soil and wipes. HUD considers paint containing 0.5% or greater (laboratory analysis) or 1.0-mg/cm² or greater (XRF) as lead based paint. HUD is concerned with target housing, child occupied facilities, and therefore its guidelines are very stringent. Inspections performed in accordance with the HUD Guidelines are required to test every painted surface/substrate combination. Since the HUD sampling guidelines are intended to protect children, a certified lead inspector may use his professional judgment to determine sample locations and numbers in other situations such as commercial buildings.

The OSHA Lead in Construction Standard (29 CFR 1926.62) does not define lead based paint in terms of lead quantity; therefore, compliance with the OSHA standard may be required for paint with detectable quantities of lead. OSHA is concerned with what will be done to that surface and how much lead dust will be generated. A contractor who will be disturbing a painted surface must know the concentration of lead in order to properly protect his workers.

As requested by Mrs. Boyack of Newport News Public Schools. Marine Chemist Service, Inc performed a XRF Lead-Based Paint Inspection at Yates Elementary School located at 73 Maxwell Lane, Newport News Virginia, on July 18, 2016 and September 1, 2016. Angela Mulleano, a Lead Risk Assessor (Virginia License No.3356-000460) conducted the XRF Lead-Based Paint Inspection. This lead-based paint inspection was not conducted to HUD guidelines. Lead-based paint was identified in the all base cabinets, HVAC unit casings, book shelves and some walls. On September 1, 2016 additional XRF samples were taken of the walls to confirm that the walls contain lead based paint. It was confirmed all walls do contain lead based paint. The black baseboards ceramic tiles are lead containing and can be found throughout the school. Detectable levels of lead were also found on components throughout the building.



DESCRIPTION

The building, located at 73 Maxwell Lane, Newport News Virginia, consists of a one-story brick School Building. The building and its painted components were in good condition throughout. Lead-based paint was identified in the all base cabinets, HVAC unit casings, book shelves and some walls. On September 1, 2016 additional XRF samples were taken of the walls to confirm that the walls contain lead based paint. It was confirmed all walls do contain lead based paint. The black baseboards ceramic tiles are lead containing and can be found throughout the school. Detectable levels of lead were also found on components throughout the building.

STRUCTURAL COMPONENTS LISTED BY LEAD CONTENT

Marine Chemist Services, Inc uses the Niton XLp Model 300 X-Ray Fluorescence (XRF) Spectrum Analyzer, Serial Number 12533 operating under Virginia Radioactive Material License #700-135-1. All necessary documentation, licenses, certificates, and operating procedures are carried by the registered operator and maintained with the unit. The results of the XRF readings are displayed in the columns with the heading Pb-L or Pb-K and Pb-C (lead-mg/cm²).

The results of the XRF inspection indicate that lead-based paint, in amounts ≥ 1.00 -mg/cm², for lead-based paint and within the parameters of this document Does Exist. Lead-based paint was identified in the all base cabinets, HVAC unit casings, book shelves and some walls. On September 1, 2016 additional XRF samples were taken of the walls to confirm that the walls contain lead based paint. It was confirmed all walls do contain lead based paint. The black baseboards ceramic tiles are lead containing and can be found throughout the school.

Detectable levels of lead were also found in painted components as detailed in the *Lead Paint Content in Descending Order* spreadsheet. The spreadsheet lead content is identified under the following columns:

Pb-L: This row is for: Any value above ≥ 1.00 -mg/cm² indicates a lead content in surface lead.

Pb-K: This row is for: Any value above ≥ 1.00 -mg/cm² indicates a lead content in buried lead.

Pb-C: This row is for: Any value from Pb-L (surface lead) and Pb-K (buried lead) above ≥ 1.00 -mg/cm² to indicate a combination of the highest levels of surface or buried lead content. “

Example: If your Pb-L level tested below 1.00-mg/cm² (example; 0.24mg/cm²) but your Pb-K tested above ≥ 1.00 -mg/cm² (example; 1.39mg/cm²) the Pb-C results for this signifies a positive reading for lead-based paint.

All structural components do not require testing when components are of like structural material and share the same maintenance history.



XRF READINGS SUMMARY

In accordance with HUD, EPA, and the Commonwealth of Virginia, paint containing more than one milligram of lead per square centimeter (1.00-mg/cm²) of dry film is lead-based paint.

Disturbing paint films with NITON XRF readings between 0.00-mg/cm² and 1.00-mg/cm² may come under OSHA's Lead in Construction Standard (29 CFR 1926.62) as lead activity depending upon what is done to that surface (i.e. hand scraping, hand sanding, etc.).

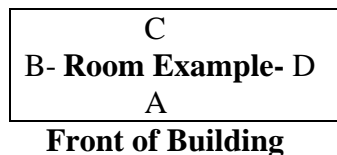
The results of the XRF readings are displayed in the column with the heading Pb L (mg/cm²).

- If the reading is greater 1.00-mg/cm², then the paint is considered lead-based paint.
- If the reading is between 0.00-mg/cm² and 1.00-mg/cm², work on this painted surface may come under OSHA's Lead Standard.

Descriptions to the abbreviations at the top of the sheet:

XRF No.	-	Reading number
Room	-	Room # in which readings were taken
Side	-	Indicates which side of building / room the reading is taken. Each wall of each room of a building is labeled. The labeling runs clockwise starting at the front of each apartment, the A side being the front door.

Sides Identified:





Component	-	Indicates type of building component being analyzed
Substrate		The material of which the building component is composite.
Color	-	Color of the paint
Condition		Condition of the paint
Pb-L (mg/cm ²)-		L – shell reading indicates surface lead content In milligrams / centimeter squared
Pb-K (mg/cm ²)-		K – shell reading indicates a buried lead content. In milligrams / centimeter squared
Pb-C (mg/cm ²)-		C- shell reading indicates a combination of the highest levels of surface or buried lead content. In milligrams / centimeter squared.

Definitions:

1. Lead-Based Paint: Any painted or surface coating that contains lead equal to or exceeding 1.0 milligram per square centimeter ($\leq 1.00\text{-mg/cm}^2$); or 0.5 percent by weight; or 5,000 parts per million.
2. Detectable Levels of Lead: Detectable levels of lead in paint are levels below that of lead-based paint. Detectable levels of lead pose potential health hazards as lead dust. Perform work on these lead-containing surfaces in accordance with OSHA's regulations.
3. Lead-Based Paint Hazard: Any condition that causes exposure to lead from dust-lead hazards, soil-lead hazards, or lead-based paint that is deteriorated or present in chewable surfaces, or impact surfaces, and that would result in adverse human health effects.
4. Deteriorated Paint: Any interior or exterior paint or coating that is peeling, chipping, chalking or cracking, or any paint or coating located on an interior or exterior surface or fixture that is otherwise damaged or separating from the substrate.

XRF Reading	Lead-mg/cm2			Building Components				Color	
	Results	Pb-L	Pb-K	Pb-C	Component	Substrate	Side		Condition
Classroom-1									
11	Positive	3.4	3.3	3.4	Cabinet Casing	Wood	D	Intact	Tan
8	Positive	3	5.8	3	Baseboard	Tile	B	Intact	Black
10	Positive	1.8	1.8	1.8	HVAC Unit	Wood	C	Intact	Tan
9	Positive	1.7	1.7	1.7	Book Shelf	Wood	C	Intact	Tan
6	Negative	0.13	-0.14	0.13	Door Casing	Metal	A	Intact	Blue
12	Negative	0.07	-0.05	0.07	Loudspeaker	Wood	A	Intact	Gray
14	Negative	0.06	0.5	0.06	Projector Screen Holder	Wood	A	Intact	White
13	Negative	0.06	0.2	0.06	Wall Molding	Wood	A	Intact	White
5	Negative	0.01	0.06	0.01	Door	Wood	A	Intact	Varnish
7	Negative	0	0.15	0	Wall	Cinder Block	B	Intact	White
Classroom-1 Bathroom									
15	Negative	0.15	-0.47	0.15	Door Casing	Wood	B	Intact	Blue
18	Negative	0.11	-0.09	0.11	Ceiling	Plaster		Intact	White
17	Negative	0.04	-0.01	0.04	Lower Wall	Tile	B	Intact	Pink
19	Negative	0.04	-0.63	0.04	Ceiling	Plaster		Intact	White
16	Negative	0	0.04	0	Upper Wall	Cinder Block	B	Intact	White

XRF Reading	Lead-mg/cm2				Building Components				
	Results	Pb-L	Pb-K	Pb-C	Component	Substrate	Side	Condition	Color
Classroom-2									
23	Positive	3.2	4.3	3.2	Baseboard	Tile	D	Intact	Black
26	Positive	2.4	2.3	2.4	Cabinet Casing	Wood	B	Intact	Tan
28	Positive	1.9	1.9	1.9	Book Shelf	Wood	C	Intact	Tan
29	Positive	1.2	1.3	1.2	HVAC Unit	Wood	C	Intact	Tan
22	Negative	0.6	0.8	0.6	Wall	Cinder Block	D	Intact	White
31	Negative	0.14	0.26	0.14	Wall Molding	Wood	A	Intact	White
21	Negative	0.11	-0.18	-0.18	Door Casing	Metal	C	Intact	Blue
24	Negative	0.1	-0.08	0.1	Cabinet Casing	Wood	B	Intact	Tan
25	Negative	0.09	0.4	0.09	Cabinet Casing	Wood	B	Intact	Tan
30	Negative	0.05	-0.39	0.05	Closet Upper Wall	Plaster	A	Intact	White
32	Negative	0.04	-0.32	0.04	Loudspeaker	Wood	A	Intact	Gray
20	Negative	0	-0.01	0	Door	Wood	C	Intact	Varnish
Classroom-2 Bathroom									
42	Negative	0.6	1.1	0.6	Upper Wall	Cinder Block	A	Intact	White
33	Negative	0.5	-0.08	0.5	Door Casing	Metal	A	Intact	Blue
40	Negative	0.04	0.21	0.04	Ceiling	Drywall		Intact	White
39	Negative	0.04	0.14	0.04	Lower Wall	Tile	A	Intact	Pink

XRF Reading	Lead-mg/cm2			Building Components					
	Results	Pb-L	Pb-K	Pb-C	Component	Substrate	Side	Condition	Color
Classroom-4									
46	Positive	3.7	4.7	3.7	Baseboard	Tile	D	Intact	Black
47	Positive	3.1	2.5	3.1	Book Shelf	Wood	C	Intact	Tan
48	Positive	2.6	2.4	2.6	HVAC Unit	Wood	C	Intact	Tan
50	Positive	2.1	2.3	2.1	Cabinet Casing	Wood	B	Intact	Tan
51	Negative	0.25	0.3	0.25	Upper Wall	Plaster	A	Intact	White
53	Negative	0.09	-0.53	0.09	Ceiling Tile Grid	Metal		Intact	White
45	Negative	0.06	0.3	0.06	Wall	Cinder Block	D	Intact	White
52	Negative	0.03	0.3	0.03	Wall Molding	Wood	A	Intact	White
44	Negative	0.03	-0.06	0.03	Door Casing	Metal	C	Intact	Blue
43	Negative	0	0.13	0	Door	Wood	C	Intact	Varnish
Classroom-4 Bathroom									
54	Negative	0.07	-0.33	0.07	Door Casing	Metal	A	Intact	Blue
57	Negative	0.03	0.7	0.03	Ceiling	Drywall		Intact	White
56	Negative	0.03	-1.18	0.03	Lower Wall	Tile	A	Intact	Pink
55	Negative	0.02	0.04	0.02	Upper Wall	Cinder Block	A	Intact	White

Yates Elementary School
 73 Maxwell Lane
 Newport News, Virginia

Lead Content in Paint in Descending Order Per Room Location

Marine Chemist Service, Inc.
 11850 Tug Boat Lane
 Newport News, VA 23606
 757-873-0933

XRF Reading	Lead-mg/cm2			Building Components					
	Results	Pb-L	Pb-K	Pb-C	Component	Substrate	Side	Condition	Color
Classroom-3									
61	Positive	3	3.9	3	Book Shelf	Wood	A	Intact	Beige
62	Positive	2.7	2.7	2.7	HVAC Unit	Wood	A	Intact	Beige
64	Positive	2.2	1.5	2.2	Cabinet Casing	Wood	D	Intact	Beige
66	Negative	0.2	-0.2	0.2	Wall Molding	Wood	C	Intact	White
60	Negative	0.14	0.4	0.14	Wall	Cinder Block	B	Intact	White
67	Negative	0.1	0.6	0.1	Ceiling Tile Grid	Metal		Intact	White
59	Negative	0.02	0.2	0.02	Door Casing	Metal	A	Intact	Blue
58	Negative	0	-0.16	0	Door	Wood	A	Intact	Varnish
65	Negative	0	-0.49	0	Projector Screen Holder	Wood	C	Intact	White
Classroom-3 Bathroom									
69	Negative	0.22	0.22	0.22	Upper Wall	Cinder Block	C	Intact	White
68	Negative	0.07	0.5	0.07	Door Casing	Metal	C	Intact	Blue
71	Negative	0.04	0.4	0.04	Ceiling	Drywall		Intact	White
70	Negative	0.02	0.23	0.02	Lower Wall	Tile	C	Intact	Pink

By: Angela Mulleano
 Lead Risk Assessor
 VA State # 3356-000460

Date of Inspection: 7-18-2016
 Date of Evaluation: 7-18-2016

XRF Reading	Lead-mg/cm2			Building Components				Color	
	Results	Pb-L	Pb-K	Pb-C	Component	Substrate	Side		Condition
Classroom-6									
75	Positive	3.8	5.1	3.8	Baseboard	Tile	D	Intact	Black
77	Positive	3.5	3	3.5	Book Shelf	Wood	C	Intact	Beige
79	Positive	3.2	3.2	3.2	Cabinet Casing	Wood	B	Intact	Beige
78	Positive	2.7	2	2.7	HVAC Unit	Wood	C	Intact	Beige
74	Negative	0.7	0.8	0.7	Wall	Cinder Block	D	Intact	White
73	Negative	0.09	0.5	0.09	Door Casing	Metal	C	Intact	Blue
82	Negative	0.08	0.4	0.08	Ceiling Tile Grid	Metal		Intact	White
81	Negative	0.04	0.4	0.04	Wall Molding	Wood	A	Intact	White
80	Negative	0.03	-0.53	0.03	Projector Screen Holder	Wood	A	Intact	White
72	Negative	0	-0.27	0	Door	Wood	C	Intact	Varnish
Classroom-5									
89	Positive	7	3.3	7	Cabinet Casing	Wood	D	Peeling	Beige
86	Positive	4.3	6.4	4.3	Baseboard	Tile	B	Intact	Black
88	Positive	3.4	4.1	3.4	HVAC Unit	Wood	A	Peeling	Beige
87	Positive	2.8	3.2	2.8	Book Shelf	Wood	A	Peeling	Beige
85	Negative	0.19	0.21	0.19	Wall	Cinder Block	B	Intact	White
84	Negative	0.11	0.6	0.11	Door Casing	Metal	A	Intact	Blue
93	Negative	0.08	0.5	0.08	Ceiling Tile Grid	Metal		Intact	White
90	Negative	0.02	-0.42	0.02	Projector Screen Holder	Wood	C	Intact	White
83	Negative	0.01	-0.04	0.01	Door	Wood	A	Intact	Varnish
92	Negative	0	0.12	0	Wall Molding	Wood	C	Intact	White

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XRF Reading	Lead-mg/cm2				Building Components				
	Results	Pb-L	Pb-K	Pb-C	Component	Substrate	Side	Condition	Color
Classroom-8									
97	Positive	4.8	5.5	4.8	Baseboard	Tile	D	Intact	Black
100	Positive	3.3	2.9	3.3	Cabinet Casing	Wood	B	Intact	Beige
99	Positive	2	1.3	2	HVAC Unit	Wood	C	Intact	Beige
98	Positive	1.9	1.8	1.9	Book Shelf	Wood	C	Intact	Beige
96	Positive	0.8	1.5	1.5	Wall	Cinder Block	D	Intact	White
103	Negative	0.07	0.23	0.07	Wall Molding	Wood	A	Intact	White
95	Negative	0.06	-0.14	0.06	Door Casing	Metal	C	Intact	Blue
104	Negative	0.05	-0.37	0.05	Ceiling Tile Grid	Metal		Intact	White
94	Negative	0.02	-0.16	0.02	Door	Wood	C	Intact	Varnish
106	Negative	0.01	0.27	0.01	Projector Screen Holder	Wood	D	Intact	Beige
102	Negative	0.01	-0.99	0.01	Upper Wall	Wood	A	Intact	White
105	Negative	0	0.1	0	Loudspeaker	Wood	A	Intact	Gray

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XRF Reading	Lead-mg/cm2				Building Components				
	Results	Pb-L	Pb-K	Pb-C	Component	Substrate	Side	Condition	Color
Classroom-7									
110	Positive	3.9	4	3.9	Baseboard	Tile	B	Intact	Black
114	Positive	2.1	2.6	2.1	Cabinet Casing	Wood	D	Peeling	Beige
113	Positive	1.9	2.8	1.9	HVAC Unit	Wood	A	Peeling	Beige
112	Positive	1.6	1.4	1.6	Book Shelf	Wood	A	Peeling	Beige
117	Negative	0.07	0.09	0.07	Ceiling Tile Grid	Metal		Intact	White
118	Negative	0.07	-0.28	0.07	Loudspeaker	Wood	C	Intact	Gray
109	Negative	0.06	0.4	0.06	Wall	Cinder Block	B	Intact	White
108	Negative	0.03	0.8	0.03	Door Casing	Metal	A	Intact	Blue
115	Negative	0.01	0.5	0.01	Upper Wall	Wood	C	Intact	White
119	Negative	0.01	0.14	0.01	Projector Screen Holder	Wood	B	Intact	Beige
116	Negative	0	0.4	0	Wall Molding	Wood	C	Intact	White
107	Negative	0	-0.07	0	Door	Wood	A	Intact	Varnish

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XRF Reading	Lead-mg/cm2				Building Components				
	Results	Pb-L	Pb-K	Pb-C	Component	Substrate	Side	Condition	Color
Classroom-10									
123	Positive	4.1	5.8	4.1	Baseboard	Tile	D	Intact	Black
125	Positive	3.9	3.3	3.9	HVAC Unit	Wood	C	Peeling	Beige
126	Positive	2.8	2.1	2.8	Cabinet Casing	Wood	B	Peeling	Beige
124	Positive	2.6	2.3	2.6	Book Shelf	Wood	C	Intact	Beige
122	Negative	0.7	1.2	0.7	Wall	Cinder Block	D	Intact	White
130	Negative	0.07	0.3	0.07	Ceiling Tile Grid	Metal		Intact	White
121	Negative	0.06	-0.19	0.06	Door Casing	Metal	C	Intact	Blue
129	Negative	0.05	0.17	0.05	Wall Molding	Wood	A	Intact	White
128	Negative	0.03	-0.48	0.03	Upper Wall	Wood	A	Intact	White
132	Negative	0.01	0.5	0.01	Projector Screen Holder	Wood	D	Intact	Beige
120	Negative	0.01	-0.16	0.01	Door	Wood	C	Intact	Varnish
131	Negative	0	-0.26	0	Loudspeaker	Wood	A	Intact	Gray

XRF Reading	Lead-mg/cm2				Building Components				
	Results	Pb-L	Pb-K	Pb-C	Component	Substrate	Side	Condition	Color
Classroom-9									
139	Positive	5.9	5.5	5.5	Cabinet Casing	Wood	D	Peeling	Beige
136	Positive	3.3	5.7	3.3	Baseboard	Tile	B	Intact	Black
137	Positive	3	2.3	3	Book Shelf	Wood	A	Peeling	Beige
138	Positive	2.9	2.5	2.9	HVAC Unit	Wood	A	Peeling	Beige
134	Negative	0.04	0.5	0.04	Door Casing	Metal	C	Intact	Blue
135	Negative	0.03	-0.3	0.03	Wall	Metal	B	Intact	White
142	Negative	0.02	0.17	0.02	Ceiling Tile Grid	Metal		Intact	White
144	Negative	0.01	0.17	0.01	Projector Screen Holder	Wood	B	Intact	Beige
140	Negative	0.01	-0.32	0.01	Upper Wall	Wood	C	Intact	White
133	Negative	0	0.12	0	Door	Wood	C	Intact	Varnish
141	Negative	0	-0.1	0	Wall Molding	Wood	C	Intact	White
143	Negative	0	-0.22	0	Loudspeaker	Wood	C	Intact	Gray
Teachers Lounge									
148	Positive	3.6	5	3.6	Baseboard	Tile	B	Intact	Black
149	Negative	0.15	0.7	0.15	Wall	Cinder Block	D	Intact	Tan
147	Negative	0.11	1	0.11	Wall	Cinder Block	B	Intact	White
146	Negative	0.05	0.4	0.05	Door Casing	Metal	A	Intact	Beige
145	Negative	0	-0.07	0	Door	Wood	A	Intact	Varnish
Teachers Lounge bathroom									
150	Negative	0.17	-0.09	0.17	Door Casing	Metal	B	Intact	Beige
151	Negative	0.12	0.7	0.12	Upper Wall	Cinder Block	B	Intact	Blue
153	Negative	0.02	0.8	0.02	Ceiling	Drywall		Intact	Beige
154	Negative	0.01	0.22	0.01	Cabinet Casing	Wood	A	Intact	Beige
152	Negative	0.01	-0.17	0.01	Lower Wall	Tile	B	Intact	Pink

XRF Reading	Lead-mg/cm2			Building Components					
	Results	Pb-L	Pb-K	Pb-C	Component	Substrate	Side	Condition	Color
Men's Bathroom									
163	Negative	0.08	0.5	0.08	Ceiling	Drywall		Intact	White
158	Negative	0.05	0.9	0.05	Lower Wall	Tile	A	Intact	Gray
156	Negative	0.05	-0.27	0.05	Door Casing	Metal	A	Intact	Blue
157	Negative	0.01	0.6	0.01	Upper Wall	Cinder Block	A	Intact	White
155	Negative	0	0.4	0	Door	Wood	A	Intact	Varnish
159	Negative	0	0.1	0	Heater Unit	Wood	A	Peeling	White
Music Room 33									
173	Negative	0.06	0.5	0.06	Door Casing	Metal	C	Intact	Blue
174	Negative	0.01	-0.46	0.01	Wall	Cinder Block	D	Intact	White
172	Negative	0	0.04	0	Door	Wood	C	Intact	Varnish
175	Negative	0	-0.26	0	Wall	Drywall	C	Intact	White
Hallway-Primary									
176	Negative	0.11	-0.65	0.11	Upper Wall	Cinder Block	A	Intact	White
177	Negative	0.07	-0.39	0.07	Middle Wall	Cinder Block	A	Intact	Blue
178	Negative	0.03	0.09	0.03	Lower Wall	Tile	A	Intact	Pink
Cafeteria									
181	Negative	0.01	-0.3	0.01	Lower Wall	Tile	B	Intact	Gray
179	Negative	0	-0.34	0	Upper Wall	Cinder Block	B	Intact	Blue
180	Negative	0	-0.54	0	Middle Wall	Cinder Block	B	Intact	White
Kitchen									
183	Negative	0.02	-0.14	0.02	Upper Wall	Cinder Block	D	Intact	White
182	Negative	0.02	-0.2	0.02	Door Casing	Metal	B	Intact	Blue
184	Negative	0	-0.87	0	Lower Wall	Tile	D	Intact	Tan

XRF Reading	Lead-mg/cm2			Building Components			Color		
	Results	Pb-L	Pb-K	Pb-C	Component	Substrate		Side	Condition
Auditorium									
186	Negative	0.17	0.12	0.17	Upper Wall	Cinder Block	D	Intact	White
187	Negative	0.17	-0.13	0.17	Lower Wall	Cinder Block	D	Intact	Blue
185	Negative	0.05	0.5	0.05	Door Casing	Metal	D	Intact	Black
Reading Room									
191	Negative	0.07	0.3	0.07	Baseboard	Tile	D	Intact	Gray
190	Negative	0.02	0.13	0.02	Wall	Cinder Block	D	Intact	White
189	Negative	0	0.15	0	Door Casing	Metal	D	Intact	Blue
188	Negative	0	-0.07	0	Door	Wood	D	Intact	Varnish
Clinic									
194	Negative	0.3	0.5	0.3	Wall	Cinder Block	C	Intact	White
193	Negative	0.06	-0.54	0.06	Door Casing	Metal	D	Intact	Blue
192	Negative	0	-0.25	0	Door	Wood	D	Intact	Varnish
Main Office									
199	Positive	4.7	5.9	4.7	Baseboard	Tile	A	Intact	Black
200	Positive	1.9	2.1	1.9	HVAC Unit	Wood	D	Intact	Beige
197	Negative	0.6	0.3	0.6	Wall	Cinder Block	B	Intact	White
198	Negative	0.06	-0.69	0.06	Window Casing	Metal	B	Intact	Beige
196	Negative	0.05	-0.2	-0.2	Door Casing	Metal	D	Intact	Blue
195	Negative	0	0.13	0	Door	Wood	D	Intact	Varnish
Main Office Vault									
201	Negative	0.02	-0.32	0.02	Cabinet Casing	Wood	D	Intact	Beige

XRF Reading	Lead-mg/cm2				Building Components				
	Results	Pb-L	Pb-K	Pb-C	Component	Substrate	Side	Condition	Color
205	Positive	3.6	5.9	3.6	Baseboard	Tile	C	Intact	Black
207	Positive	2.2	1.8	2.2	HVAC Unit	Wood	C	Intact	Beige
204	Negative	0.17	-0.01	0.17	Wall	Cinder Block	C	Intact	White
206	Negative	0.02	0.19	0.02	HVAC Unit	Wood	C	Intact	Beige
203	Negative	0	0.5	0	Door Casing	Metal	C	Intact	Beige
209	Negative	0	-0.01	0	Book Shelf	Wood	C	Intact	Beige
208	Negative	0	-0.03	0	Book Shelf	Wood	C	Intact	Beige
202	Negative	0	-0.13	0	Door	Wood	C	Intact	Varnish
Library									
214	Positive	3.3	2.7	3.3	Book Shelf	Wood	C	Peeling	Beige
216	Positive	2.1	1.7	2.1	HVAC Unit	Wood	C	Peeling	Beige
215	Negative	0.08	0	0.08	HVAC Unit	Wood	C	Peeling	Beige
211	Negative	0.08	-0.41	-0.41	Door Casing	Metal	B	Intact	Blue
213	Negative	0.07	-0.35	0.07	Wall	Cinder Block	C	Intact	Blue
212	Negative	0.03	-0.24	0.03	Wall	Cinder Block	A	Intact	White
210	Negative	0	-0.53	0	Door	Wood	B	Intact	Varnish

XRF Reading	Lead-mg/cm2				Building Components				
	Results	Pb-L	Pb-K	Pb-C	Component	Substrate	Side	Condition	Color
222	Positive	3.6	2.7	3.6	Cabinet Casing	Wood	A	Intact	Beige
219	Positive	3.4	5.4	3.4	Baseboard	Tile	D	Intact	Black
221	Negative	0.8	0.8	0.8	Book Shelf	Wood	A	Intact	Beige
224	Negative	0.16	0.22	0.16	I-Beam	Metal		Intact	White
220	Negative	0.14	0.11	0.14	Book Shelf	Wood	A	Intact	Beige
217	Negative	0.1	0.09	0.1	Door Casing	Metal	D	Intact	Beige
218	Negative	0.06	-0.11	0.06	Wall	Cinder Block	D	Intact	White
223	Negative	0.06	-0.33	0.06	Support Column	Metal	C	Intact	White
Assistant Principals Office									
229	Positive	4.6	5.4	4.6	Baseboard	Tile	D	Intact	Black
225	Negative	0.08	-0.27	0.08	Door Casing	Metal	A	Intact	Beige
226	Negative	0.01	0.01	0.01	Wall	Cinder Block	C	Intact	White
228	Negative	0	0.13	0	Book Shelf	Wood	C	Intact	Beige
227	Negative	0	0.05	0	Book Shelf	Wood	C	Intact	Beige

XRF Reading	Lead-mg/cm2				Building Components				
	Results	Pb-L	Pb-K	Pb-C	Component	Substrate	Side	Condition	Color
Classroom-11									
236	Positive	4.2	4.5	4.2	Cabinet Casing	Wood	B	Intact	Beige
235	Positive	4.1	3.5	4.1	HVAC Unit	Wood	C	Intact	Beige
233	Positive	3.5	3.7	3.5	Baseboard	Tile	D	Intact	Black
232	Positive	2.5	3.4	2.5	Wall	Cinder Block	D	Intact	White
234	Positive	1.6	1.4	1.6	Book Shelf	Wood	C	Intact	Beige
239	Negative	0.25	0.7	0.25	Ceiling Tile Grid	Metal		Intact	White
231	Negative	0.06	-0.87	0.06	Door Casing	Metal	C	Intact	Blue
241	Negative	0.01	-0.35	0.01	Projector Screen Holder	Wood	D	Intact	Beige
238	Negative	0	-0.16	0	Wall Molding	Wood	A	Intact	White
230	Negative	0	-0.33	0	Door	Wood	C	Intact	Varnish
240	Negative	0	-0.5	0	Loudspeaker	Wood	A	Intact	Gray
237	Negative	0	-0.7	0	Upper Wall	Wood	A	Intact	White
Classroom-12									
246	Positive	5.2	3.2	5.2	HVAC Unit	Wood	C	Intact	Beige
247	Positive	3.5	3.7	3.5	Cabinet Casing	Wood	B	Intact	Beige
245	Positive	2	1.7	2	Book Shelf	Cinder Block	C	Intact	Beige
244	Positive	1.3	2.3	2.3	Wall	Cinder Block	D	Intact	White
243	Negative	0.1	-0.48	0.1	Door Casing	Metal	C	Intact	Blue
250	Negative	0.06	0.7	0.06	Ceiling Tile Grid	Metal		Intact	White
242	Negative	0.01	0.01	0.01	Door	Wood	C	Intact	Varnish
249	Negative	0.01	-0.13	0.01	Wall Molding	Wood	A	Intact	White
248	Negative	0.01	-0.72	0.01	Upper Wall	Wood	A	Intact	White
251	Negative	0	-0.34	0	Loudspeaker	Wood	A	Intact	Gray

XRF Reading	Lead-mg/cm2			Building Components					
	Results	Pb-L	Pb-K	Pb-C	Component	Substrate	Side	Condition	Color
Classroom-14									
256	Positive	3.1	5.9	3.1	Baseboard	Tile	D	Intact	Black
258	Positive	2.3	2.6	2.3	HVAC Unit	Wood	C	Intact	Beige
257	Positive	2.3	2	2.3	Book Shelf	Wood	C	Intact	Beige
259	Positive	2.3	2	2.3	Cabinet Casing	Wood	B	Peeling	Beige
255	Negative	0.8	1.2	0.8	Wall	Cinder Block	D	Intact	White
253	Negative	0.4	0.5	0.4	Door Casing	Metal	A	Intact	Blue
262	Negative	0.13	0.7	0.13	Ceiling Tile Grid	Metal		Intact	White
260	Negative	0.07	-0.49	0.07	Upper Wall	Wood	A	Intact	White
263	Negative	0.05	-0.62	0.05	Loudspeaker	Wood	A	Intact	Gray
261	Negative	0.03	-0.27	0.03	Wall Molding	Wood	A	Intact	White
252	Negative	0	-0.23	0	Door	Wood	A	Intact	Varnish
Classroom-15									
267	Positive	3	4	3	Baseboard	Tile	B	Intact	Black
270	Positive	2.3	1.8	2.3	Cabinet Casing	Wood	D	Intact	Beige
269	Positive	2.1	1.5	2.1	HVAC Unit	Wood	A	Intact	Beige
268	Positive	1.4	2.2	1.4	Book Shelf	Wood	A	Intact	Beige
266	Negative	0.4	0.4	0.4	Wall	Cinder Block	B	Intact	White
273	Negative	0.13	0.4	0.13	Ceiling Tile Grid	Metal		Intact	White
271	Negative	0.06	-0.55	0.06	Upper Wall	Wood	C	Intact	White
265	Negative	0.05	-0.38	0.05	Door Casing	Metal	A	Intact	Blue
274	Negative	0.03	-0.12	0.03	Loudspeaker	Wood	C	Intact	Gray
272	Negative	0.01	0.22	0.01	Wall Molding	Wood	C	Intact	White
264	Negative	0.01	0.15	0.01	Door	Wood	A	Intact	Varnish
275	Negative	0.01	-0.01	0.01	Projector Screen Holder	Wood	B	Intact	Beige

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	Results	Pb-L	Pb-K	Pb-C	Component	Substrate	Side	Condition	Color
Classroom-17									
280	Positive	4.6	4.1	4.6	Book Shelf	Wood	A	Intact	Beige
279	Positive	4.2	6	4.2	Baseboard	Tile	B	Intact	Black
282	Positive	3.9	3.6	3.9	HVAC Unit	Wood	A	Intact	Beige
283	Positive	3.5	3.7	3.5	Cabinet Casing	Wood	D	Intact	Beige
278	Negative	0.15	0.13	0.15	Wall	Cinder Block	B	Intact	White
286	Negative	0.11	-0.18	0.11	Ceiling Tile Grid	Metal		Intact	White
277	Negative	0.09	-0.52	0.09	Door Casing	Metal	A	Intact	Blue
288	Negative	0.01	0.3	0.01	Projector Screen Holder	Wood	B	Intact	Beige
285	Negative	0	0.21	0	Wall Molding	Wood	C	Intact	White
287	Negative	0	-0.11	0	Loudspeaker	Wood	C	Intact	Gray
276	Negative	0	-0.28	0	Projector Screen Holder	Wood	A	Intact	Varnish
284	Negative	0	-0.75	0	Upper Wall	Wood	C	Intact	White

XRF Reading	Lead-mg/cm2				Building Components				
	Results	Pb-L	Pb-K	Pb-C	Component	Substrate	Side	Condition	Color
Classroom-20									
291	Positive	4.7	4.4	4.7	Book Shelf	Wood	C	Intact	Beige
294	Positive	3.2	6	3.2	Baseboard	Tile	D	Intact	Black
292	Positive	2.9	2.7	2.9	HVAC Unit	Wood	C	Intact	Beige
295	Positive	2.5	1.9	2.5	Cabinet Casing	Wood	B	Intact	Beige
298	Negative	0.17	-0.17	0.17	Ceiling Tile Grid	Metal		Intact	White
293	Negative	0.11	-0.36	0.11	Wall	Cinder Block	D	Intact	White
300	Negative	0.05	0.09	0.05	Projector Screen Holder	Wood	D	Intact	Beige
296	Negative	0.05	-0.69	0.05	Upper Wall	Wood	A	Intact	White
290	Negative	0.04	-0.12	0.04	Door Casing	Metal	C	Intact	Blue
299	Negative	0.03	-0.26	0.03	Loudspeaker	Wood	A	Intact	Gray
289	Negative	0.02	-0.11	0.02	Door	Wood	C	Intact	Varnish
297	Negative	0.02	-0.54	0.02	Wall Molding	Wood	A	Intact	White
Classroom-19									
307	Positive	4	4.3	4	Cabinet Casing	Wood	D	Peeling	Beige
304	Positive	3.6	4.6	3.6	Baseboard	Tile	B	Intact	Black
306	Positive	3.5	4.9	3.5	HVAC Unit	Wood	A	Peeling	Beige
305	Positive	3	2.6	3	Book Shelf	Wood	A	Peeling	Beige
310	Negative	0.14	-0.15	-0.15	Ceiling Tile Grid	Metal		Intact	White
302	Negative	0.02	-0.22	0.02	Door Casing	Metal	A	Intact	Blue
308	Negative	0.01	-0.99	0.01	Upper Wall	Wood	D	Intact	White
303	Negative	0	0	0	Wall	Cinder Block	B	Intact	White
309	Negative	0	-0.04	0	Wall Molding	Wood	C	Intact	White
301	Negative	0	-0.29	0	Door	Wood	A	Intact	Varnish

XRF Reading	Lead-mg/cm2			Building Components				Color	
	Results	Pb-L	Pb-K	Pb-C	Component	Substrate	Side		Condition
Classroom-22									
315	Positive	5.5	5.2	5.2	Book Shelf	Wood	C	Intact	Beige
316	Positive	4.3	2.9	4.3	HVAC Unit	Wood	C	Intact	Beige
314	Positive	2.7	5.7	2.7	Baseboard	Tile	D	Intact	Black
317	Positive	2.4	2.3	2.4	Cabinet Casing	Wood	B	Intact	Beige
320	Negative	0.5	1.2	0.5	Ceiling Tile Grid	Metal		Intact	White
313	Negative	0.5	0.7	0.5	Wall	Cinder Block	D	Intact	White
312	Negative	0.09	-0.09	-0.09	Door Casing	Metal	C	Intact	Blue
318	Negative	0.08	-0.6	0.08	Upper Wall	Wood	A	Intact	White
321	Negative	0.04	-0.36	0.04	Loudspeaker	Wood	A	Intact	Gray
311	Negative	0	-0.2	0	Door	Wood	C	Intact	Varnish
319	Negative	0	-0.29	0	Wall Molding	Wood	A	Intact	White
Hallway-Upper Class									
323	Negative	0.15	-0.41	-0.41	Door Casing	Metal	B	Intact	Blue
324	Negative	0.13	0.16	0.13	Upper Wall	Cinder Block	A	Intact	White
325	Negative	0.13	-0.15	0.13	Middle Wall	Cinder Block	A	Intact	Blue
322	Negative	0.11	-0.14	-0.14	Door	Wood	B	Intact	Blue
326	Negative	0.01	0.19	0.01	Lower Wall	Tile	A	Intact	Pink

XRF Reading	Lead-mg/cm2			Building Components					
	Results	Pb-L	Pb-K	Pb-C	Component	Substrate	Side	Condition	Color
Additional Wall Samples Of Classroom-1									
6	Negative	0.02	-0.31	0.02	Wall	Plaster	C	Intact	White
5	Negative	0	0.3	0	Wall	Cinder Block	A	Intact	White
7	Negative	0	-0.09	0	Wall	Plaster	D	Intact	White
Additional Wall Samples Of Classroom-2									
8	Positive	0.8	2.2	2.2	Wall	Plaster	A	Intact	White
13	Positive	0.7	2.6	2.6	Wall	Plaster	C	Intact	White
12	Negative	0.12	0.28	0.12	Wall	Plaster	B	Intact	White
Additional Wall Samples Of Classroom-3									
16	Negative	0.3	0.5	0.3	Wall	Cinder Block	C	Intact	White
15	Negative	0.12	0.5	0.12	Wall	Cinder Block	B	Intact	White
14	Negative	0.05	0.4	0.05	Wall	Cinder Block	A	Intact	White
Additional Wall Samples Of Classroom-4									
20	Positive	0.9	1.5	1.5	Wall	Cinder Block	D	Intact	White
19	Negative	0.19	0.18	0.19	Wall	Cinder Block	C	Intact	White
17	Negative	0.17	-0.03	0.17	Wall	Cinder Block	A	Intact	White
Additional Wall Samples Of Classroom-6									
21	Positive	0.9	2.2	2.2	Wall	Cinder Block	A	Intact	White
22	Negative	0.7	1.1	0.7	Wall	Cinder Block	B	Intact	White
25	Negative	0.5	0.8	0.5	Wall	Cinder Block	C	Intact	White

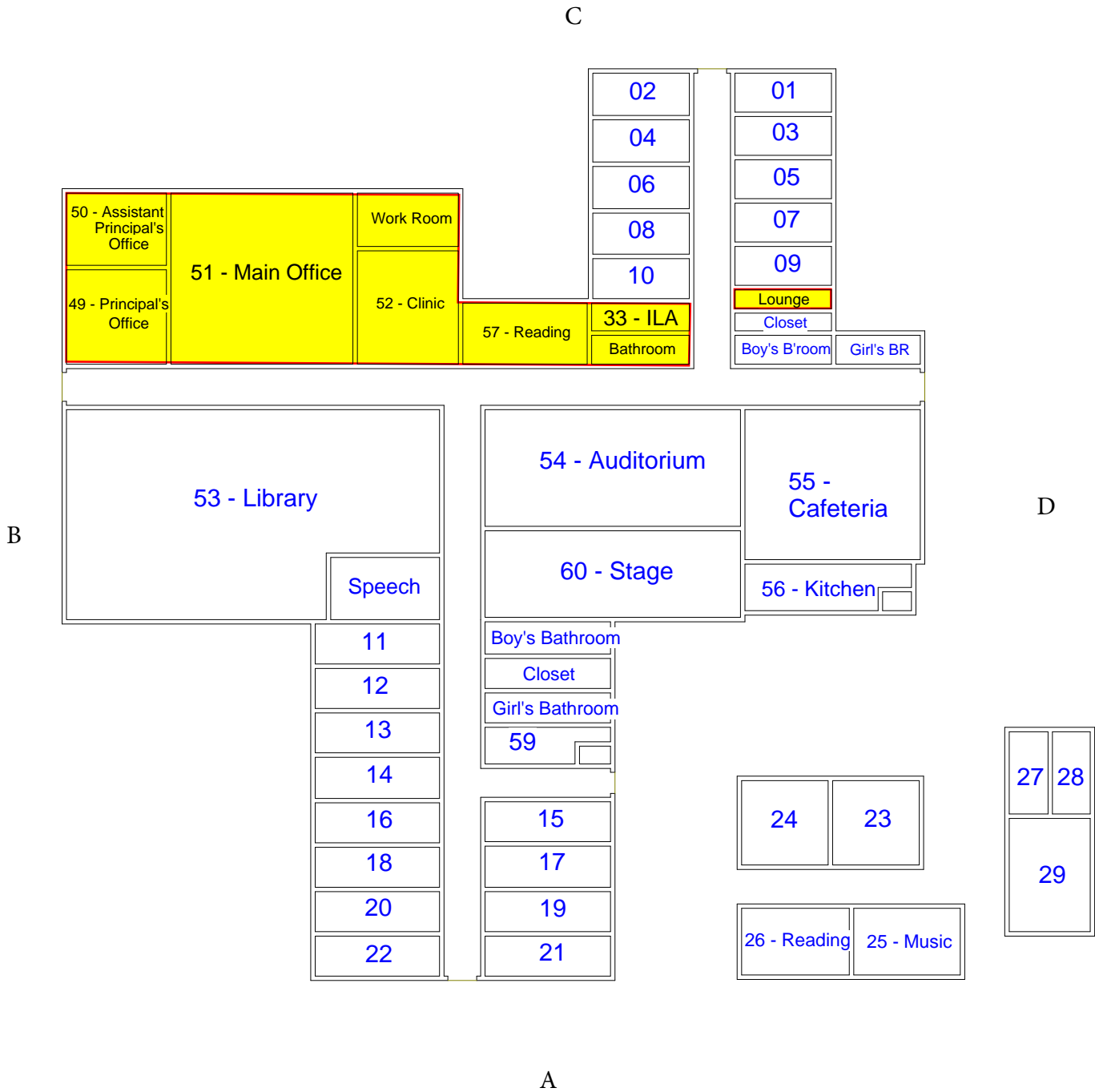
XRF Reading	Lead-mg/cm2			Building Components			Color		
	Results	Pb-L	Pb-K	Pb-C	Component	Substrate		Side	Condition
Additional Wall Samples Of Classroom-5									
30	Positive	0.7	1.5	1.5	Wall	Cinder Block	A	Intact	White
31	Negative	0.7	1.2	0.7	Wall	Cinder Block	B	Intact	White
26	Negative	0.15	0.24	0.15	Wall	Cinder Block	A	Intact	White
28	Negative	0.13	-0.03	0.13	Wall	Cinder Block	D	Intact	White
27	Negative	0.05	0.3	0.05	Wall	Cinder Block	C	Intact	White
Additional Wall Samples Of Classroom-7									
33	Negative	0.17	0.3	0.17	Wall	Cinder Block	C	Intact	White
34	Negative	0.02	0.28	0.02	Wall	Cinder Block	D	Intact	White
32	Negative	0	0.06	0	Wall	Cinder Block	A	Intact	White
Additional Wall Samples Of Classroom-8									
35	Positive	1.3	1.7	1.3	Wall	Cinder Block	A	Intact	White
38	Positive	1.1	2	2	Wall	Cinder Block	B	Intact	White
37	Negative	0.8	1	0.8	Wall	Cinder Block	B	Intact	White
39	Negative	0	-0.2	0	Wall	Cinder Block	C	Intact	White
Additional Wall Samples Of Classroom-9									
42	Negative	0.15	-0.06	-0.06	Wall	Cinder Block	D	Intact	White
40	Negative	0.1	-0.17	0.1	Wall	Cinder Block	A	Intact	White
41	Negative	0.09	0.01	0.09	Wall	Cinder Block	C	Intact	White
Additional Wall Samples Of Teachers Lounge									
43	Negative	0.1	0.3	0.1	Wall	Cinder Block	A	Intact	White
45	Negative	0.08	-0.11	0.08	Wall	Cinder Block	D	Intact	White
44	Negative	0.05	0.09	0.05	Wall	Cinder Block	C	Intact	White

XRF Reading	Lead-mg/cm2			Building Components				Color	
	Results	Pb-L	Pb-K	Pb-C	Component	Substrate	Side		Condition
Additional Wall Samples Of Classroom-33									
46	Negative	0.03	0.1	0.03	Wall	Cinder Block	A	Intact	White
48	Negative	0.01	0.03	0.01	Wall	Cinder Block	B	Intact	White
49	Negative	0.01	0.02	0.01	Wall	Cinder Block	A	Intact	White
51	Negative	0	0.1	0	Wall	Cinder Block	D	Intact	White
50	Negative	0	-0.35	0	Wall	Cinder Block	D	Intact	White
Additional Wall Samples Of Classroom-10									
53	Negative	0.13	0.15	0.15	Wall	Cinder Block	B	Intact	White
54	Negative	0.12	0.4	0.12	Wall	Cinder Block	C	Intact	White
52	Negative	0.08	0.15	0.08	Wall	Cinder Block	A	Intact	White
Additional Wall Samples Of Reading Room									
57	Negative	0.01	-0.14	0.01	Wall	Cinder Block	C	Intact	White
56	Negative	0	0.5	0	Wall	Cinder Block	B	Intact	White
55	Negative	0	-0.05	0	Wall	Cinder Block	A	Intact	White
Additional Wall Samples Of Classroom-11									
58	Positive	1.6	4.1	4.1	Wall	Cinder Block	A	Intact	White
59	Positive	1.6	1.9	1.6	Wall	Cinder Block	B	Intact	White
60	Positive	1.4	2	1.4	Wall	Cinder Block	C	Intact	White
Additional Wall Samples Of Classroom-12									
62	Positive	2.2	2.5	2.2	Wall	Cinder Block	B	Intact	White
61	Positive	1	3	3	Wall	Cinder Block	A	Intact	White
63	Positive	1	1.6	1.6	Wall	Cinder Block	C	Intact	White

XRF Reading	Lead-mg/cm2			Building Components			Color		
	Results	Pb-L	Pb-K	Pb-C	Component	Substrate		Side	Condition
Additional Wall Samples Of Classroom-13									
67	Positive	1.3	1.7	1.3	Wall	Cinder Block	C	Intact	White
64	Positive	0.9	2.6	2.6	Wall	Cinder Block	A	Intact	White
66	Positive	0.9	1.9	1.9	Wall	Cinder Block	B	Intact	White
68	Positive	0.8	1.7	1.7	Wall	Cinder Block	D	Intact	White
Additional Wall Samples Of Classroom-14									
72	Positive	1.2	3.2	3.2	Wall	Cinder Block	B	Intact	White
73	Positive	1.1	2.9	2.9	Wall	Cinder Block	C	Intact	White
74	Positive	1.1	2.6	2.6	Wall	Cinder Block	D	Intact	White
69	Positive	0.8	2.8	2.8	Wall	Cinder Block	A	Intact	White
Additional Wall Samples Of Classroom-16									
75	Positive	0.9	2.1	2.1	Wall	Cinder Block	A	Intact	White
77	Positive	0.9	1.7	1.7	Wall	Cinder Block	C	Intact	White
76	Positive	0.7	1.9	1.9	Wall	Cinder Block	B	Intact	White
78	Positive	0.6	2	2	Wall	Cinder Block	D	Intact	White
Additional Wall Samples Of Classroom-15									
80	Positive	0.5	1.5	1.5	Wall	Cinder Block	C	Intact	White
81	Negative	0.5	1.1	0.5	Wall	Cinder Block	D	Intact	White
79	Negative	0.5	0.8	0.5	Wall	Cinder Block	A	Intact	White
Additional Wall Samples Of Classroom-18									
85	Positive	1	1.8	1.8	Wall	Cinder Block	C	Intact	White
84	Negative	0.8	1.2	0.8	Wall	Cinder Block	B	Intact	White
82	Negative	0.01	0.09	0.01	Wall	Cinder Block	A	Intact	White

XRF Reading	Lead-mg/cm2			Building Components					
	Results	Pb-L	Pb-K	Pb-C	Component	Substrate	Side	Condition	Color
Additional Wall Samples Of Classroom-17									
86	Positive	0.9	1.7	1.7	Wall	Cinder Block	D	Intact	White
88	Negative	0.12	0.3	0.3	Wall	Cinder Block	C	Intact	White
87	Negative	0.05	0.6	0.05	Wall	Cinder Block	D	Intact	White
Additional Wall Samples Of Classroom-20									
91	Negative	0.06	0.26	0.06	Wall	Cinder Block	C	Intact	White
90	Negative	0.05	0.25	0.05	Wall	Cinder Block	B	Intact	White
89	Negative	0.04	0.14	0.04	Wall	Cinder Block	A	Intact	White
Additional Wall Samples Of Classroom-19									
94	Negative	0.19	0.4	0.19	Wall	Cinder Block	D	Intact	White
92	Negative	0.16	0.17	0.17	Wall	Cinder Block	A	Intact	White
93	Negative	0.04	0.19	0.04	Wall	Cinder Block	C	Intact	White
Additional Wall Samples Of Classroom-21									
96	Negative	0.11	0.4	0.11	Wall	Cinder Block	B	Intact	White
98	Negative	0.11	0.28	0.11	Wall	Cinder Block	D	Intact	White
95	Negative	0.07	0.22	0.07	Wall	Cinder Block	A	Intact	White
97	Negative	0.06	0.5	0.06	Wall	Cinder Block	C	Intact	White
Additional Wall Samples Of Classroom-22									
102	Positive	1.3	2.5	2.5	Wall	Cinder Block	B	Intact	White
103	Positive	0.9	2.7	2.7	Wall	Cinder Block	C	Intact	White
99	Positive	0.8	2.3	2.3	Wall	Cinder Block	A	Intact	White

HIGHLIGHTED AREAS REPRESENT APPROXIMATE SCOPE OF WORK ZONE FOR ALTERATIONS AND RENOVATIONS UNDER THE SECURITY VESTIBULE / OFFICE ADDITION PROJECT.



NOT TO SCALE

Yates Elementary School
Newport News, Virginia



NNPS

73 Maxwell Lane Newport News VA
MCS Job No: 16-036X

Marine Chemist Service, Inc.
11850 Tug Boat Lane
Newport News Virginia 23606

Yates Elementary School NN

Reading No	Room Equivalent	Component	Substrate	Side	Condition	Color	Results	PbC	PbL	PbK
1	Shutter-Cal	Start-Up						5.59 ± 0.00	0.98 ± 0.00	0.02 ± 0.00
2	Cal-1						Positive	1.50 ± 0.10	1.50 ± 0.10	1.20 ± 0.40
3	Cal-2						Positive	1.40 ± 0.10	1.40 ± 0.10	0.80 ± 0.40
4	Cal-3						Positive	1.50 ± 0.10	1.50 ± 0.10	1.00 ± 0.40
5	Classroom-1	Door	Wood	A	Intact	Varnish	Negative	0.01 ± 0.04	0.01 ± 0.04	0.06 ± 1.29
6	Classroom-1	Door Casing	Metal	A	Intact	Blue	Negative	0.13 ± 0.18	0.13 ± 0.18	-0.14 ± 2.12
7	Classroom-1	Wall	Cinder Block	B	Intact	White	Negative	0.00 ± 0.02	0.00 ± 0.02	0.15 ± 0.90
8	Classroom-1	Baseboard	Tile	B	Intact	Black	Positive	3.00 ± 1.40	3.00 ± 1.40	5.80 ± 7.10
9	Classroom-1	Book Shelf	Wood	C	Intact	Tan	Positive	1.70 ± 0.30	1.70 ± 0.30	1.70 ± 0.90
10	Classroom-1	HVAC Unit	Wood	C	Intact	Tan	Positive	1.80 ± 0.40	1.80 ± 0.40	1.80 ± 0.90
11	Classroom-1	Cabinet Casing	Wood	D	Intact	Tan	Positive	3.40 ± 1.20	3.40 ± 1.20	3.30 ± 2.60
12	Classroom-1	Loudspeaker	Wood	A	Intact	Gray	Negative	0.07 ± 0.10	0.07 ± 0.10	-0.05 ± 1.58
13	Classroom-1	Wall Molding	Wood	A	Intact	White	Negative	0.06 ± 0.12	0.06 ± 0.12	0.20 ± 1.30
14	Classroom-1	Projector Screen Holder	Wood	A	Intact	White	Negative	0.06 ± 0.07	0.06 ± 0.07	0.50 ± 1.90
15	Classroom-1 Bathroom	Door Casing	Wood	B	Intact	Blue	Negative	0.15 ± 0.27	0.15 ± 0.27	-0.47 ± 2.07
16	Classroom-1 Bathroom	Upper Wall	Cinder Block	B	Intact	White	Negative	0.00 ± 0.02	0.00 ± 0.02	0.04 ± 0.96
17	Classroom-1 Bathroom	Lower Wall	Tile	B	Intact	Pink	Negative	0.04 ± 0.05	0.04 ± 0.05	-0.01 ± 0.94
18	Classroom-1 Bathroom	Ceiling	Plaster		Intact	White	Negative	0.11 ± 0.12	0.11 ± 0.12	-0.09 ± 1.06
19	Classroom-1 Bathroom	Ceiling	Plaster		Intact	White	Negative	0.04 ± 0.09	0.04 ± 0.09	-0.63 ± 1.28
20	Classroom_2	Door	Wood	C	Intact	Varnish	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.01 ± 1.20
21	Classroom_2	Door Casing	Metal	C	Intact	Blue	Negative	-0.18 ± 0.93	0.11 ± 0.08	-0.18 ± 0.93
22	Classroom_2	Wall	Cinder Block	D	Intact	White	Negative	0.60 ± 0.20	0.60 ± 0.20	0.80 ± 0.80
23	Classroom_2	Baseboard	Tile	D	Intact	Black	Positive	3.20 ± 0.80	3.20 ± 0.80	4.30 ± 3.20
24	Classroom_2	Cabinet Casing	Wood	B	Intact	Tan	Negative	0.10 ± 0.11	0.10 ± 0.11	-0.08 ± 1.43
25	Classroom_2	Cabinet Casing	Wood	B	Intact	Tan	Negative	0.09 ± 0.13	0.09 ± 0.13	0.40 ± 1.40
26	Classroom_2	Cabinet Casing	Wood	B	Intact	Tan	Positive	2.40 ± 0.40	2.40 ± 0.40	2.30 ± 0.70
27	Classroom_2	Book Shelf Void	Wood	C	Intact	Tan	Null	0.90 ± 0.10	0.90 ± 0.10	0.80 ± 0.40
28	Classroom_2	Book Shelf	Wood	C	Intact	Tan	Positive	1.90 ± 0.70	1.90 ± 0.70	1.90 ± 1.70
29	Classroom_2	HVAC Unit	Wood	C	Intact	Tan	Positive	1.20 ± 0.20	1.20 ± 0.20	1.30 ± 0.70
30	Classroom_2	Closet Upper Wall	Plaster	A	Intact	White	Negative	0.05 ± 0.14	0.05 ± 0.14	-0.39 ± 1.13
31	Classroom_2	Wall Molding	Wood	A	Intact	White	Negative	0.14 ± 0.20	0.14 ± 0.20	0.26 ± 1.24
32	Classroom_2	Loudspeaker	Wood	A	Intact	Gray	Negative	0.04 ± 0.07	0.04 ± 0.07	-0.32 ± 1.53



NNPS

73 Maxwell Lane Newport News VA
MCS Job No: 16-036X

Marine Chemist Service, Inc.
11850 Tug Boat Lane
Newport News Virginia 23606

Yates Elementary School NN

Reading No	Room Equivalent	Component	Substrate	Side	Condition	Color	Results	PbC	PbL	PbK
33	Classroom_2 Bathroom	Door Casing	Metal	A	Intact	Blue	Negative	0.50 ± 0.40	0.50 ± 0.40	-0.08 ± 2.18
34	Classroom_2 Bathroom	Upper Wall Void	Cinder Block	A	Intact	White	Null	0.70 ± 0.20	0.70 ± 0.20	1.00 ± 0.80
35	Classroom_2 Bathroom	Upper Wall Void	Cinder Block	A	Intact	White	Null	0.60 ± 0.20	0.60 ± 0.20	0.90 ± 0.80
36	Classroom_2 Bathroom	Upper Wall Void	Cinder Block	A	Intact	White	Null	0.90 ± 0.20	0.90 ± 0.20	1.00 ± 0.50
37	Classroom_2 Bathroom	Upper Wall Void	Cinder Block	A	Intact	White	Null	0.70 ± 0.20	0.70 ± 0.20	1.50 ± 0.90
38	Classroom_2 Bathroom	Upper Wall Void	Cinder Block	A	Intact	White	Null	0.80 ± 0.20	0.80 ± 0.20	0.70 ± 0.80
39	Classroom_2 Bathroom	Lower Wall	Tile	A	Intact	Pink	Negative	0.04 ± 0.12	0.04 ± 0.12	0.14 ± 2.43
40	Classroom_2 Bathroom	Ceiling	Drywall		Intact	White	Negative	0.04 ± 0.03	0.04 ± 0.03	0.21 ± 0.62
41	Classroom_2 Bathroom	Upper Wall Void	Cinder Block	A	Intact	White	Null	1.30 ± 0.40	0.60 ± 0.10	1.30 ± 0.40
42	Classroom_2 Bathroom	Upper Wall	Cinder Block	A	Intact	White	Negative	0.60 ± 0.10	0.60 ± 0.10	1.10 ± 0.50
43	Classroom_4	Door	Wood	C	Intact	Varnish	Negative	0.00 ± 0.02	0.00 ± 0.02	0.13 ± 1.22
44	Classroom_4	Door Casing	Metal	C	Intact	Blue	Negative	0.03 ± 0.07	0.03 ± 0.07	-0.06 ± 2.34
45	Classroom_4	Wall	Cinder Block	D	Intact	White	Negative	0.06 ± 0.04	0.06 ± 0.04	0.30 ± 0.88
46	Classroom_4	Baseboard	Tile	D	Intact	Black	Positive	3.70 ± 1.10	3.70 ± 1.10	4.70 ± 3.80
47	Classroom_4	Book Shelf	Wood	C	Intact	Tan	Positive	3.10 ± 1.10	3.10 ± 1.10	2.50 ± 2.00
48	Classroom_4	HVAC Unit	Wood	C	Intact	Tan	Positive	2.60 ± 0.40	2.60 ± 0.40	2.40 ± 0.80
49	Classroom_4	Cabinet Casing Void	Wood	B	Intact	Tan	Null	0.90 ± 0.10	0.90 ± 0.10	1.30 ± 0.50
50	Classroom_4	Cabinet Casing	Wood	B	Intact	Tan	Positive	2.10 ± 0.40	2.10 ± 0.40	2.30 ± 1.10
51	Classroom_4	Upper Wall	Plaster	A	Intact	White	Negative	0.25 ± 0.24	0.25 ± 0.24	0.30 ± 1.39
52	Classroom_4	Wall Molding	Wood	A	Intact	White	Negative	0.03 ± 0.05	0.03 ± 0.05	0.30 ± 1.12
53	Classroom_4	Ceiling Tile Grid	Metal	Intact	Intact	White	Negative	0.09 ± 0.10	0.09 ± 0.10	-0.53 ± 2.39
54	Classroom_4 Bathroom	Door Casing	Metal	A	Intact	Blue	Negative	0.07 ± 0.11	0.07 ± 0.11	-0.33 ± 2.17
55	Classroom_4 Bathroom	Upper Wall	Cinder Block	A	Intact	White	Negative	0.02 ± 0.02	0.02 ± 0.02	0.04 ± 0.62
56	Classroom_4 Bathroom	Lower Wall	Tile	A	Intact	Pink	Negative	0.03 ± 0.08	0.03 ± 0.08	-1.18 ± 2.29
57	Classroom_4 Bathroom	Ceiling	Drywall	Intact	Intact	White	Negative	0.03 ± 0.03	0.03 ± 0.03	0.70 ± 0.70
58	Classroom-3	Door	Wood	A	Intact	Varnish	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.16 ± 1.27
59	Classroom-3	Door Casing	Metal	A	Intact	Blue	Negative	0.02 ± 0.04	0.02 ± 0.04	0.20 ± 2.25
60	Classroom-3	Wall	Cinder Block	B	Intact	White	Negative	0.14 ± 0.12	0.14 ± 0.12	0.40 ± 0.90
61	Classroom-3	Book Shelf	Wood	A	Intact	Beige	Positive	3.00 ± 1.00	3.00 ± 1.00	3.90 ± 2.10
62	Classroom-3	HVAC Unit	Wood	A	Intact	Beige	Positive	2.70 ± 0.90	2.70 ± 0.90	2.70 ± 2.10
63	Classroom-3	Cabinet Casing Void	Wood	D	Intact	Beige	Null	1.70 ± 2.20	1.70 ± 2.20	1.50 ± 5.30
64	Classroom-3	Cabinet Casing	Wood	D	Intact	Beige	Positive	2.20 ± 0.90	2.20 ± 0.90	1.50 ± 1.70



NNPS

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Reading No	Room Equivalent	Component	Substrate	Side	Condition	Color	Results	PbC	PbL	PbK
65	Classroom-3	Projector Screen Holder	Wood	C	Intact	White	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.49 ± 1.18
66	Classroom-3	Wall Molding	Wood	C	Intact	White	Negative	0.20 ± 0.28	0.20 ± 0.28	-0.20 ± 2.66
67	Classroom-3	Ceiling Tile Grid	Metal		Intact	White	Negative	0.10 ± 0.14	0.10 ± 0.14	0.60 ± 2.70
68	Classroom-3 Bathroom	Door Casing	Metal	C	Intact	Blue	Negative	0.07 ± 0.08	0.07 ± 0.08	0.50 ± 2.20
69	Classroom-3 Bathroom	Upper Wall	Cinder Block	C	Intact	White	Negative	0.22 ± 0.15	0.22 ± 0.15	0.22 ± 0.86
70	Classroom-3 Bathroom	Lower Wall	Tile	C	Intact	Pink	Negative	0.02 ± 0.08	0.02 ± 0.08	0.23 ± 2.58
71	Classroom-3 Bathroom	Ceiling	Drywall		Intact	White	Negative	0.04 ± 0.03	0.04 ± 0.03	0.40 ± 0.80
72	Classroom-6	Door	Wood	C	Intact	Varnish	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.27 ± 1.21
73	Classroom-6	Door Casing	Metal	C	Intact	Blue	Negative	0.09 ± 0.14	0.09 ± 0.14	0.50 ± 2.20
74	Classroom-6	Wall	Cinder Block	D	Intact	White	Negative	0.70 ± 0.10	0.70 ± 0.10	0.80 ± 0.60
75	Classroom-6	Baseboard	Tile	D	Intact	Black	Positive	3.80 ± 2.50	3.80 ± 2.50	5.10 ± 9.80
76	Classroom-6	Book Shelf Void	Wood	C	Intact	Beige	Null	2.50 ± 2.30	2.50 ± 2.30	2.20 ± 6.30
77	Classroom-6	Book Shelf	Wood	C	Intact	Beige	Positive	3.50 ± 1.20	3.50 ± 1.20	3.00 ± 2.30
78	Classroom-6	HVAC Unit	Wood	C	Intact	Beige	Positive	2.70 ± 1.00	2.70 ± 1.00	2.00 ± 2.10
79	Classroom-6	Cabinet Casing	Wood	B	Intact	Beige	Positive	3.20 ± 1.20	3.20 ± 1.20	3.20 ± 2.90
80	Classroom-6	Projector Screen Holder	Wood	A	Intact	White	Negative	0.03 ± 0.08	0.03 ± 0.08	-0.53 ± 1.25
81	Classroom-6	Wall Molding	Wood	A	Intact	White	Negative	0.04 ± 0.09	0.04 ± 0.09	0.40 ± 1.40
82	Classroom-6	Ceiling Tile Grid	Metal		Intact	White	Negative	0.08 ± 0.14	0.08 ± 0.14	0.40 ± 2.60
83	Classroom-5	Door	Wood	A	Intact	Varnish	Negative	0.01 ± 0.03	0.01 ± 0.03	-0.04 ± 1.42
84	Classroom-5	Door Casing	Metal	A	Intact	Blue	Negative	0.11 ± 0.19	0.11 ± 0.19	0.60 ± 2.80
85	Classroom-5	Wall	Cinder Block	B	Intact	White	Negative	0.19 ± 0.14	0.19 ± 0.14	0.21 ± 0.86
86	Classroom-5	Baseboard	Tile	B	Intact	Black	Positive	4.30 ± 1.30	4.30 ± 1.30	6.40 ± 3.90
87	Classroom-5	Book Shelf	Wood	A	Peeling	Beige	Positive	2.80 ± 1.10	2.80 ± 1.10	3.20 ± 2.50
88	Classroom-5	HVAC Unit	Wood	A	Peeling	Beige	Positive	3.40 ± 1.30	3.40 ± 1.30	4.10 ± 2.80
89	Classroom-5	Cabinet Casing	Wood	D	Peeling	Beige	Positive	7.00 ± 5.20	7.00 ± 5.20	3.30 ± 4.80
90	Classroom-5	Projector Screen Holder	Wood	C	Intact	White	Negative	0.02 ± 0.06	0.02 ± 0.06	-0.42 ± 1.23
91	Classroom-5	Wall Molding Void	Wood	C	Intact	White	Null	0.30 ± 1.03	0.30 ± 1.03	0.80 ± 3.90
92	Classroom-5	Wall Molding	Wood	C	Intact	White	Negative	0.00 ± 0.02	0.00 ± 0.02	0.12 ± 1.43
93	Classroom-5	Ceiling Tile Grid	Metal		Intact	White	Negative	0.08 ± 0.13	0.08 ± 0.13	0.50 ± 2.60
94	Classroom-8	Door	Wood	C	Intact	Varnish	Negative	0.02 ± 0.09	0.02 ± 0.09	-0.16 ± 1.15
95	Classroom-8	Door Casing	Metal	C	Intact	Blue	Negative	0.06 ± 0.11	0.06 ± 0.11	-0.14 ± 2.16
96	Classroom-8	Wall	Cinder Block	D	Intact	White	Positive	1.50 ± 0.50	0.80 ± 0.10	1.50 ± 0.50



Yates Elementary School NN

Reading No	Room Equivalent	Component	Substrate	Side	Condition	Color	Results	PbC	PbL	PbK
97	Classroom-8	Baseboard	Tile	D	Intact	Black	Positive	4.80 ± 1.40	4.80 ± 1.40	5.50 ± 4.00
98	Classroom-8	Book Shelf	Wood	C	Intact	Beige	Positive	1.90 ± 0.50	1.90 ± 0.50	1.80 ± 1.00
99	Classroom-8	HVAC Unit	Wood	C	Intact	Beige	Positive	2.00 ± 0.70	2.00 ± 0.70	1.30 ± 1.60
100	Classroom-8	Cabinet Casing	Wood	B	Intact	Beige	Positive	3.30 ± 1.10	3.30 ± 1.10	2.90 ± 2.20
101	Classroom-8	Upper Wall Void	Wood	A	Intact	White	Null	0.00 ± 0.05	0.00 ± 0.05	-0.35 ± 3.51
102	Classroom-8	Upper Wall	Wood	A	Intact	White	Negative	0.01 ± 0.03	0.01 ± 0.03	-0.99 ± 1.38
103	Classroom-8	Wall Molding	Wood	A	Intact	White	Negative	0.07 ± 0.22	0.07 ± 0.22	0.23 ± 1.43
104	Classroom-8	Ceiling Tile Grid	Metal	Intact	Intact	White	Negative	0.05 ± 0.09	0.05 ± 0.09	-0.37 ± 2.43
105	Classroom-8	Loudspeaker	Wood	A	Intact	Gray	Negative	0.00 ± 0.02	0.00 ± 0.02	0.10 ± 1.57
106	Classroom-8	Projector Screen Holder	Wood	D	Intact	Beige	Negative	0.01 ± 0.03	0.01 ± 0.03	0.27 ± 1.29
107	Classroom-7	Door	Wood	A	Intact	Varnish	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.07 ± 1.44
108	Classroom-7	Door Casing	Metal	A	Intact	Blue	Negative	0.03 ± 0.05	0.03 ± 0.05	0.80 ± 2.20
109	Classroom-7	Wall	Cinder Block	B	Intact	White	Negative	0.06 ± 0.07	0.06 ± 0.07	0.40 ± 0.90
110	Classroom-7	Baseboard	Tile	B	Intact	Black	Positive	3.90 ± 1.20	3.90 ± 1.20	4.00 ± 3.90
111	Classroom-7	Book Shelf Void	Wood	A	Peeling	Beige	Null	1.60 ± 0.60	1.60 ± 0.60	2.30 ± 1.80
112	Classroom-7	Book Shelf	Wood	A	Peeling	Beige	Positive	1.60 ± 0.50	1.60 ± 0.50	1.40 ± 1.40
113	Classroom-7	HVAC Unit	Wood	A	Peeling	Beige	Positive	1.90 ± 0.60	1.90 ± 0.60	2.80 ± 2.20
114	Classroom-7	Cabinet Casing	Wood	D	Peeling	Beige	Positive	2.10 ± 0.70	2.10 ± 0.70	2.60 ± 1.90
115	Classroom-7	Upper Wall	Wood	C	Intact	White	Negative	0.01 ± 0.04	0.01 ± 0.04	0.50 ± 1.20
116	Classroom-7	Wall Molding	Wood	C	Intact	White	Negative	0.00 ± 0.02	0.00 ± 0.02	0.40 ± 1.40
117	Classroom-7	Ceiling Tile Grid	Metal	Intact	Intact	White	Negative	0.07 ± 0.12	0.07 ± 0.12	0.09 ± 2.20
118	Classroom-7	Loudspeaker	Wood	C	Intact	Gray	Negative	0.07 ± 0.11	0.07 ± 0.11	-0.28 ± 1.45
119	Classroom-7	Projector Screen Holder	Wood	B	Intact	Beige	Negative	0.01 ± 0.03	0.01 ± 0.03	0.14 ± 1.29
120	Classroom-10	Door	Wood	C	Intact	Varnish	Negative	0.01 ± 0.03	0.01 ± 0.03	-0.16 ± 1.29
121	Classroom-10	Door Casing	Metal	C	Intact	Blue	Negative	0.06 ± 0.10	0.06 ± 0.10	-0.19 ± 2.23
122	Classroom-10	Wall	Cinder Block	D	Intact	White	Negative	0.70 ± 0.10	0.70 ± 0.10	1.20 ± 0.50
123	Classroom-10	Baseboard	Tile	D	Intact	Black	Positive	4.10 ± 1.20	4.10 ± 1.20	5.80 ± 4.20
124	Classroom-10	Book Shelf	Wood	C	Intact	Beige	Positive	2.60 ± 0.90	2.60 ± 0.90	2.30 ± 2.00
125	Classroom-10	HVAC Unit	Wood	C	Peeling	Beige	Positive	3.90 ± 1.50	3.90 ± 1.50	3.30 ± 2.40
126	Classroom-10	Cabinet Casing	Wood	B	Peeling	Beige	Positive	2.80 ± 1.10	2.80 ± 1.10	2.10 ± 2.40
127	Classroom-10	Upper Wall Void	Wood	A	Intact	White	Null	0.00 ± 0.05	0.00 ± 0.05	-0.12 ± 2.87
128	Classroom-10	Upper Wall	Wood	A	Intact	White	Negative	0.03 ± 0.12	0.03 ± 0.12	-0.48 ± 1.21



NNPS

73 Maxwell Lane Newport News VA
MCS Job No: 16-036X

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11850 Tug Boat Lane
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Yates Elementary School NN

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129	Classroom-10	Wall Molding	Wood	A	Intact	White	Negative	0.05 ± 0.16	0.05 ± 0.16	0.17 ± 1.10
130	Classroom-10	Ceiling Tile Grid	Metal		Intact	White	Negative	0.07 ± 0.14	0.07 ± 0.14	0.30 ± 2.51
131	Classroom-10	Loudspeaker	Wood	A	Intact	Gray	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.26 ± 1.44
132	Classroom-10	Projector Screen Holder	Wood	D	Intact	Beige	Negative	0.01 ± 0.03	0.01 ± 0.03	0.50 ± 1.30
133	Classroom-9	Door	Wood	C	Intact	Varnish	Negative	0.00 ± 0.02	0.00 ± 0.02	0.12 ± 1.51
134	Classroom-9	Door Casing	Metal	C	Intact	Blue	Negative	0.04 ± 0.08	0.04 ± 0.08	0.50 ± 2.40
135	Classroom-9	Wall	Metal	B	Intact	White	Negative	0.03 ± 0.04	0.03 ± 0.04	-0.30 ± 0.99
136	Classroom-9	Baseboard	Tile	B	Intact	Black	Positive	3.30 ± 1.00	3.30 ± 1.00	5.70 ± 3.90
137	Classroom-9	Book Shelf	Wood	A	Peeling	Beige	Positive	3.00 ± 1.20	3.00 ± 1.20	2.30 ± 2.40
138	Classroom-9	HVAC Unit	Wood	A	Peeling	Beige	Positive	2.90 ± 0.20	2.90 ± 0.20	2.50 ± 0.40
139	Classroom-9	Cabinet Casing	Wood	D	Peeling	Beige	Positive	5.50 ± 2.60	5.90 ± 1.80	5.50 ± 2.60
140	Classroom-9	Upper Wall	Wood	C	Intact	White	Negative	0.01 ± 0.02	0.01 ± 0.02	-0.32 ± 0.36
141	Classroom-9	Wall Molding	Wood	C	Intact	White	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.10 ± 1.30
142	Classroom-9	Ceiling Tile Grid	Metal		Intact	White	Negative	0.02 ± 0.04	0.02 ± 0.04	0.17 ± 2.19
143	Classroom-9	Loudspeaker	Wood	C	Intact	Gray	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.22 ± 1.19
144	Classroom-9	Projector Screen Holder	Wood	B	Intact	Beige	Negative	0.01 ± 0.02	0.01 ± 0.02	0.17 ± 0.31
145	Teachers Lounge	Door	Wood	A	Intact	Varnish	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.07 ± 1.35
146	Teachers Lounge	Door Casing	Metal	A	Intact	Beige	Negative	0.05 ± 0.07	0.05 ± 0.07	0.40 ± 2.70
147	Teachers Lounge	Wall	Cinder Block	B	Intact	White	Negative	0.11 ± 0.06	0.11 ± 0.06	1.00 ± 0.60
148	Teachers Lounge	Baseboard	Tile	B	Intact	Black	Positive	3.60 ± 1.00	3.60 ± 1.00	5.00 ± 3.50
149	Teachers Lounge	Wall	Cinder Block	D	Intact	Tan	Negative	0.15 ± 0.12	0.15 ± 0.12	0.70 ± 0.90
150	Teachers Lounge bathroom	Door Casing	Metal	B	Intact	Beige	Negative	0.17 ± 0.19	0.17 ± 0.19	-0.09 ± 1.94
151	Teachers Lounge bathroom	Upper Wall	Cinder Block	B	Intact	Blue	Negative	0.12 ± 0.09	0.12 ± 0.09	0.70 ± 0.70
152	Teachers Lounge bathroom	Lower Wall	Tile	B	Intact	Pink	Negative	0.01 ± 0.05	0.01 ± 0.05	-0.17 ± 2.53
153	Teachers Lounge bathroom	Ceiling	Drywall		Intact	Beige	Negative	0.02 ± 0.02	0.02 ± 0.02	0.80 ± 0.70
154	Teachers Lounge bathroom	Cabinet Casing	Wood	A	Intact	Beige	Negative	0.01 ± 0.04	0.01 ± 0.04	0.22 ± 1.11
155	Mens Bathroom	Door	Wood	A	Intact	Varnish	Negative	0.00 ± 0.02	0.00 ± 0.02	0.40 ± 1.20
156	Mens Bathroom	Door Casing	Metal	A	Intact	Blue	Negative	0.05 ± 0.07	0.05 ± 0.07	-0.27 ± 2.13
157	Mens Bathroom	Upper Wall	Cinder Block	A	Intact	White	Negative	0.01 ± 0.02	0.01 ± 0.02	0.60 ± 0.80
158	Mens Bathroom	Lower Wall	Tile	A	Intact	Gray	Negative	0.05 ± 0.16	0.05 ± 0.16	0.90 ± 2.80
159	Mens Bathroom	Heater Unit	Wood	A	Peeling	White	Negative	0.00 ± 0.02	0.00 ± 0.02	0.10 ± 1.12
160	Mens Bathroom	Ceiling Void	Drywall		Intact	White	Null	0.04 ± 0.08	0.04 ± 0.08	0.90 ± 2.00



NNPS

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161	Mens Bathroom	Ceiling Void	Drywall		Intact	White	Null	0.02 ± 0.07	0.02 ± 0.07	0.60 ± 3.40
162	Mens Bathroom	Ceiling Void	Drywall		Intact	White	Null	0.03 ± 0.05	0.03 ± 0.05	0.11 ± 1.80
163	Mens Bathroom	Ceiling	Drywall		Intact	White	Negative	0.08 ± 0.06	0.08 ± 0.06	0.50 ± 0.90
164	Cal-4						Positive	1.50 ± 0.10	1.50 ± 0.10	1.50 ± 0.40
165	Cal-5						Positive	1.40 ± 0.10	1.40 ± 0.10	1.60 ± 0.40
166	Cal-6						Positive	1.40 ± 0.10	1.40 ± 0.10	1.70 ± 0.40
167	Shutter-Cal	Shut-Down						5.66 ± 0.00	0.83 ± 0.00	0.01 ± 0.00
168	Shutter-Cal	Start-Up						6.13 ± 0.00	0.80 ± 0.00	0.00 ± 0.00
169	Cal-1						Positive	1.50 ± 0.10	1.50 ± 0.10	1.10 ± 0.40
170	Cal-2						Positive	1.40 ± 0.10	1.40 ± 0.10	1.20 ± 0.40
171	Cal-3						Positive	1.50 ± 0.10	1.50 ± 0.10	1.30 ± 0.40
172	Music Room 33	Door	Wood	C	Intact	Varnish	Negative	0.00 ± 0.02	0.00 ± 0.02	0.04 ± 1.29
173	Music Room 33	Door Casing	Metal	C	Intact	Blue	Negative	0.06 ± 0.09	0.06 ± 0.09	0.50 ± 2.40
174	Music Room 33	Wall	Cinder Block	D	Intact	White	Negative	0.01 ± 0.03	0.01 ± 0.03	-0.46 ± 1.70
175	Music Room 33	Wall	Drywall	C	Intact	White	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.26 ± 1.36
176	Hallway-Primary	Upper Wall	Cinder Block	A	Intact	White	Negative	0.11 ± 0.11	0.11 ± 0.11	-0.65 ± 1.10
177	Hallway-Primary	Middle Wall	Cinder Block	A	Intact	Blue	Negative	0.07 ± 0.10	0.07 ± 0.10	-0.39 ± 0.93
178	Hallway-Primary	Lower Wall	Tile	A	Intact	Pink	Negative	0.03 ± 0.03	0.03 ± 0.03	0.09 ± 0.90
179	Cafeteria	Upper Wall	Cinder Block	B	Intact	Blue	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.34 ± 0.88
180	Cafeteria	Middle Wall	Cinder Block	B	Intact	White	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.54 ± 1.06
181	Cafeteria	Lower Wall	Tile	B	Intact	Gray	Negative	0.01 ± 0.03	0.01 ± 0.03	-0.30 ± 1.08
182	Kitchen	Door Casing	Metal	B	Intact	Blue	Negative	0.02 ± 0.04	0.02 ± 0.04	-0.20 ± 2.33
183	Kitchen	Upper Wall	Cinder Block	D	Intact	White	Negative	0.02 ± 0.03	0.02 ± 0.03	-0.14 ± 0.95
184	Kitchen	Lower Wall	Tile	D	Intact	Tan	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.87 ± 1.29
185	Auditorium	Door Casing	Metal	D	Intact	Black	Negative	0.05 ± 0.14	0.05 ± 0.14	0.50 ± 2.50
186	Auditorium	Upper Wall	Cinder Block	D	Intact	White	Negative	0.17 ± 0.14	0.17 ± 0.14	0.12 ± 0.95
187	Auditorium	Lower Wall	Cinder Block	D	Intact	Blue	Negative	0.17 ± 0.17	0.17 ± 0.17	-0.13 ± 1.04
188	Reading Room	Door	Wood	D	Intact	Varnish	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.07 ± 1.49
189	Reading Room	Door Casing	Metal	D	Intact	Blue	Negative	0.00 ± 0.02	0.00 ± 0.02	0.15 ± 2.24
190	Reading Room	Wall	Cinder Block	D	Intact	White	Negative	0.02 ± 0.03	0.02 ± 0.03	0.13 ± 0.94
191	Reading Room	Baseboard	Tile	D	Intact	Gray	Negative	0.07 ± 0.12	0.07 ± 0.12	0.30 ± 0.85
192	Clinic	Door	Wood	D	Intact	Varnish	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.25 ± 1.26



Yates Elementary School NN

Reading No	Room Equivalent	Component	Substrate	Side	Condition	Color	Results	PbC	PbL	PbK
193	Clinic	Door Casing	Metal	D	Intact	Blue	Negative	0.06 ± 0.08	0.06 ± 0.08	-0.54 ± 2.22
194	Clinic	Wall	Cinder Block	C	Intact	White	Negative	0.30 ± 0.15	0.30 ± 0.15	0.50 ± 0.90
195	Main Office	Door	Wood	D	Intact	Varnish	Negative	0.00 ± 0.02	0.00 ± 0.02	0.13 ± 1.82
196	Main Office	Door Casing	Metal	D	Intact	Blue	Negative	-0.20 ± 0.89	0.05 ± 0.05	-0.20 ± 0.89
197	Main Office	Wall	Cinder Block	B	Intact	White	Negative	0.60 ± 0.30	0.60 ± 0.30	0.30 ± 0.92
198	Main Office	Window Casing	Metal	B	Intact	Beige	Negative	0.06 ± 0.09	0.06 ± 0.09	-0.69 ± 2.06
199	Main Office	Baseboard	Tile	A	Intact	Black	Positive	4.70 ± 1.40	4.70 ± 1.40	5.90 ± 4.40
200	Main Office	HVAC Unit	Wood	D	Intact	Beige	Positive	1.90 ± 0.30	1.90 ± 0.30	2.10 ± 0.80
201	Main Office Vault	Cabinet Casing	Wood	D	Intact	Beige	Negative	0.02 ± 0.05	0.02 ± 0.05	-0.32 ± 1.35
202	Conference Room	Door	Wood	C	Intact	Varnish	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.13 ± 1.53
203	Conference Room	Door Casing	Metal	C	Intact	Beige	Negative	0.00 ± 0.02	0.00 ± 0.02	0.50 ± 2.50
204	Conference Room	Wall	Cinder Block	C	Intact	White	Negative	0.17 ± 0.06	0.17 ± 0.06	-0.01 ± 1.04
205	Conference Room	Baseboard	Tile	C	Intact	Black	Positive	3.60 ± 1.70	3.60 ± 1.70	5.90 ± 6.40
206	Conference Room	HVAC Unit	Wood	C	Intact	Beige	Negative	0.02 ± 0.08	0.02 ± 0.08	0.19 ± 1.24
207	Conference Room	HVAC Unit	Wood	C	Intact	Beige	Positive	2.20 ± 0.90	2.20 ± 0.90	1.80 ± 2.00
208	Conference Room	Book Shelf	Wood	C	Intact	Beige	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.03 ± 1.14
209	Conference Room	Book Shelf	Wood	C	Intact	Beige	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.01 ± 1.19
210	Library	Door	Wood	B	Intact	Varnish	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.53 ± 1.32
211	Library	Door Casing	Metal	B	Intact	Blue	Negative	-0.41 ± 0.94	0.08 ± 0.07	-0.41 ± 0.94
212	Library	Wall	Cinder Block	A	Intact	White	Negative	0.03 ± 0.04	0.03 ± 0.04	-0.24 ± 1.00
213	Library	Wall	Cinder Block	C	Intact	Blue	Negative	0.07 ± 0.14	0.07 ± 0.14	-0.35 ± 1.80
214	Library	Book Shelf	Wood	C	Peeling	Beige	Positive	3.30 ± 1.30	3.30 ± 1.30	2.70 ± 2.70
215	Library	HVAC Unit	Wood	C	Peeling	Beige	Negative	0.08 ± 0.15	0.08 ± 0.15	-0.00 ± 1.33
216	Library	HVAC Unit	Wood	C	Peeling	Beige	Positive	2.10 ± 0.90	2.10 ± 0.90	1.70 ± 2.10
217	Speech Room	Door Casing	Metal	D	Intact	Beige	Negative	0.10 ± 0.12	0.10 ± 0.12	0.09 ± 2.79
218	Speech Room	Wall	Cinder Block	D	Intact	White	Negative	0.06 ± 0.04	0.06 ± 0.04	-0.11 ± 0.97
219	Speech Room	Baseboard	Tile	D	Intact	Black	Positive	3.40 ± 1.00	3.40 ± 1.00	5.40 ± 4.00
220	Speech Room	Book Shelf	Wood	A	Intact	Beige	Negative	0.14 ± 0.15	0.14 ± 0.15	0.11 ± 1.40
221	Speech Room	Book Shelf	Wood	A	Intact	Beige	Negative	0.80 ± 0.10	0.80 ± 0.10	0.80 ± 0.50
222	Speech Room	Cabinet Casing	Wood	A	Intact	Beige	Positive	3.60 ± 1.20	3.60 ± 1.20	2.70 ± 2.80
223	Speech Room	Support Column	Metal	C	Intact	White	Negative	0.06 ± 0.10	0.06 ± 0.10	-0.33 ± 2.41
224	Speech Room	L-Beam	Metal		Intact	White	Negative	0.16 ± 0.14	0.16 ± 0.14	0.22 ± 2.92



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225	Assistant Principals Office	Door Casing	Metal	A	Intact	Beige	Negative	0.08 ± 0.14	0.08 ± 0.14	-0.27 ± 2.06
226	Assistant Principals Office	Wall	Cinder Block	C	Intact	White	Negative	0.01 ± 0.02	0.01 ± 0.02	0.01 ± 1.01
227	Assistant Principals Office	Book Shelf	Wood	C	Intact	Beige	Negative	0.00 ± 0.02	0.00 ± 0.02	0.05 ± 1.44
228	Assistant Principals Office	Book Shelf	Wood	C	Intact	Beige	Negative	0.00 ± 0.02	0.00 ± 0.02	0.13 ± 1.27
229	Assistant Principals Office	Baseboard	Tile	D	Intact	Black	Positive	4.60 ± 2.20	4.60 ± 2.20	5.40 ± 6.70
230	Classroom-11	Door	Wood	C	Intact	Varnish	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.33 ± 1.69
231	Classroom-11	Door Casing	Metal	C	Intact	Blue	Negative	0.06 ± 0.12	0.06 ± 0.12	-0.87 ± 2.74
232	Classroom-11	Wall	Cinder Block	D	Intact	White	Positive	2.50 ± 1.20	2.50 ± 1.20	3.40 ± 2.60
233	Classroom-11	Baseboard	Tile	D	Intact	Black	Positive	3.50 ± 1.80	3.50 ± 1.80	3.70 ± 6.40
234	Classroom-11	Book Shelf	Wood	C	Intact	Beige	Positive	1.60 ± 0.30	1.60 ± 0.30	1.40 ± 0.90
235	Classroom-11	HVAC Unit	Wood	C	Intact	Beige	Positive	4.10 ± 1.80	4.10 ± 1.80	3.50 ± 3.00
236	Classroom-11	Cabinet Casing	Wood	B	Intact	Beige	Positive	4.20 ± 1.90	4.20 ± 1.90	4.50 ± 3.40
237	Classroom-11	Upper Wall	Wood	A	Intact	White	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.70 ± 1.22
238	Classroom-11	Wall Molding	Wood	A	Intact	White	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.16 ± 1.45
239	Classroom-11	Ceiling Tile Grid	Metal	Intact	Intact	White	Negative	0.25 ± 0.26	0.25 ± 0.26	0.70 ± 2.10
240	Classroom-11	Loudspeaker	Wood	A	Intact	Gray	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.50 ± 1.49
241	Classroom-11	Projector Screen Holder	Wood	D	Intact	Beige	Negative	0.01 ± 0.04	0.01 ± 0.04	-0.35 ± 2.29
242	Classroom-12	Door	Wood	C	Intact	Varnish	Negative	0.01 ± 0.05	0.01 ± 0.05	0.01 ± 1.41
243	Classroom-12	Door Casing	Metal	C	Intact	Blue	Negative	0.10 ± 0.16	0.10 ± 0.16	-0.48 ± 2.44
244	Classroom-12	Wall	Cinder Block	D	Intact	White	Positive	2.30 ± 1.10	1.30 ± 0.30	2.30 ± 1.10
245	Classroom-12	Book Shelf	Cinder Block	C	Intact	Beige	Positive	2.00 ± 0.80	2.00 ± 0.80	1.70 ± 1.90
246	Classroom-12	HVAC Unit	Wood	C	Intact	Beige	Positive	5.20 ± 2.40	5.20 ± 2.40	3.20 ± 3.00
247	Classroom-12	Cabinet Casing	Wood	B	Intact	Beige	Positive	3.50 ± 1.50	3.50 ± 1.50	3.70 ± 3.00
248	Classroom-12	Upper Wall	Wood	A	Intact	White	Negative	0.01 ± 0.04	0.01 ± 0.04	-0.72 ± 1.54
249	Classroom-12	Wall Molding	Wood	A	Intact	White	Negative	0.01 ± 0.02	0.01 ± 0.02	-0.13 ± 1.36
250	Classroom-12	Ceiling Tile Grid	Metal	Intact	Intact	White	Negative	0.06 ± 0.13	0.06 ± 0.13	0.70 ± 2.80
251	Classroom-12	Loudspeaker	Wood	A	Intact	Gray	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.34 ± 1.42
252	Classroom-14	Door	Wood	A	Intact	Varnish	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.23 ± 1.47
253	Classroom-14	Door Casing	Metal	A	Intact	Blue	Negative	0.40 ± 0.20	0.40 ± 0.20	0.50 ± 2.80
254	Classroom-14	Wall Void	Cinder Block	D	Intact	White	Null	1.30 ± 0.50	0.70 ± 0.10	1.30 ± 0.50
255	Classroom-14	Wall	Cinder Block	D	Intact	White	Negative	0.80 ± 0.10	0.80 ± 0.10	1.20 ± 0.50
256	Classroom-14	Baseboard	Tile	D	Intact	Black	Positive	3.10 ± 1.50	3.10 ± 1.50	5.90 ± 6.90



NNPS

73 Maxwell Lane Newport News VA
MCS Job No: 16-036X

Marine Chemist Service, Inc.
11850 Tug Boat Lane
Newport News Virginia 23606

Yates Elementary School NN

Reading No	Room Equivalent	Component	Substrate	Side	Condition	Color	Results	PbC	PbL	PbK
257	Classroom-14	Book Shelf	Wood	C	Intact	Beige	Positive	2.30 ± 0.30	2.30 ± 0.30	2.00 ± 0.80
258	Classroom-14	HVAC Unit	Wood	C	Intact	Beige	Positive	2.30 ± 0.80	2.30 ± 0.80	2.60 ± 2.20
259	Classroom-14	Cabinet Casing	Wood	B	Peeling	Beige	Positive	2.30 ± 0.70	2.30 ± 0.70	2.00 ± 2.00
260	Classroom-14	Upper Wall	Wood	A	Intact	White	Negative	0.07 ± 0.22	0.07 ± 0.22	-0.49 ± 1.48
261	Classroom-14	Wall Molding	Wood	A	Intact	White	Negative	0.03 ± 0.11	0.03 ± 0.11	-0.27 ± 1.62
262	Classroom-14	Ceiling Tile Grid	Metal		Intact	White	Negative	0.13 ± 0.22	0.13 ± 0.22	0.70 ± 2.20
263	Classroom-14	Loudspeaker	Wood	A	Intact	Gray	Negative	0.05 ± 0.07	0.05 ± 0.07	-0.62 ± 1.75
264	Classroom-15	Door	Wood	A	Intact	Varnish	Negative	0.01 ± 0.03	0.01 ± 0.03	0.15 ± 1.45
265	Classroom-15	Door Casing	Metal	A	Intact	Blue	Negative	0.05 ± 0.10	0.05 ± 0.10	-0.38 ± 2.72
266	Classroom-15	Wall	Cinder Block	B	Intact	White	Negative	0.40 ± 0.20	0.40 ± 0.20	0.40 ± 0.90
267	Classroom-15	Baseboard	Tile	B	Intact	Black	Positive	3.00 ± 0.90	3.00 ± 0.90	4.00 ± 4.00
268	Classroom-15	Book Shelf	Wood	A	Intact	Beige	Positive	1.40 ± 0.30	1.40 ± 0.30	2.20 ± 0.90
269	Classroom-15	HVAC Unit	Wood	A	Intact	Beige	Positive	2.10 ± 0.80	2.10 ± 0.80	1.50 ± 1.80
270	Classroom-15	Cabinet Casing	Wood	D	Intact	Beige	Positive	2.30 ± 1.00	2.30 ± 1.00	1.80 ± 1.80
271	Classroom-15	Upper Wall	Wood	C	Intact	White	Negative	0.06 ± 0.19	0.06 ± 0.19	-0.55 ± 1.63
272	Classroom-15	Wall Molding	Wood	C	Intact	White	Negative	0.01 ± 0.06	0.01 ± 0.06	0.22 ± 1.55
273	Classroom-15	Ceiling Tile Grid	Metal		Intact	White	Negative	0.13 ± 0.15	0.13 ± 0.15	0.40 ± 2.60
274	Classroom-15	Loudspeaker	Wood	C	Intact	Gray	Negative	0.03 ± 0.06	0.03 ± 0.06	-0.12 ± 1.71
275	Classroom-15	Projector Screen Holder	Wood	B	Intact	Beige	Negative	0.01 ± 0.03	0.01 ± 0.03	-0.01 ± 1.34
276	Classroom-17	Projector Screen Holder	Wood	A	Intact	Varnish	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.28 ± 1.61
277	Classroom-17	Door Casing	Metal	A	Intact	Blue	Negative	0.09 ± 0.19	0.09 ± 0.19	-0.52 ± 2.77
278	Classroom-17	Wall	Cinder Block	B	Intact	White	Negative	0.15 ± 0.12	0.15 ± 0.12	0.13 ± 0.84
279	Classroom-17	Baseboard	Tile	B	Intact	Black	Positive	4.20 ± 2.10	4.20 ± 2.10	6.00 ± 6.40
280	Classroom-17	Book Shelf	Wood	A	Intact	Beige	Positive	4.60 ± 2.20	4.60 ± 2.20	4.10 ± 3.10
281	Classroom-17	HVAC Unit VOID	Wood	A	Intact	Beige	Null	2.60 ± 2.60	2.60 ± 2.60	4.60 ± 8.30
282	Classroom-17	HVAC Unit	Wood	A	Intact	Beige	Positive	3.90 ± 1.80	3.90 ± 1.80	3.60 ± 3.00
283	Classroom-17	Cabinet Casing	Wood	D	Intact	Beige	Positive	3.50 ± 0.60	3.50 ± 0.60	3.70 ± 1.00
284	Classroom-17	Upper Wall	Wood	C	Intact	White	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.75 ± 1.28
285	Classroom-17	Wall Molding	Wood	C	Intact	White	Negative	0.00 ± 0.02	0.00 ± 0.02	0.21 ± 1.24
286	Classroom-17	Ceiling Tile Grid	Metal		Intact	White	Negative	0.11 ± 0.06	0.11 ± 0.06	-0.18 ± 0.79
287	Classroom-17	Loudspeaker	Wood	C	Intact	Gray	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.11 ± 1.39
288	Classroom-17	Projector Screen Holder	Wood	B	Intact	Beige	Negative	0.01 ± 0.04	0.01 ± 0.04	0.30 ± 1.42

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September 16, 2016

By Angela Mulleano On 7-18-2016

08/04/16 08:17:35



NNPS

73 Maxwell Lane Newport News VA
MCS Job No: 16-036X

Marine Chemist Service, Inc.
11850 Tug Boat Lane
Newport News Virginia 23606

Yates Elementary School NN

Reading No	Room Equivalent	Component	Substrate	Side	Condition	Color	Results	PbC	PbL	PbK
289	Classroom-20	Door	Wood	C	Intact	Varnish	Negative	0.02 ± 0.07	0.02 ± 0.07	-0.11 ± 1.25
290	Classroom-20	Door Casing	Metal	C	Intact	Blue	Negative	0.04 ± 0.07	0.04 ± 0.07	-0.12 ± 2.09
291	Classroom-20	Book Shelf	Wood	C	Intact	Beige	Positive	4.70 ± 2.20	4.70 ± 2.20	4.40 ± 3.00
292	Classroom-20	HVAC Unit	Wood	C	Intact	Beige	Positive	2.90 ± 1.00	2.90 ± 1.00	2.70 ± 2.00
293	Classroom-20	Wall	Cinder Block	D	Intact	White	Negative	0.11 ± 0.12	0.11 ± 0.12	-0.36 ± 1.04
294	Classroom-20	Baseboard	Tile	D	Intact	Black	Positive	3.20 ± 1.50	3.20 ± 1.50	6.00 ± 6.70
295	Classroom-20	Cabinet Casing	Wood	B	Intact	Beige	Positive	2.50 ± 1.00	2.50 ± 1.00	1.90 ± 2.20
296	Classroom-20	Upper Wall	Wood	A	Intact	White	Negative	0.05 ± 0.17	0.05 ± 0.17	-0.69 ± 1.58
297	Classroom-20	Wall Molding	Wood	A	Intact	White	Negative	0.02 ± 0.10	0.02 ± 0.10	-0.54 ± 1.28
298	Classroom-20	Ceiling Tile Grid	Metal	A	Intact	White	Negative	0.17 ± 0.28	0.17 ± 0.28	-0.17 ± 2.09
299	Classroom-20	Loudspeaker	Wood	A	Intact	Gray	Negative	0.03 ± 0.13	0.03 ± 0.13	-0.26 ± 2.45
300	Classroom-20	Projector Screen Holder	Wood	D	Intact	Beige	Negative	0.05 ± 0.15	0.05 ± 0.15	0.09 ± 1.59
301	Classroom-19	Door	Wood	A	Intact	Varnish	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.29 ± 1.62
302	Classroom-19	Door Casing	Metal	A	Intact	Blue	Negative	0.02 ± 0.05	0.02 ± 0.05	-0.22 ± 2.83
303	Classroom-19	Wall	Cinder Block	B	Intact	White	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.00 ± 1.01
304	Classroom-19	Baseboard	Tile	B	Intact	Black	Positive	3.60 ± 1.10	3.60 ± 1.10	4.60 ± 3.90
305	Classroom-19	Book Shelf	Wood	A	Peeling	Beige	Positive	3.00 ± 1.10	3.00 ± 1.10	2.60 ± 2.30
306	Classroom-19	HVAC Unit	Wood	A	Peeling	Beige	Positive	3.50 ± 2.30	3.50 ± 2.30	4.90 ± 5.20
307	Classroom-19	Cabinet Casing	Wood	D	Peeling	Beige	Positive	4.00 ± 1.40	4.00 ± 1.40	4.30 ± 3.00
308	Classroom-19	Upper Wall	Wood	D	Intact	White	Negative	0.01 ± 0.04	0.01 ± 0.04	-0.99 ± 1.47
309	Classroom-19	Wall Molding	Wood	C	Intact	White	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.04 ± 1.19
310	Classroom-19	Ceiling Tile Grid	Metal	A	Intact	White	Negative	-0.15 ± 0.98	0.14 ± 0.09	-0.15 ± 0.98
311	Classroom-22	Door	Wood	C	Intact	Varnish	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.20 ± 1.29
312	Classroom-22	Door Casing	Metal	C	Intact	Blue	Negative	-0.09 ± 0.90	0.09 ± 0.06	-0.09 ± 0.90
313	Classroom-22	Wall	Cinder Block	D	Intact	White	Negative	0.50 ± 0.20	0.50 ± 0.20	0.70 ± 0.80
314	Classroom-22	Baseboard	Tile	D	Intact	Black	Positive	2.70 ± 0.80	2.70 ± 0.80	5.70 ± 3.80
315	Classroom-22	Book Shelf	Wood	C	Intact	Beige	Positive	5.20 ± 3.40	5.50 ± 2.50	5.20 ± 3.40
316	Classroom-22	HVAC Unit	Wood	C	Intact	Beige	Positive	4.30 ± 1.60	4.30 ± 1.60	2.90 ± 2.20
317	Classroom-22	Cabinet Casing	Wood	B	Intact	Beige	Positive	2.40 ± 0.90	2.40 ± 0.90	2.30 ± 2.10
318	Classroom-22	Upper Wall	Wood	A	Intact	White	Negative	0.08 ± 0.22	0.08 ± 0.22	-0.60 ± 1.30
319	Classroom-22	Wall Molding	Wood	A	Intact	White	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.29 ± 1.62
320	Classroom-22	Ceiling Tile Grid	Metal	A	Intact	White	Negative	0.50 ± 0.40	0.50 ± 0.40	1.20 ± 2.90



NNPS

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Yates Elementary School NN

Reading No	Room Equivalent	Component	Substrate	Side	Condition	Color	Results	PbC	PbL	PbK
321	Classroom-22	Loudspeaker	Wood	A	Intact	Gray	Negative	0.04 ± 0.07	0.04 ± 0.07	-0.36 ± 1.47
322	Hallway-Upper Class	Door	Wood	B	Intact	Blue	Negative	-0.14 ± 0.86	0.11 ± 0.09	-0.14 ± 0.86
323	Hallway-Upper Class	Door Casing	Metal	B	Intact	Blue	Negative	-0.41 ± 0.67	0.15 ± 0.09	-0.41 ± 0.67
324	Hallway-Upper Class	Upper Wall	Cinder Block	A	Intact	White	Negative	0.13 ± 0.07	0.13 ± 0.07	0.16 ± 0.64
325	Hallway-Upper Class	Middle Wall	Cinder Block	A	Intact	Blue	Negative	0.13 ± 0.20	0.13 ± 0.20	-0.15 ± 1.71
326	Hallway-Upper Class	Lower Wall	Tile	A	Intact	Pink	Negative	0.01 ± 0.07	0.01 ± 0.07	0.19 ± 2.93
327	Cal-4						Positive	1.50 ± 0.10	1.50 ± 0.10	0.90 ± 0.40
328	Cal-5						Positive	1.50 ± 0.10	1.50 ± 0.10	1.20 ± 0.40
329	Cal-6						Positive	1.40 ± 0.10	1.40 ± 0.10	1.20 ± 0.40
330	Shutter-Cal	Shut-Down						6.62 ± 0.00	0.92 ± 0.00	0.00 ± 0.00



Yates Elementary School NN

Reading No	Room Equivalent	Component	Substrate	Side	Condition	Color	Results	PbC	PbL	PbK
1	Shutter-Cal	Start-Up 9-1-2016						5.67 ± 0.00	0.71 ± 0.00	0.01 ± 0.00
2							Positive	1.50 ± 0.10	1.50 ± 0.10	0.90 ± 0.40
3							Positive	1.40 ± 0.10	1.40 ± 0.10	1.40 ± 0.40
4							Positive	1.40 ± 0.10	1.40 ± 0.10	1.20 ± 0.40
5	Classroom-1	Wall	Cinder Block	A	Intact	White	Negative	0.00 ± 0.02	0.00 ± 0.02	0.30 ± 0.90
6	Classroom-1	Wall	Plaster	C	Intact	White	Negative	0.02 ± 0.02	0.02 ± 0.02	-0.31 ± 0.45
7	Classroom-1	Wall	Plaster	D	Intact	White	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.09 ± 0.92
8	Classroom-2	Wall	Plaster	A	Intact	White	Positive	2.20 ± 1.10	0.80 ± 0.30	2.20 ± 1.10
9	Classroom-2	Wall Void	Plaster	B	Intact	White	Null	0.60 ± 0.10	0.60 ± 0.10	1.30 ± 0.40
10	Classroom-2	Wall Void	Plaster	B	Intact	White	Null	0.90 ± 0.30	0.90 ± 0.30	1.50 ± 0.80
11	Classroom-2	Wall Void	Plaster	B	Intact	White	Null	0.90 ± 0.20	0.90 ± 0.20	1.20 ± 0.60
12	Classroom-2	Wall	Plaster	B	Intact	White	Negative	0.12 ± 0.07	0.12 ± 0.07	0.28 ± 0.64
13	Classroom-2	Wall	Plaster	C	Intact	White	Positive	2.60 ± 1.00	0.70 ± 0.20	2.60 ± 1.00
14	Classroom-4	Wall	Cinder Block	A	Intact	White	Negative	0.05 ± 0.05	0.05 ± 0.05	0.40 ± 0.90
15	Classroom-4	Wall	Cinder Block	B	Intact	White	Negative	0.12 ± 0.08	0.12 ± 0.08	0.50 ± 0.90
16	Classroom-4	Wall	Cinder Block	C	Intact	White	Negative	0.30 ± 0.15	0.30 ± 0.15	0.50 ± 0.90
17	Classroom-4	Wall	Cinder Block	A	Intact	White	Negative	0.17 ± 0.11	0.17 ± 0.11	-0.03 ± 1.01
18	Classroom-4	Wall Void	Cinder Block	C	Intact	White	Null	0.50 ± 0.20	0.50 ± 0.20	0.18 ± 0.83
19	Classroom-4	Wall	Cinder Block	C	Intact	White	Negative	0.19 ± 0.11	0.19 ± 0.11	0.18 ± 0.97
20	Classroom-4	Wall	Cinder Block	D	Intact	White	Positive	1.50 ± 0.50	0.90 ± 0.10	1.50 ± 0.50
21	Classroom-6	Wall	Cinder Block	A	Intact	White	Positive	2.20 ± 1.10	0.90 ± 0.30	2.20 ± 1.10
22	Classroom-6	Wall	Cinder Block	B	Intact	White	Negative	0.70 ± 0.20	0.70 ± 0.20	1.10 ± 0.60
23	Classroom-6	Wall Void	Cinder Block	C	Intact	White	Null	0.80 ± 0.20	0.80 ± 0.20	1.70 ± 0.70
24	Classroom-6	Wall Void	Cinder Block	C	Intact	White	Null	0.60 ± 0.50	0.60 ± 0.50	0.80 ± 2.70
25	Classroom-6	Wall	Cinder Block	C	Intact	White	Negative	0.50 ± 0.10	0.50 ± 0.10	0.80 ± 0.80
26	Classroom-5	Wall	Cinder Block	A	Intact	White	Negative	0.15 ± 0.07	0.15 ± 0.07	0.24 ± 0.70
27	Classroom-5	Wall	Cinder Block	C	Intact	White	Negative	0.05 ± 0.05	0.05 ± 0.05	0.30 ± 0.89
28	Classroom-5	Wall	Cinder Block	D	Intact	White	Negative	0.13 ± 0.09	0.13 ± 0.09	-0.03 ± 0.94
29	Classroom-5	Wall Void	Cinder Block	A	Intact	White	Null	1.30 ± 2.20	1.30 ± 2.20	1.50 ± 4.70
30	Classroom-5	Wall	Cinder Block	A	Intact	White	Positive	1.50 ± 0.50	0.70 ± 0.10	1.50 ± 0.50
31	Classroom-5	Wall	Cinder Block	B	Intact	White	Negative	0.70 ± 0.10	0.70 ± 0.10	1.20 ± 0.50



Yates Elementary School NN

Reading No	Room Equivalent	Component	Substrate	Side	Condition	Color	Results	PbC	PbL	PbK
32	Classroom-7	Wall	Cinder Block	A	Intact	White	Negative	0.00 ± 0.02	0.00 ± 0.02	0.06 ± 0.99
33	Classroom-7	Wall	Cinder Block	C	Intact	White	Negative	0.17 ± 0.09	0.17 ± 0.09	0.30 ± 0.68
34	Classroom-7	Wall	Cinder Block	D	Intact	White	Negative	0.02 ± 0.03	0.02 ± 0.03	0.28 ± 0.91
35	Classroom-8	Wall	Cinder Block	A	Intact	White	Positive	1.30 ± 0.30	1.30 ± 0.30	1.70 ± 0.80
36	Classroom-8	Wall Void	Cinder Block	B	Intact	White	Null	1.00 ± 0.10	1.00 ± 0.10	1.10 ± 0.50
37	Classroom-8	Wall	Cinder Block	B	Intact	White	Negative	0.80 ± 0.20	0.80 ± 0.20	1.00 ± 0.70
38	Classroom-8	Wall	Cinder Block	B	Intact	White	Positive	2.00 ± 0.90	1.10 ± 0.30	2.00 ± 0.90
39	Classroom-7	Wall	Cinder Block	C	Intact	White	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.20 ± 1.01
40	Classroom-9	Wall	Cinder Block	A	Intact	White	Negative	0.10 ± 0.07	0.10 ± 0.07	-0.17 ± 0.97
41	Classroom-9	Wall	Cinder Block	C	Intact	White	Negative	0.09 ± 0.07	0.09 ± 0.07	0.01 ± 0.84
42	Classroom-9	Wall	Cinder Block	D	Intact	White	Negative	-0.06 ± 0.79	0.15 ± 0.16	-0.06 ± 0.79
43	Teachers Lounge	Wall	Cinder Block	A	Intact	White	Negative	0.10 ± 0.05	0.10 ± 0.05	0.30 ± 0.68
44	Teachers Lounge	Wall	Cinder Block	C	Intact	White	Negative	0.05 ± 0.04	0.05 ± 0.04	0.09 ± 0.94
45	Teachers Lounge	Wall	Cinder Block	D	Intact	White	Negative	0.08 ± 0.08	0.08 ± 0.08	-0.11 ± 0.97
46	Classroom-33	Wall	Cinder Block	A	Intact	White	Negative	0.03 ± 0.04	0.03 ± 0.04	0.10 ± 0.59
47	Classroom-33	Wall Void	Cinder Block	B	Intact	White	Null	0.07 ± 0.13	0.07 ± 0.13	0.40 ± 0.90
48	Classroom-33	Wall	Cinder Block	B	Intact	White	Negative	0.01 ± 0.02	0.01 ± 0.02	0.03 ± 0.92
49	Classroom-33	Wall	Cinder Block	A	Intact	White	Negative	0.01 ± 0.02	0.01 ± 0.02	0.02 ± 0.90
50	Classroom-33	Wall	Cinder Block	D	Intact	White	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.35 ± 1.07
51	Classroom-33	Wall	Cinder Block	D	Intact	White	Negative	0.00 ± 0.02	0.00 ± 0.02	0.10 ± 0.91
52	Classroom-10	Wall	Cinder Block	A	Intact	White	Negative	0.08 ± 0.07	0.08 ± 0.07	0.15 ± 1.00
53	Classroom-10	Wall	Cinder Block	B	Intact	White	Negative	0.15 ± 0.68	0.13 ± 0.12	0.15 ± 0.68
54	Classroom-10	Wall	Cinder Block	C	Intact	White	Negative	0.12 ± 0.09	0.12 ± 0.09	0.40 ± 0.70
55	Reading Room	Wall	Cinder Block	A	Intact	White	Negative	0.00 ± 0.02	0.00 ± 0.02	-0.05 ± 0.93
56	Reading Room	Wall	Cinder Block	B	Intact	White	Negative	0.00 ± 0.02	0.00 ± 0.02	0.50 ± 0.80
57	Reading Room	Wall	Cinder Block	C	Intact	White	Negative	0.01 ± 0.02	0.01 ± 0.02	-0.14 ± 0.94
58	Classroom-11	Wall	Cinder Block	A	Intact	White	Positive	4.10 ± 2.50	1.60 ± 0.90	4.10 ± 2.50
59	Classroom-11	Wall	Cinder Block	B	Intact	White	Positive	1.60 ± 0.40	1.60 ± 0.40	1.90 ± 1.10
60	Classroom-11	Wall	Cinder Block	C	Intact	White	Positive	1.40 ± 0.30	1.40 ± 0.30	2.00 ± 1.10
61	Classroom-12	Wall	Cinder Block	A	Intact	White	Positive	3.00 ± 1.20	1.00 ± 0.40	3.00 ± 1.20
62	Classroom-12	Wall	Cinder Block	B	Intact	White	Positive	2.20 ± 0.60	2.20 ± 0.60	2.50 ± 1.20



NNPS

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Reading No	Room Equivalent	Component	Substrate	Side	Condition	Color	Results	PbC	PbL	PbK
63	Classroom-12	Wall	Cinder Block	C	Intact	White	Positive	1.60 ± 0.60	1.00 ± 0.20	1.60 ± 0.60
64	Classroom-13	Wall	Cinder Block	A	Intact	White	Positive	2.60 ± 1.20	0.90 ± 0.30	2.60 ± 1.20
65	Classroom-13	Wall Void	Cinder Block	B	Intact	White	Null	1.00 ± 0.10	1.00 ± 0.10	1.40 ± 0.50
66	Classroom-13	Wall	Cinder Block	B	Intact	White	Positive	1.90 ± 0.90	0.90 ± 0.20	1.90 ± 0.90
67	Classroom-13	Wall	Cinder Block	C	Intact	White	Positive	1.30 ± 0.30	1.30 ± 0.30	1.70 ± 0.90
68	Classroom-13	Wall	Cinder Block	D	Intact	White	Positive	1.70 ± 0.60	0.80 ± 0.10	1.70 ± 0.60
69	Classroom-14	Wall	Cinder Block	A	Intact	White	Positive	2.80 ± 0.90	0.80 ± 0.30	2.80 ± 0.90
70	Classroom-14	Wall Void	Cinder Block	B	Intact	White	Null	0.80 ± 0.20	0.80 ± 0.20	1.60 ± 0.70
71	Classroom-14	Wall Void	Cinder Block	B	Intact	White	Null	1.20 ± 0.20	1.20 ± 0.20	1.70 ± 0.70
72	Classroom-14	Wall	Cinder Block	B	Intact	White	Positive	3.20 ± 1.20	1.20 ± 0.50	3.20 ± 1.20
73	Classroom-14	Wall	Cinder Block	C	Intact	White	Positive	2.90 ± 1.20	1.10 ± 0.40	2.90 ± 1.20
74	Classroom-14	Wall	Cinder Block	D	Intact	White	Positive	2.60 ± 1.20	1.10 ± 0.40	2.60 ± 1.20
75	Classroom-16	Wall	Cinder Block	A	Intact	White	Positive	2.10 ± 0.70	0.90 ± 0.20	2.10 ± 0.70
76	Classroom-16	Wall	Cinder Block	B	Intact	White	Positive	1.90 ± 0.60	0.70 ± 0.10	1.90 ± 0.60
77	Classroom-16	Wall	Cinder Block	C	Intact	White	Positive	1.70 ± 0.60	0.90 ± 0.20	1.70 ± 0.60
78	Classroom-16	Wall	Cinder Block	D	Intact	White	Positive	2.00 ± 0.80	0.60 ± 0.10	2.00 ± 0.80
79	Classroom-15	Wall	Cinder Block	A	Intact	White	Negative	0.50 ± 0.10	0.50 ± 0.10	0.80 ± 0.70
80	Classroom-15	Wall	Cinder Block	C	Intact	White	Positive	1.50 ± 0.50	0.50 ± 0.10	1.50 ± 0.50
81	Classroom-15	Wall	Cinder Block	D	Intact	White	Negative	0.50 ± 0.10	0.50 ± 0.10	1.10 ± 0.50
82	Classroom-18	Wall	Cinder Block	A	Intact	White	Negative	0.01 ± 0.02	0.01 ± 0.02	0.09 ± 0.86
83	Classroom-18	Wall Void	Cinder Block	B	Intact	White	Null	1.00 ± 0.10	1.00 ± 0.10	1.40 ± 0.40
84	Classroom-18	Wall	Cinder Block	B	Intact	White	Negative	0.80 ± 0.10	0.80 ± 0.10	1.20 ± 0.50
85	Classroom-18	Wall	Cinder Block	C	Intact	White	Positive	1.80 ± 0.80	1.00 ± 0.20	1.80 ± 0.80
86	Classroom-17	Wall	Cinder Block	D	Intact	White	Positive	1.70 ± 0.60	0.90 ± 0.20	1.70 ± 0.60
87	Classroom-17	Wall	Cinder Block	D	Intact	White	Negative	0.05 ± 0.05	0.05 ± 0.05	0.60 ± 0.90
88	Classroom-17	Wall	Cinder Block	C	Intact	White	Negative	0.30 ± 0.56	0.12 ± 0.10	0.30 ± 0.56
89	Classroom-20	Wall	Cinder Block	A	Intact	White	Negative	0.04 ± 0.03	0.04 ± 0.03	0.14 ± 0.82
90	Classroom-20	Wall	Cinder Block	B	Intact	White	Negative	0.05 ± 0.06	0.05 ± 0.06	0.25 ± 0.98
91	Classroom-20	Wall	Cinder Block	C	Intact	White	Negative	0.06 ± 0.07	0.06 ± 0.07	0.26 ± 0.83
92	Classroom-19	Wall	Cinder Block	A	Intact	White	Negative	0.17 ± 0.80	0.16 ± 0.15	0.17 ± 0.80
93	Classroom-19	Wall	Cinder Block	C	Intact	White	Negative	0.04 ± 0.04	0.04 ± 0.04	0.19 ± 0.90

September 16, 2016



NNPS

73 Maxwell Lane Newport News VA
MCS Job No: 16-036X

Marine Chemist Service, Inc.
11850 Tug Boat Lane
Newport News Virginia 23606

Yates Elementary School NN

Reading No	Room Equivalent	Component	Substrate	Side	Condition	Color	Results	PbC	PbL	PbK
94	Classroom-19	Wall	Cinder Block	D	Intact	White	Negative	0.19 ± 0.14	0.19 ± 0.14	0.40 ± 0.90
95	Classroom-21	Wall	Cinder Block	A	Intact	White	Negative	0.07 ± 0.07	0.07 ± 0.07	0.22 ± 0.87
96	Classroom-21	Wall	Cinder Block	B	Intact	White	Negative	0.11 ± 0.09	0.11 ± 0.09	0.40 ± 0.90
97	Classroom-21	Wall	Cinder Block	C	Intact	White	Negative	0.06 ± 0.06	0.06 ± 0.06	0.50 ± 0.90
98	Classroom-21	Wall	Cinder Block	D	Intact	White	Negative	0.11 ± 0.09	0.11 ± 0.09	0.28 ± 0.74
99	Classroom-22	Wall	Cinder Block	A	Intact	White	Positive	2.30 ± 1.00	0.80 ± 0.30	2.30 ± 1.00
100	Classroom-22	Wall Void	Cinder Block	B	Intact	White	Null	0.70 ± 0.20	0.70 ± 0.20	1.30 ± 0.50
101	Classroom-22	Wall Void	Cinder Block	B	Intact	White	Null	1.30 ± 0.40	1.30 ± 0.40	1.80 ± 0.90
102	Classroom-22	Wall	Cinder Block	B	Intact	White	Positive	2.50 ± 0.80	1.30 ± 0.40	2.50 ± 0.80
103	Classroom-22	Wall	Cinder Block	C	Intact	White	Positive	2.70 ± 0.80	0.90 ± 0.30	2.70 ± 0.80
104	Cal-4						Positive	1.50 ± 0.10	1.50 ± 0.10	1.10 ± 0.40
105	Cal-5						Positive	1.30 ± 0.10	1.30 ± 0.10	1.10 ± 0.40
106	Cal-6						Positive	1.40 ± 0.10	1.40 ± 0.10	1.00 ± 0.40
107	Shutter-Cal	Shut-Down 9-1-2016						5.78 ± 0.00	0.77 ± 0.00	0.00 ± 0.00

September 16, 2016



Lead XRF Comments:

1. Lead-based paint was identified in the all base cabinets, HVAC unit casings, book shelves and some walls. On September 1, 2016 additional XRF samples were taken of the walls to confirm that the walls contain lead based paint. It was confirmed all walls do contain lead based paint. The black baseboards ceramic tiles are lead containing and can be found throughout the school. Detectable levels of lead were also found on components throughout the building.
2. Detectable levels of lead were also found in other painted components as detailed in the *Lead Paint Content in Descending Order* spreadsheet. This value is below the 1.00-mg/cm² standard. Sufficient disruption of even the lowest lead-containing surface can result in a lead dust hazard.
3. The XRF lead inspection was not performed in accordance with the HUD Guidelines, which are required to test every interior and exterior painted surface/substrate combination.
4. Servicing components containing lead based paint or any detectable level of lead can create a lead hazard. Lead dust can be released during any renovations if the painted surface becomes chafed through improper scraping or sanding. Sufficient accumulations of renovation generated lead dust can create an unhealthy environment even though no lead-based paint was identified.
5. The presence of lead based paint and detectable levels of lead should be considered in all repairs and maintenance work. Perform work on these lead-containing surfaces in accordance with OSHA's regulations.
6. Take precautions before you or your contractor begins renovations or construction that may disturb painted surfaces (such as scraping off paint or tearing out walls). Do not use a belt-sander, propane torch, heat gun, dry scraper, or dry sandpaper to remove lead-based paint. These actions create large amounts of lead dust and fumes. Lead dust can remain in your air long after the work is done.
7. Always hire a company with special training for correcting lead problems. Use someone that knows how to perform lead work safely and has the proper equipment to clean up thoroughly. Effective April 2010, all renovation involving lead-based paint (with some exceptions) must be performed by a certified renovator.



Marine Chemist Service, Inc.

Inspection Information

The survey contractor for the XRF Lead-Based Paint Inspection of Yates Elementary School, 73 Maxwell Lane, Newport News, Virginia is:

**MARINE CHEMIST SERVICES, INC.
11850 Tug Boat Lane
Newport News, Virginia 23606**

The team leader responsible for quality control coordination of inspection and adherence to inspection protocol is:

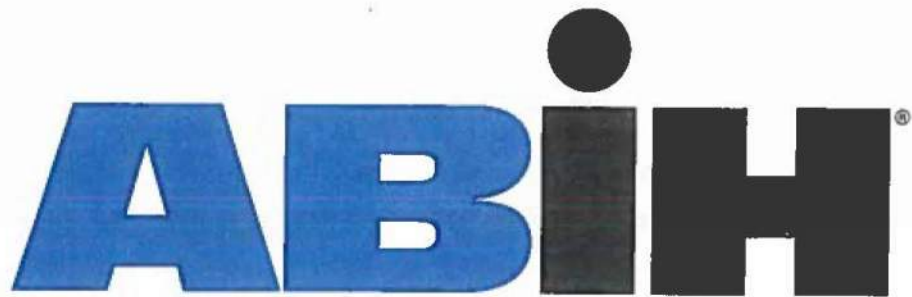
**Colleen Becker, CIH, CSP
MARINE CHEMIST SERVICES, INC.
11850 Tug Boat Lane
Newport News, Virginia 23606**

The Virginia Licensed Lead Risk Assessor who performed this XRF lead inspection is:

**Angela Mulleano
License # 3356-000460**

The lead risk assessor is employed by:

**MARINE CHEMIST SERVICE, INC.
11850 TUG BOAT LANE
NEWPORT NEWS, VIRGINIA 23606
(757) 873-0933**



american board of industrial hygiene®

organized to improve the practice of industrial hygiene
proclaims that

Colleen Becker

having met all requirements of
education, experience and examination, and
ongoing maintenance,
is hereby certified in the

**COMPREHENSIVE PRACTICE
of
INDUSTRIAL HYGIENE**

and has the right to use the designations

CERTIFIED INDUSTRIAL HYGIENIST

CIH

Certificate Number	3708 CP
Awarded:	December 9, 1987
Expiration Date:	June 1, 2020



Nicole Green
Chair, ABIH

Alvin H. Quinn
Chief Executive Officer, ABIH

COMMONWEALTH of VIRGINIA

Department of Professional and Occupational Regulation

9960 Mayland Drive, Suite 400, Richmond, VA 23233

Telephone: (804) 367-8500

EXPIRES ON
10-31-2016

NUMBER
3356000460

BOARD FOR ASBESTOS, LEAD, AND HOME INSPECTORS
LEAD RISK ASSESSOR LICENSE



ANGELA MULLEANO

DPOR

Status can be verified at <http://www.dpor.virginia.gov>

Jay W. DeBoer
Jay W. DeBoer, Director

SECTION 023200, GEOTECHNICAL INVESTIGATION REPORT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 PROJECT DESCRIPTION

- A. Work includes earthwork, site preparation, building foundations and other site-related construction using in-situ soil materials. The information herein is made part of the Contract Documents and is included for the information and use by the Contractor. Attached is the Geotechnical Investigation Report prepared by Terracon/GET Solutions, dated May 28, 2024.
- B. Refer also to the Site Preparation Notes and area delimited for soils excavation, fill placement and compaction shown on Sheet A0.01 of the Drawings.

PART 2 - PRODUCTS (Not applicable).

PART 3 – EXECUTION (Not applicable).

END OF SECTION 023200

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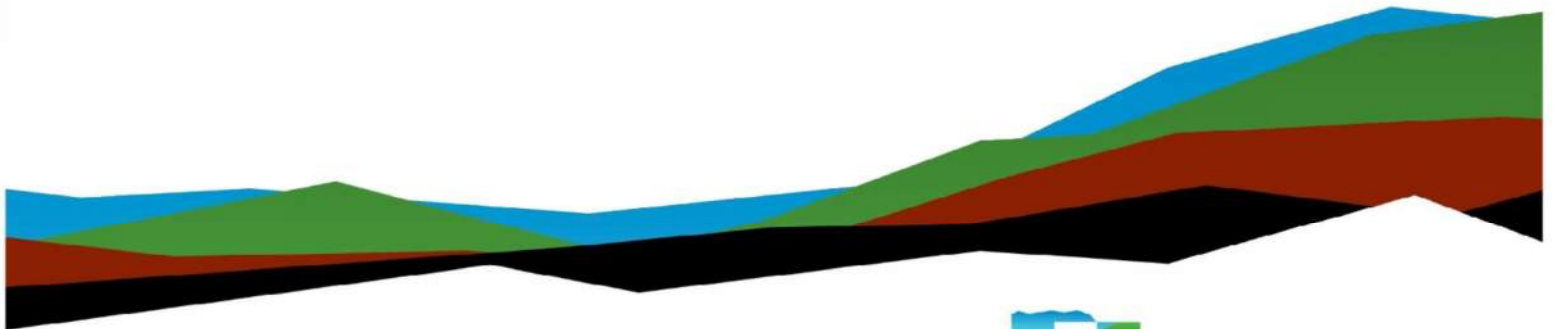
Security Vestibule Addition – Richard T. Yates Elementary School

Geotechnical Engineering Report

Newport News, VA

Prepared for:

Hudson & Associates Architects
PLLC
120 W. Queens Way, Suite 201
Hampton, VA 23606



Nationwide

Terracon.com

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- Geotechnical
- Materials



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Williamsburg, VA 23185
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May 28, 2024

Hudson & Associates Architects PLLC
120 W. Queens Way, Suite 201
Hampton, VA 23606

Attn: Wheeler, Jay
P: 757-722-1964
E: rcorner@hudsonarch.com

Re: Geotechnical Engineering Report
Security Vestibule Addition – Richard T. Yates Elementary School
73 Maxwell Lane
Newport News, VA
Terracon Project No. K4245013

Dear Mr. Corner:

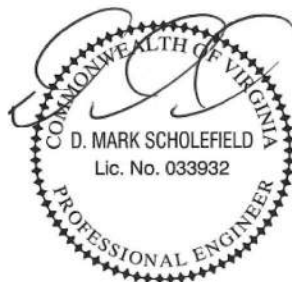
We have completed the scope of Geotechnical Engineering services for the above referenced project in general accordance with Terracon Proposal No. PK4245013 dated February 14, 2024. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations and floor slabs for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,

Terracon

James R. Wheeler, P.G.
Office Manager



D. Mark Scholefield, P.E.
Senior Principal
Virginia Lic. No. 033932

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Exploration and Laboratory Results

Supporting Information

Note: This report was originally delivered in a web-based format. **Blue Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the  Terracon logo will bring you back to this page. For more interactive features, please view your project online at client.terracon.com.

Refer to each individual Attachment for a listing of contents.

Introduction

This report presents the results of our Subsurface Exploration and Geotechnical Engineering services performed for the proposed Security Vestibule Addition located at Richard T. Yates Elementary School at 73 Maxwell Lane in Newport News, VA. The purpose of these services was to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions
- Seismic site classification per IBC
- Site preparation and earthwork
- Dewatering considerations
- Foundation design and construction
- Floor slab design and construction

The geotechnical engineering Scope of Services for this project included the advancement of test borings, laboratory testing, engineering analyses, and preparation of this report.

Drawings showing the site and boring locations are shown on the [Site Location and Exploration Plans](#), respectively. The results of the laboratory testing performed on soil samples obtained from the site during our field exploration are included on the boring logs and as separate graphs in the [Exploration and Laboratory Results](#) attachment.

Project Description

Our initial understanding of the project was provided in our proposal and was discussed during project planning. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

Item	Description
Information Provided	An email request for proposal was provided by Richard Corner on February 12, 2024. The request included preliminary schematic design drawings dated February 12, 2024, as well as a boring location plan and specified boring depth.



Item	Description
Project Description	The project includes an addition to the school near its main entrance along the west side of the school and adjacent to the parking lot. The addition will provide a security vestibule area, a reception and administration area, an office for the assistant principal, and a single-user restroom facility.
Proposed Structure	The proposed addition will be one-story and approximately 1,500 ft ² in plan area.
Building Construction	According to the client, the addition is expected to use steel post-and-beam plus cold-framing above-grade, a concrete slab bearing on-grade, and shallow reinforced concrete footings below-grade.
Finished Floor Elevation	Finish floor elevation (FFE) for the addition is expected to coincide with the existing finish floor elevation that the addition will tie-into.
Maximum Loads	<p>In the absence of load information, we used the following loads in estimating settlement based on our experience with similar projects.</p> <ul style="list-style-type: none"> ■ Columns: 75 kips ■ Walls: 3 kips per linear foot (klf) ■ Slabs: 150 pounds per square foot (psf)
Grading/Slopes	Less than 1 foot of cut and fill will be required to develop final grade, excluding remedial grading requirements.
Building Code	2018 IBC

Terracon should be notified if any of the above information is inconsistent with the planned construction, especially the grading limits, as modifications to our recommendations may be necessary.

Site Conditions

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
<p>Parcel Information</p>	<p>The project is located at the existing Richard T. Yates Elementary School at 73 Maxwell Lane in Newport News, VA. Latitude/Longitude (approximate) 37.089787° N, -76.503708° W See Site Location.</p>
<p>Existing Improvements</p>	<p>An existing elementary school that includes the school structure itself, sidewalks, pavement areas, landscaped areas, utilities, and other associated infrastructure. The existing school is understood to be supported on shallow foundations with a grade supported slab. The proposed addition will be located near the school’s main entrance where currently a covered walkway, sidewalks, mulch beds, and a flagpole are located.</p> <p>A review of the exterior of the existing school during our site reconnaissance revealed a few isolated locations where some minor cracking was observed. This was mainly limited to building corners, at which minor vertical cracking was observed in the brick veneer. These cracks are likely an indication of settlement that has previously occurred but is considered minor and a typical occurrence for similar type structures in this region. No signs of significant settlement or cracking were observed during our site reconnaissance. Several photographs of the cracking observed at building corners are included in the Photography Log attachment to this report.</p>
<p>Current Ground Cover</p>	<p>Landscaped grassy areas, mulch beds with shrubs, a nearby tree, and concrete sidewalks.</p>
<p>Existing Topography</p>	<p>As identified in the Newport News Online GIS Viewer, the site is relatively flat with an elevation of approximately 32-ft (NAVD 1988).</p>

Geotechnical Characterization

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of the site. Conditions observed at the exploration point are indicated on the individual log. The individual log can be found in the [Exploration and Laboratory Results](#) and the GeoModel can be found in the [Figures](#) attachment of this report.

As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at the boring location, refer to the GeoModel.

Model Layer	Layer Name	General Description
1	TOPSOIL	8-in of Topsoil
2	FILL	Sandy lean Clay (CL) with trace fibrous organic material
3	UPPER CLAY	Fat and lean Clay (CH, CL)
4	UPPER SAND	Silty Sand (SM) with trace fibrous organic material
5	LOWER CLAY	Lean Clay (CL) with trace fibrous organic material
6	LOWER SAND	Silty Sand (SM)

The presence of groundwater at the boring location was examined during drilling as observed through the relative wetness of the recovered soil samples during the drilling operations. During drilling operations, fluid (clay-water slurry) is introduced into the bore hole generally impairing the ability to accurately determine groundwater levels. Groundwater was estimated to occur at a depth of about 11 feet below existing grades, corresponding to an elevation of approximately EL 21 ft (NAVD 1988). The borehole was backfilled upon completion for safety considerations.

Groundwater conditions will vary with environmental variations and seasonal conditions, such as the frequency and magnitude of rainfall patterns and man-made influences, such as existing swales, drainage ponds, underdrains and areas of covered soil (paved parking lots, sidewalks, etc.). In the project's area, seasonal groundwater fluctuations are common. We recommend that the contractor determine the actual groundwater levels at the time of the construction to determine groundwater impact on the construction procedures, if necessary.

Shrink Swell Discussion

The soils recovered during our field investigation were tested and evaluated for their potential to expand or contract with moisture changes (typically termed shrink-swell). Shallow foundations and other on-grade features constructed on expansive soils at certain depths may be subjected to detrimental uplift or horizontal forces caused by the swelling of these soils as a result of an increase in the moisture content. Conversely, as these soils lose moisture they may shrink, adversely affecting the foundations. The depth to which soils are normally affected by moisture changes extends from the ground surface to approximately 3 feet below existing grades in this area, depending on site topography and drainage characteristics.

The soil survey of Tidewater Cities Area, Virginia as prepared by the United States Department of Agriculture (USDA), Soil Conservation Service (SCS; later renamed the Natural Resource Conservation Service – NRCS), dated August 1989, identifies the predominant soil type at the site as 9B-Craven-Urban land complex, 0 to 2 percent slopes. The soil survey indicates these soils exhibit a linear extensibility of up to 5.9, which is indicative of a moderate expansive (shrink-swell) potential. The soils encountered in the boring appear to be consistent with this soil series. Urban land complex indicates that undocumented fill is expected to occur at this site, which was observed at the boring location during our field exploration. The USDA soil survey for this site has been included in [Supporting Information](#) attachment to this report.

Based on the laboratory classification test results, the shallow (upper 3 to 4 feet) fat Clay (CH) soils possess a Liquid Limit (LL) of 58% and a Plasticity Index (PI) of 31 generally indicative of possessing moderate to high shrink-swell potential. As such, this shrink-swell potential will need to be considered in designing the foundations. Design recommendations are provided herein, which include a minimum 30-inch footing embedment requirement.

Field Exploration

In order to explore the general subsurface soil types and to aid in developing associated design parameters, the following exploration program was performed:

- One (1) 40-foot deep SPT boring (designated as B-1), drilled within the footprint of the proposed security vestibule addition.

The SPT boring was performed with the use of rotary wash “mud” drilling procedures in general accordance with ASTM D 1586. The tests were performed continuously from the existing ground surface to a depth up to 12-feet, and at 5-foot intervals thereafter starting at a depth of 13-feet. The soil samples were obtained with a standard 1.4” I.D., 2” O.D., 30” long split-spoon sampler. The sampler was driven with blows of a 140 lb. hammer falling 30 inches, using an automatic hammer. The number of blows required to drive the sampler each 6-inch increment of penetration was recorded and is shown on the boring logs. The sum of the second and third penetration increments is termed the SPT N-value (uncorrected for automatic hammer). A representative portion of each disturbed split-spoon sample was collected, placed in a glass jar, sealed, labeled, and returned to our laboratory for review. The borehole was backfilled upon completion with the drilling spoils.

The boring location was established by the Client prior to mobilization. The boring location was staked in the field by a representative of **Terracon** with a handheld GPS device and by corroborating the location with easily identifiable landmarks. The approximate boring location is shown in the **Figures** attachment of this report.

Field and Laboratory Testing

Soil testing provided by **Terracon** was performed in accordance with American Society for Testing and Materials (ASTM) standards. All soils and materials tests were performed in our AASHTO re:source and US Army Corps of Engineers certified Williamsburg, Virginia laboratory.

Soil Classification and Index Testing

Representative portions of all soil samples collected during drilling operations were labeled, preserved and transferred to our laboratory in accordance with ASTM D4220 for classification and analysis. Soil descriptions on the boring log are provided using visual-manual methods in general accordance with ASTM D2488 using the Unified Soil Classification System (USCS).

Soil samples that were selected for index testing were classified in general accordance with ASTM D2487. It should be noted that some variation can be expected between samples classified using the visual-manual procedure (ASTM D2488) and the USCS (ASTM D2487). A summary of the soil classification system is provided in the [Supporting Information](#) attachment of this report.

Representative split-spoon soil samples were selected and subjected to natural moisture, #200 sieve wash, and Atterberg Limits testing in order to corroborate the visual classification. These test results, along with the soil test boring log are presented in the [Exploration and Laboratory Results](#) attachment of this report.

Geologic Setting

The project site is located within the Atlantic Coastal Plain physiographic province. Bedrock of the Late Mesozoic age is present at depths of greater than 2,000 ft, and is overlain by Lower and Upper Cretaceous, Tertiary, Pleistocene and Recent Sediments.

Across the outer Coastal Plain, the Pliocene age Yorktown Formation of the Tertiary Period is widespread, occurring from Maryland to North Carolina. Its age is estimated between 4.8 million and 2.8 million years and is estimated to have been deposited during three transgressive episodes. The depositional environment was shallow marine in nature, consisting of inner shelf, barrier-island, estuarine and lagoonal patterns. The Yorktown Formation is a glauconitic, fossiliferous, Silty to Clayey greenish-gray fine Sand. This material has been pre-consolidated by an increased effective overburden pressure generated due to a drop in the sea level at the end of the Tertiary Period, and by previously overlying sediments, which eroded away as the sea level subsequently lowered.

As sea levels rose during the Pleistocene Epoch of the Quaternary Period, areas within the project limits were filled and overlain by soils of the Shirley Formation, which is composed of fluvial and estuarine deposits. The geologic stratigraphy encountered in our subsurface explorations generally consisted of marine deposited Sands and Clays of this formation.

Seismic Site Class

The seismic design requirements for buildings and other structures are based on Seismic Design Category. Site Classification is required to determine the Seismic Design Category for a structure. The Site Classification is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Section 20.4 of ASCE 7 and the International Building Code (IBC). Based on the soil properties observed at the site and as described on the exploration log and results, our professional opinion is for that a **Seismic Site Classification of D** be considered for the project. The subsurface explorations at this site was extended to a maximum depth of 40 feet. The site properties below the boring depth to 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area. Additional deeper borings or geophysical testing may be performed to confirm the conditions below the current boring depth.

Geotechnical Overview

The site appears suitable for the proposed construction based upon geotechnical conditions encountered in the test boring, provided that the recommendations provided in this report are implemented in the design and construction phases of this project.

The subsurface materials generally consisted of undocumented fill to a depth of approximately 2 feet, overlaying Clay (CH, CL). This cohesive stratum is underlain by alternating layers of Silty Sand (SM) and lean Clay (CL) extending to the boring termination depth. Groundwater was estimated to occur at a depth of about 11 feet below current grades, corresponding to an elevation of approximately EL 21 feet (NAVD 1988).

The near surface undocumented fill could become unstable with typical earthwork and construction traffic, especially after precipitation events. The effective drainage should be completed early in the construction sequence and maintained after construction to avoid potential issues. If possible, the grading should be performed during the warmer and drier times of the year. If grading is performed during the winter months, an increased risk for possible undercutting and replacement of unstable subgrade will persist. Additional site preparation recommendations, including subgrade improvement and fill placement, are provided in the **Earthwork** section.

As previously mentioned, 2 feet of undocumented fill was encountered at the boring location. There is an inherent risk if slabs and footings are placed on this undocumented fill. **Considering the quality and composition of the undocumented fill, such as the presence of organics within the fill, it is recommended to undercut and remove all of the undocumented fill in its entirety from the building addition envelope. Based on the soil boring, the undercut depth to remove the undocumented fill will extend roughly 2 feet below existing grades, possible more.** Care should be taken to avoid undermining any of the existing structure and its foundations. This undercut should extend out at least 5-feet laterally beyond the building addition envelope. The Geotechnical Engineer should be on-site to monitor the undercut operation to ensure all undocumented fill is properly undercut and removed from the building addition envelope. Subsequently the approved excavation should be backfilled with structural fill placed and compacted as noted herein. Following these improvements, the soils will be suitable for shallow foundation and slab-on-grade support.

The recommendations contained in this report are based upon the results of field and laboratory testing (presented in the [Exploration Results](#)), engineering analyses, and our current understanding of the proposed project. The [General Comments](#) section provides an understanding of the report limitations.

Earthwork

Earthwork is anticipated to include clearing and grubbing, excavations, and structural fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria, as necessary, to render the site in the state considered in our geotechnical engineering evaluation for foundations and floor slabs.

Site Preparation

Prior to placing fill, existing vegetation, topsoil, root mat, and undocumented fill should be removed. Complete stripping of the topsoil and undocumented fill should be performed in the proposed building area.

Tree root systems can remove substantial moisture from surrounding soils. Where trees are removed, the full root ball and all associated dry and desiccated soils should be removed.

In addition to stripping the topsoil, all undocumented fill should be undercut and removed from the building addition envelope in its entirety. Based on the soil boring, the undercut depth to remove the undocumented fill will extend roughly 2 feet below existing grades, possible more. Care should be taken to avoid undermining any of the existing structure and its foundations. This undercut should extend out at least 5-feet laterally beyond the building addition envelope. The Geotechnical Engineer should be on-site to monitor the undercut operation to ensure all undocumented fill is properly undercut and removed from the building addition envelope.

Where fill is placed on existing slopes steeper than 5H:1V, benches should be cut into the existing slopes prior to fill placement. The benches should have a minimum vertical face height of 1 foot and a maximum vertical face height of 3 feet and should be cut wide enough to accommodate the compaction equipment. This benching will help provide a positive bond between the fill and natural soils and reduce the possibility of failure along the fill/natural soil interface.

Although no evidence of underground facilities (such as septic tanks, cesspools, and basements) was observed during the exploration and site reconnaissance, such features could be encountered during construction. Utility markings indicating the presence of underground utilities at this site were observed at the time of our field exploration. Also, the presence of undocumented existing fill was encountered at the boring location. This undocumented existing fill is likely associated with the previous construction of the existing building. If unexpected fills that are deemed unsuitable by the Geotechnical Engineer or underground facilities are encountered, such features should be removed, and the excavation thoroughly cleaned prior to backfill placement and/or construction.

Subgrade Preparation

The subgrade should be proofrolled with an adequately loaded vehicle such as a fully-loaded tandem-axle dump truck. The proofrolling should be performed under the observation of the Geotechnical Engineer or representative. Areas excessively deflecting under the proofroll should be delineated and subsequently addressed by the Geotechnical Engineer. Such areas should either be removed or modified by treating/applying/mixing with chemical additives (cement, lime, etc.). Excessively wet or dry material should either be removed or moisture conditioned and recompacted.

All exposed areas which will receive fill, once properly cleared, moisture conditioned, and benched, where necessary, should be compacted per the compaction requirements in this report. Compacted structural fill soils should then be placed in lifts and compacted to the proposed design grades and should be maintained until foundation and slab construction.

Existing Fill

As noted in **Geotechnical Characterization**, undocumented fill was encountered at the boring location that extended to a depth of approximately 2 feet below existing grades.

We have no records to indicate the degree of control, and consequently, the existing undocumented fill is considered unreliable for support of slab and foundation loads and should be removed in its entirety from the building addition envelope. Based on the soil boring, the undercut depth to remove the undocumented fill will be roughly 2 feet below existing grades, possible more.

Care should be taken to avoid undermining any of the existing structure and its foundations. This undercut should extend out at least 5-feet laterally beyond the building addition envelope. The Geotechnical Engineer should be on-site to monitor the undercut operation to ensure all undocumented fill is properly undercut and removed from the building addition envelope.

Excavation

We anticipate that excavations for the proposed construction can be accomplished with conventional earthmoving equipment. The bottom of excavations should be thoroughly cleaned of loose soils and disturbed materials prior to backfill placement and/or construction.

Fill Material Types

Fill required to achieve design grade should be classified as structural fill and general fill. Structural fill is material used below or within 5 feet of structures. General fill is material used to achieve grade outside of these areas (green areas).

Reuse of On-Site Soil: Generally, excavated on-site soil can be used as general fill, but is not considered suitable for reuse as structural fill. Structural fill required for this project will likely need to be imported and should be included in the project's budget.

Material property requirements for on-site soil for use as general fill and structural fill are noted in the following table:

Property	General Fill	Structural Fill
Composition	Free of deleterious material	Free of deleterious material
Maximum particle size	6 inches (or 2/3 of the lift thickness)	2 inches
Fines content	Not limited	Less than 25% Passing No. 200 sieve
Plasticity	Not limited	Maximum plasticity index of 6
On-site soils Expected to be Suitable ¹	All soils	Some SM

1. Based on subsurface exploration. Actual material suitability should be determined in the field at time of construction.

Imported Fill Materials: Imported fill materials should meet the following material property requirements. Regardless of its source, compacted fill should consist of approved materials that are free of organic matter and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade.

Soil Type ¹	USCS Classification	Acceptable Parameters (for Structural Fill)
Granular	GW, GP, GM, GC, SW, SP, SP-SM, SM	Liquid Limit less than 25% Plasticity index less than 6% Less than 25% passing No. 200 sieve

1. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation prior to use on this site.

Fill Placement and Compaction Requirements

Structural and general fill should meet the following compaction requirements.

Item	General Fill ¹	Structural Fill ¹
Maximum Lift Thickness	Same as borrow/structural fill	8 inches or less in loose thickness when heavy, self-propelled compaction equipment is used. 4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is used.
Minimum Compaction Requirements²	92% of max.	98% of the maximum dry density
Water Content Range²	As required to achieve min. compaction requirements.	±2 percentage points of optimum

1. Any fill placed within the building envelopes (including 5 feet laterally beyond the building envelopes) should meet the requirements stipulated in this report for structural fill material. General fill is material used to achieve grade outside of these areas, such as landscaped areas (green areas).
2. Maximum density and optimum water content as determined by the Standard Proctor test (ASTM D 698).

Utility Trench Backfill

Any soft or unsuitable materials encountered at the bottom of utility trench excavations should be removed and replaced with structural fill or bedding material in accordance with public works specifications for the utility to be supported. This recommendation is particularly applicable to utility work requiring grade control and/or in areas where subsequent grade raising could cause settlement in the subgrade supporting the utility. Trench excavation should not be conducted below a downward 1:1 projection from existing foundations without engineering review of shoring requirements and geotechnical observation during construction.

Trench backfill should be mechanically placed and compacted as discussed earlier in this report. Compaction of initial lifts should be accomplished with hand-operated tampers or other lightweight compactors. Where trenches are placed beneath slabs or footings, the backfill should satisfy the gradation and expansion index requirements of structural fill discussed in this report. Flooding or jetting for placement and compaction of backfill is not recommended.

For low permeability subgrades, utility trenches are a common source of water infiltration and migration. Utility trenches penetrating beneath the building should be effectively sealed to restrict water intrusion and flow through the trenches, which could migrate below the building. The trench should provide an effective trench plug that extends at least 5 feet from the face of the building exterior. The plug material should consist of cementitious flowable fill or low permeability clay. The trench plug material should be placed to surround the utility line. If used, the clay trench plug material should be placed and compacted to comply with the water content and compaction recommendations for structural fill stated previously in this report.

Grading and Drainage

All grades must provide effective drainage away from the building during and after construction and should be maintained throughout the life of the structure. Water retained next to the building can result in soil movements greater than those discussed in this report. Greater movements can result in unacceptable differential floor slab and/or foundation movements, cracked slabs and walls, and roof leaks. The roof should have gutters/drains with downspouts that discharge onto splash blocks at a distance of at least 10 feet from the building.

Exposed ground should be sloped and maintained at a minimum 5% away from the building for at least 10 feet beyond the perimeter of the building. Locally, flatter grades may be necessary to transition ADA access requirements for flatwork. After building construction and landscaping have been completed, final grades should be verified to document effective drainage has been achieved. Grades around the structure should also be periodically inspected and adjusted, as necessary, as part of the structure's maintenance program. Where paving or flatwork abuts the structure, a maintenance program should be established to effectively seal and maintain joints and prevent surface water infiltration.

Earthwork Construction Considerations

Shallow excavations for the proposed structure are anticipated to be accomplished with conventional construction equipment. Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction of grade-supported improvements such as floor slabs. Construction traffic over the completed subgrades should be avoided. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. Water collecting over or adjacent to construction areas should be removed. If the subgrade freezes, desiccates, saturates, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted prior to floor slab construction.

The groundwater table could affect excavation efforts, especially for overexcavation and replacement of lower strength soils. A temporary dewatering system consisting of sumps with pumps may be necessary to achieve the recommended depth of excavation or overexcavation depending on groundwater or temporary perched water conditions at the time of construction.

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, "Excavations" and its appendices, and in accordance with any applicable local and/or state regulations.

Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming responsibility for construction site safety or the contractor's activities; such responsibility shall neither be implied nor inferred.

Excavations or other activities resulting in ground disturbance have the potential to affect adjoining properties and structures. Our scope of services does not include review of available final grading information or consider potential temporary grading performed by the contractor for potential effects such as ground movement beyond the project limits. A preconstruction/ precondition survey should be conducted to document nearby property/infrastructure prior to any site development activity. Excavation or ground disturbance activities adjacent or near property lines should be monitored or instrumented for potential ground movements that could negatively affect adjoining property and/or structures.

Construction Observation and Testing

The earthwork efforts should be observed by the Geotechnical Engineer (or others under their direction). Observation should include documentation of adequate removal of surficial materials (vegetation, topsoil, and undocumented fill), as well as proofrolling and mitigation of unsuitable areas delineated by the proofroll.

Each lift of compacted fill should be tested, evaluated, and reworked, as necessary, as recommended by the Geotechnical Engineer prior to placement of additional lifts. Each lift of fill should be tested for density and water content at a frequency of at least one test for every 2,000 square feet of compacted fill in the building areas (minimum 3 tests per lift). Where not specified by local ordinance, one density and water content test should be performed for every 100 linear feet of compacted utility trench backfill and a minimum of one test performed for every 12 vertical inches of compacted backfill.

In areas of foundation excavations, the bearing subgrade should be evaluated by the Geotechnical Engineer or his representative. Specifically, the inspector should perform hand auger borings in the base of the footings to confirm the bearing soils are consistent with those presented in this report. If unanticipated conditions are observed, the Geotechnical Engineer should prescribe mitigation options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer’s evaluation of subsurface conditions, including assessing variations and associated design changes.

Shallow Foundations

If the site has been prepared in accordance with the requirements noted in **Earthwork**, the following design parameters are applicable for shallow foundations.

Design Parameters – Compressive Loads

Item	Description
Maximum Net Allowable Bearing Pressure ^{1, 2}	2,000 psf
Required Bearing Stratum ³	Undisturbed native soils or structural fill extending to undisturbed native soils
Minimum Wall Footing Width	24 inches
Minimum Embedment Below Finished Grade ⁴	30 inches
Estimated Total Settlement from Structural Loads ²	Less than about 1-inch
Estimated Differential Settlement ^{2, 5}	Lean than ½ inch

1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. Values assume that exterior grades are no steeper than 20% within 10 feet of structure.
2. Values provided are for maximum loads noted in **Project Description**. Additional geotechnical consultation will be necessary if higher loads are anticipated.
3. Unsuitable (including undocumented fill) or soft soils should be over-excavated and replaced per the recommendations presented in **Earthwork**.
4. Embedment necessary to minimize the effects of shrink-swell, frost and/or seasonal water content variations. For sloping ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal feet of the structure.
5. Differential settlements are noted for equivalent-loaded foundations and bearing elevation as measured over a span of 50 feet.

Construction Adjacent to Existing Building

Differential settlement between the new addition and the existing building is expected to approach the magnitude of the total settlement of the addition. Expansion joints should be provided between the existing building and the proposed addition to accommodate differential movements between the two structures. Underground piping between the two structures should be designed with flexible couplings and utility knockouts in foundation walls should be oversized so minor deflections in alignment do not result in breakage or distress. Care should be taken during excavation adjacent to existing foundations to avoid disturbing existing foundation bearing soils.

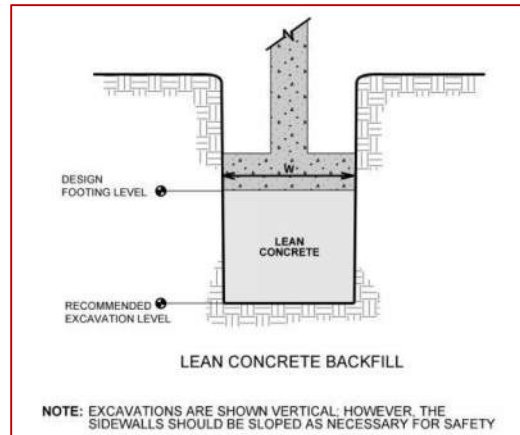
New footings should bear at or near the bearing elevation of immediately adjacent existing foundations. Depending upon their locations and current loads on the existing footings, footings for the new addition could cause settlement of adjacent walls resulting in separation of the mortar joints and cracking of the brick veneer or possibly unevenness of the slab. This would be expected to be more notable at the interface of the new and existing foundations/slab.

Foundation Construction Considerations

As noted in **Earthwork**, the footing excavations should be evaluated under the observation of the Geotechnical Engineer. The base of all foundation excavations should be free of water and loose soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the footing excavations should be removed/reconditioned before foundation concrete is placed.

Sensitive soils exposed at the surface of footing excavations may require surficial compaction with hand-held dynamic compaction equipment prior to placing structural fill, steel, and/or concrete. Should surficial compaction not be adequate, construction of a working surface consisting of either crushed stone or a lean concrete mud mat may be required prior to the placement of reinforcing steel and construction of foundations.

If unsuitable bearing soils are observed at the base of the planned footing excavation, the excavation should be extended deeper to suitable soils, and the footings could bear directly on these soils at the lower level or on lean concrete backfill placed in the excavations. The lean concrete replacement zone is illustrated on the following sketch.



Floor Slabs

Design parameters for floor slabs assume the requirements for **Earthwork** have been followed. Specific attention should be given to positive drainage away from the structure and positive drainage of the porous fill beneath the floor slab.

Existing undocumented fill material was observed at the site to a depth of approximately 2 feet below existing grades. As previously described, all existing undocumented fill is to be removed in its entirety from the building addition envelope (and 5-foot offsets).

Floor Slab Design Parameters

Item	Description
Floor Slab Support¹	Use at least 4 inches of relatively clean, compacted, poorly graded sand (SP) or gravel (GP), with less than 5% passing the No. 200 Sieve (0.074 mm). Subgrade compacted to recommendations in Earthwork .
Estimated Modulus of Subgrade Reaction²	100 pounds per square inch per inch (psi/in) for point loads.

1. Floor slabs should be structurally independent of building footings or walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation.
2. Modulus of subgrade reaction is an estimated value based upon our experience with the subgrade condition, the requirements noted in **Earthwork**, and the floor slab support as noted in this table. It is provided for point loads. For large area loads the modulus of subgrade reaction would be lower.

The use of a vapor retarder should be considered beneath concrete slabs on grade covered with wood, tile, carpet, or other moisture sensitive or impervious coverings, when the project includes humidity-controlled areas, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

Saw-cut contraction joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations, refer to the ACI Design Manual. Joints or cracks should be sealed with a waterproof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

Where floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or floor slab cracks beyond the length of the structural dowels. The Structural Engineer should account for potential differential settlement through use of sufficient control joints, appropriate reinforcing or other means.

Mitigation measures, as noted in **Existing Fill** within **Earthwork**, are critical to the performance of floor slabs. In addition to the mitigation measures, the floor slab can be stiffened by adding steel reinforcement, grade beams, and/or post-tensioned elements.

Floor Slab Construction Considerations

Finished subgrade, within and for at least 10 feet beyond the floor slab, should be protected from traffic, rutting, or other disturbance and maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become damaged or desiccated prior to construction of floor slabs, the affected material should be removed, and structural fill should be added to replace the resulting excavation. Final conditioning of the finished subgrade should be performed immediately prior to placement of the floor slab support course.

The Geotechnical Engineer should observe the condition of the floor slab subgrades immediately prior to placement of the floor slab support course, reinforcing steel, and concrete. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

General Comments

Our analyses and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

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Security Vestibule Addition – Richard T. Yates Elementary School | Newport News, VA
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Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly effect excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety and cost estimating including excavation support and dewatering requirements/design are the responsibility of others. Construction and site development have the potential to affect adjacent properties. Such impacts can include damages due to vibration, modification of groundwater/surface water flow during construction, foundation movement due to undermining or subsidence from excavation, as well as noise or air quality concerns. Evaluation of these items on nearby properties are commonly associated with contractor means and methods and are not addressed in this report. The owner and contractor should consider a preconstruction/precondition survey of surrounding development. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

Geotechnical Engineering Report

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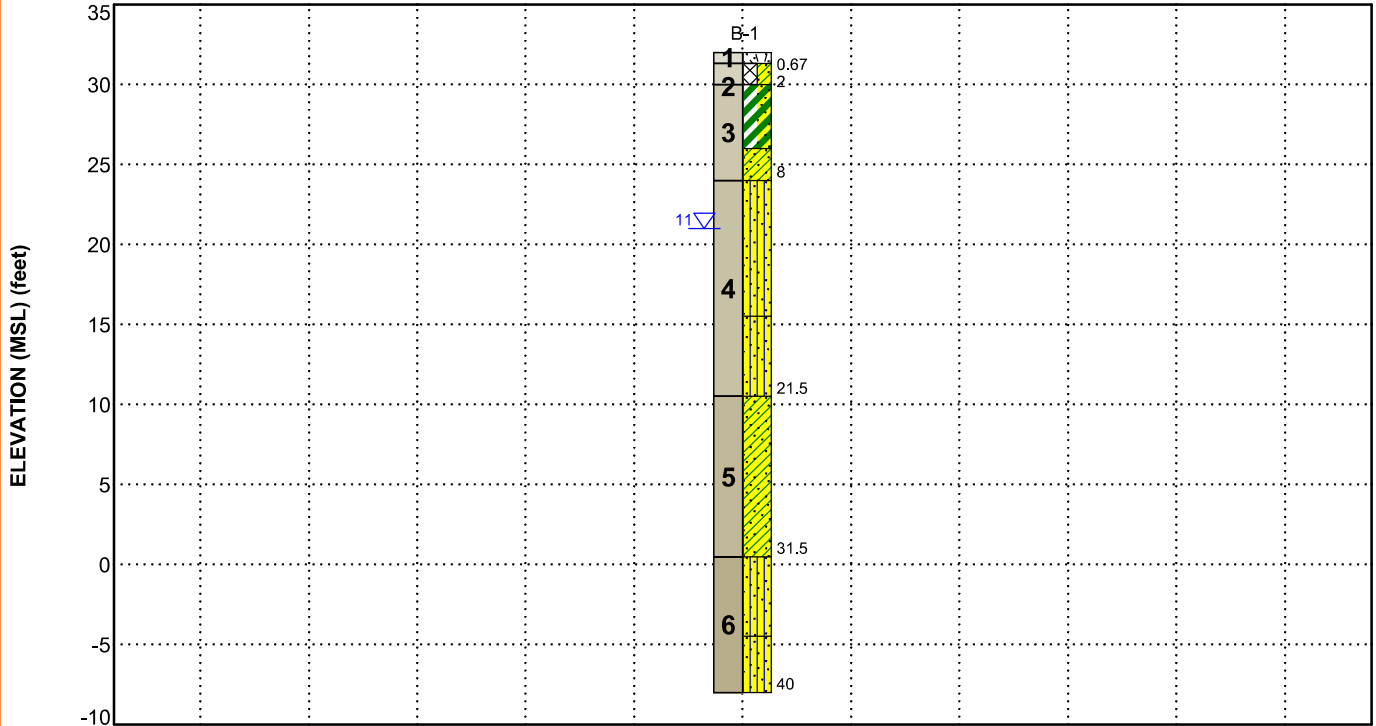
Figures

Contents:

GeoModel

GEOMODEL

Security Vestibule Addition - Richard T. Yates Elementary School ■ Newport News, VA
 Terracon Project No. K4245013



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

LEGEND

- Topsoil
- Sandy Lean Clay
- Fat Clay with Sand
- Silty Sand

Model Layer	Layer Name	General Description
1	TOPSOIL	8-in of Topsoil
2	FILL	Sandy lean Clay (CL) with trace fibrous organic material
3	UPPER CLAY	Fat and lean Clay (CH, CL)
4	UPPER SAND	Silty Sand (SM) with trace fibrous organic material
5	LOWER CLAY	Lean Clay (CL) with trace fibrous organic material
6	LOWER SAND	Silty Sand (SM)

NOTES:
 Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project.

First Water Observation

The groundwater levels shown are representative of the date and time of our exploration. Significant changes are possible over time. Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

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Attachments

Exploration and Testing Procedures

Field Exploration

Number of Borings	Approximate Boring Depth (feet)	Location
1	40	Security Vestibule Addition Footprint

Boring Layout and Elevations: Terracon personnel provided the boring layout using handheld GPS equipment (estimated horizontal accuracy of about ±10 feet) and referencing existing site features. Approximate ground surface elevation was obtained by interpolation of elevations provided on the City of Newport News Online GIS Viewer. If elevation and a more precise boring layout are desired, we recommend the boring location be surveyed.

Subsurface Exploration Procedures: The SPT boring was performed with a track-mounted, rotary drill rig using rotary wash “mud” drilling procedures. The tests were performed continuously from the existing ground surface to a depth of 12-feet, and at 5-foot intervals thereafter starting at a depth of 13-feet. The soil samples were obtained with a standard 1.4” I.D., 2” O.D., 30” long split-spoon sampler. The sampler was driven with blows of a 140 lb. hammer falling 30 inches, using an automatic hammer. The number of blows required to drive the sampler each 6-inch increment of penetration was recorded and is shown on the boring logs. The sum of the second and third penetration increments is termed the SPT N-value (uncorrected for automatic hammer). A representative portion of each disturbed split-spoon sample was collected, placed in a glass jar, sealed, labeled, and returned to our laboratory for review. The borehole was backfilled upon completion with the drilling spoils.

We also observed the borehole while drilling and at the completion of drilling for the presence of groundwater. The groundwater level encountered at the time of drilling is shown on the attached boring log.

The sampling depth, penetration distances, and other sampling information was recorded on the boring log. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a geologist. The final boring log represents the geologist's interpretation of the soils and include modifications based on observations and tests of the samples in our laboratory.

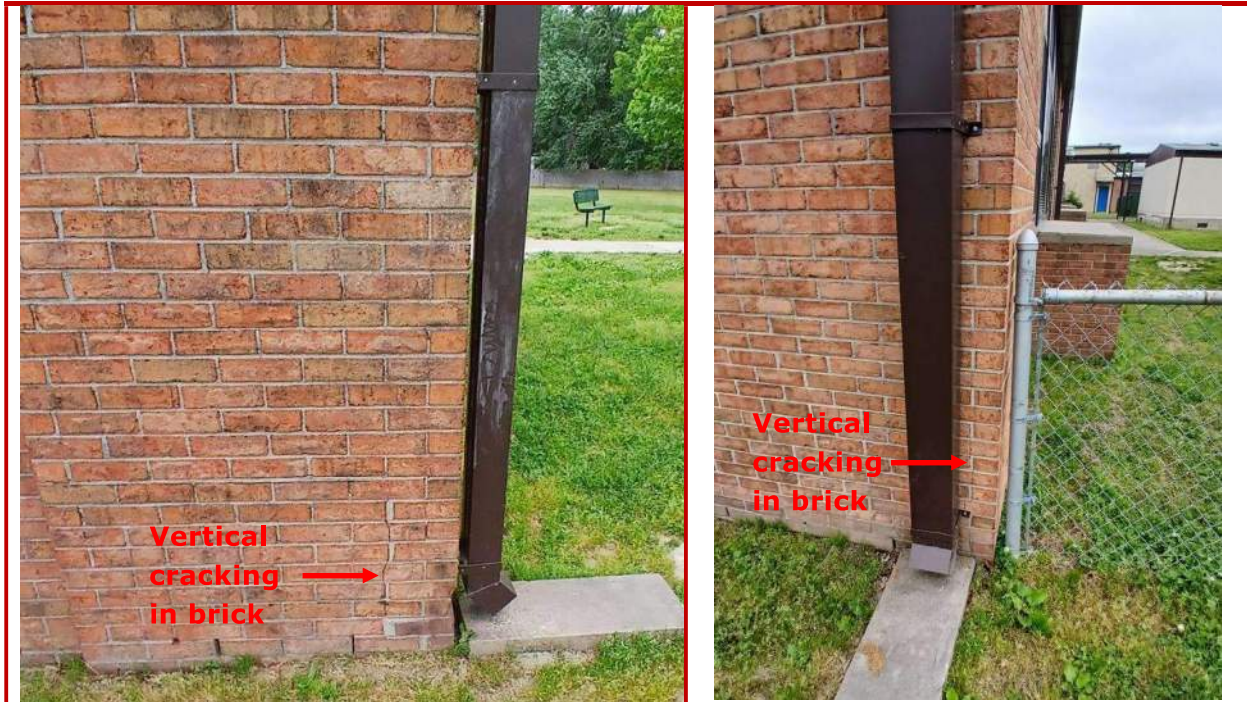
Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests. The laboratory testing program included the following types of tests:

- Moisture Content
- Sieve Analysis
- Atterberg Limits

The laboratory testing program often included examination of soil samples by an engineer. Based on the results of our field and laboratory programs, we described and classified the soil samples in accordance with the Unified Soil Classification System.

Photography Log



Pictures illustrating minor cracking observed near building corners.



Pictures illustrating minor cracking observed near building corners.

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Site Location and Exploration Plans

Contents:

Site Location Plan
Exploration Plan

Note: All attachments are one page unless noted above.

Site Location

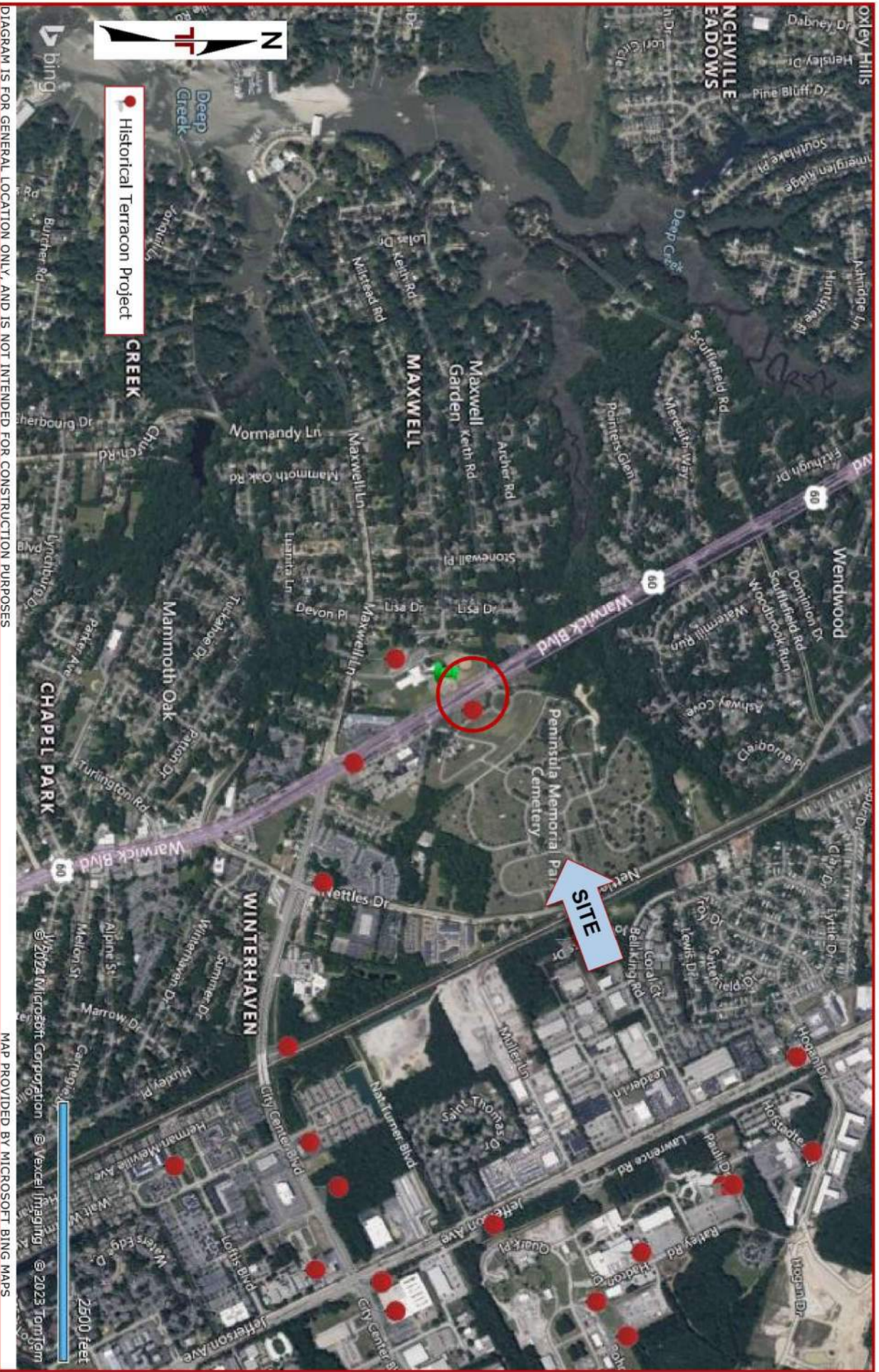
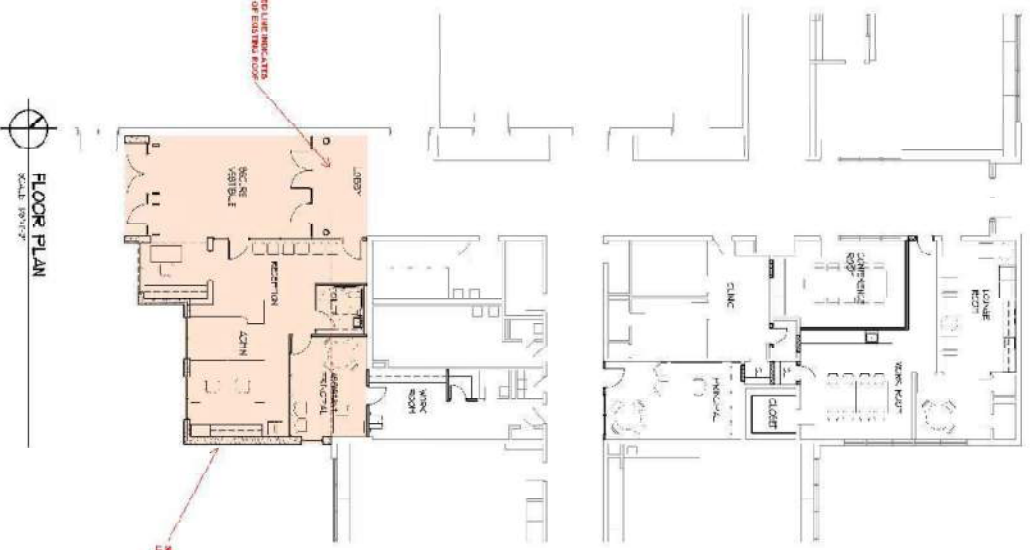
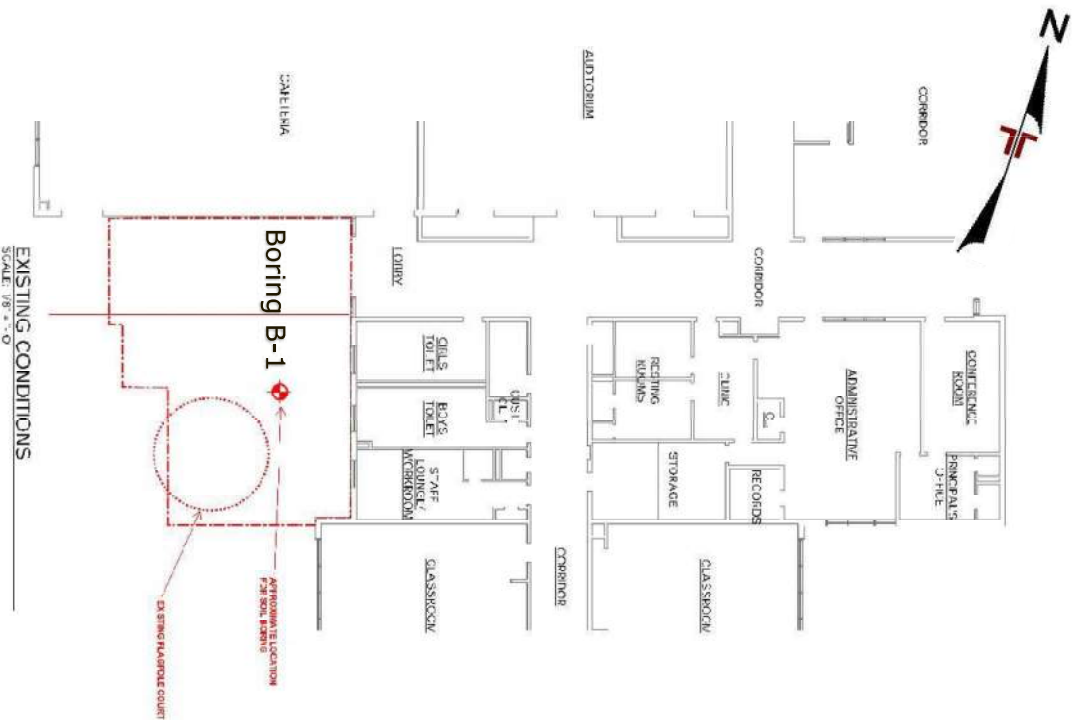


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Exploration Plan



A0.01

SCHEMATIC DESIGN
 NOT TO BE USED
 FOR CONSTRUCTION
 JOB NUMBER 2312

□ □ □
 FLOOR PLAN

□ □ □
 REVISION: 1.2024

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 YATES BY SECURITY
 VESTIBULE STUDY
 217000 - 15.000000 - 000

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 MUDSON/ASSOCIATES
 ARCHITECTS
 10000 - 15.000000 - 000

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

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Exploration and Laboratory Results

Contents:

- Boring Log (2 pages)
- Summary of Laboratory Results

Note: All attachments are one page unless noted above.

Boring Log No. B-1

Graphic Log	Location: See Exploration Plan		Depth (Ft.)	Water Level Observations	Sample Type	Recovery (In.)	Field Test Results	Water Content (%)	Atterberg Limits		
	Latitude: 37.0898° Longitude: -76.5037°								LL-PL-PI	Percent Fines	
Depth (Ft.)		Elevation.: 32 (Ft.)									
0.7	TOPSOIL , 8-in of Topsoil		31.33								
2.0	FILL - SANDY LEAN CLAY (CL) , with trace fibrous organic material, brown, moist, soft		30			14	2-2-2-3 N=4				
6.0	FAT CLAY WITH SAND (CH) , orange-brown and light gray, moist, medium stiff to stiff		26			16	3-4-4-3 N=8	26.8	58-27-31	67	
8.0	SANDY LEAN CLAY (CL) , orange-brown, moist, stiff		24			20	5-6-5-4 N=11				
10.0	SILTY SAND (SM) , fine to medium grained, light brown to orange-brown, moist to wet, loose to medium dense		24			18	6-6-5-4 N=11				
11.0	Wet below 11-ft		24	▽		24	6-8-6-6 N=14				
15.0			15.5			18	1-1-5-6 N=6				
16.5	SILTY SAND (SM) , fine to medium grained, dark gray, wet, very loose		15.5			24	4-3-2-2 N=5				
20.0			20			24	1-0-1-0 N=1	28.0		27	
21.5	SANDY LEAN CLAY (CL) , with trace fibrous organic material, dark gray, wet, very soft		10.5			24	1-0-1-0 N=1				
25.0			25			24	2-0-1-0 N=1	37.0	33-21-12	65	

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (If any).
 See [Supporting Information](#) for explanation of symbols and abbreviations.
 Elevation Reference: Elevations were interpolated from Newport News Online GIS Viewer (Unknown Datum).

Notes

Water Level Observations
 ▽ At completion of drilling

Drill Rig
CME-55

Hammer Type
Automatic

Driller
Terracon

Advancement Method
mud wash "rotary"

Logged by
C. Hayes

Boring Started
04-04-2024

Boring Completed
04-04-2024

Abandonment Method
Boring backfilled with Auger Cuttings and/or Bentonite
Surface Capped with Asphalt

Boring Log No. B-1

Graphic Log	Location: See Exploration Plan Latitude: 37.0898° Longitude: -76.5037°	Depth (Ft.)	Water Level Observations	Sample Type	Recovery (In.)	Field Test Results	Water Content (%)	Atterberg Limits	
								LL-PL-PI	Percent Fines
	Depth (Ft.) Elevation.: 32 (Ft.)								
SANDY LEAN CLAY (CL), with trace fibrous organic material, dark gray, wet, very soft <i>(continued)</i>		30		24		0-0-2-4 N=2			
		31.5							
SILTY SAND (SM), with trace Clay, fine to medium grained, dark gray, wet, very loose		35		18		1-1-1-1 N=2			
		36.5							
SILTY SAND (SM), fine to medium grained, gray, wet, loose		40		24		1-2-3-2 N=5			
	Boring Terminated at 40 Feet	40							

<p>See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).</p> <p>See Supporting Information for explanation of symbols and abbreviations.</p> <p>Elevation Reference: Elevations were interpolated from Newport News Online GIS Viewer (Unknown Datum).</p>	<p>Water Level Observations At completion of drilling</p>	<p>Drill Rig CME-55</p> <p>Hammer Type Automatic</p> <p>Driller Terracon</p>
<p>Notes</p>	<p>Advancement Method mud wash "rotary"</p> <p>Abandonment Method Boring backfilled with Auger Cuttings and/or Bentonite Surface Capped with Asphalt</p>	<p>Logged by C. Hayes</p> <p>Boring Started 04-04-2024</p> <p>Boring Completed 04-04-2024</p>

SUMMARY OF LABORATORY RESULTS

BORING ID	Depth (Ft.)	Soil Classification USCS	Liquid Limit	Plastic Limit	Plasticity Index	% Fines	Water Content (%)
B-1	2-4	SANDY FAT CLAY(CH)	58	27	31	66.6	26.8
B-1	18-20					27.2	28.0
B-1	23-25	SANDY LEAN CLAY(CL)	33	21	12	64.9	37.0

PROJECT: Security Vestibule Addition - Richard T. Yates Elementary School

SITE: 73 Maxwell Lane
Newport News, VA



PH. 757-564-6452

FAX. 757-564-6453

PROJECT NUMBER: K4245013

CLIENT: Hudson + Associates Architects PLLC
Hampton, VA

EXHIBIT: B-1

Geotechnical Engineering Report

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
Supporting Information

Contents:

General Notes
Unified Soil Classification System
USDA Soil Survey (3 pages)

Note: All attachments are one page unless noted above.

General Notes

Sampling	Water Level	Field Tests
 Standard Penetration Test	 Water Level Initially Encountered  Water Level After a Specified Period of Time  Water Level After a Specified Period of Time  Cave In Encountered Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.	N Standard Penetration Test Resistance (Blows/Ft.) (HP) Hand Penetrometer (T) Torvane (DCP) Dynamic Cone Penetrometer UC Unconfined Compressive Strength (PID) Photo-Ionization Detector (OVA) Organic Vapor Analyzer

Descriptive Soil Classification

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

Location And Elevation Notes

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

Strength Terms

Relative Density of Coarse-Grained Soils (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		Consistency of Fine-Grained Soils (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Relative Density	Standard Penetration or N-Value (Blows/Ft.)	Consistency	Unconfined Compressive Strength Qu (tsf)	Standard Penetration or N-Value (Blows/Ft.)
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	Medium Stiff	0.50 to 1.00	4 - 8
Dense	30 - 50	Stiff	1.00 to 2.00	8 - 15
Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30
		Hard	> 4.00	> 30

Relevance of Exploration and Laboratory Test Results

Exploration/field results and/or laboratory test data contained within this document are intended for application to the project as described in this document. Use of such exploration/field results and/or laboratory test data should not be used independently of this document.

Unified Soil Classification System

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A				Soil Classification	
				Group Symbol	Group Name ^B
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	Gravels: More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels: Less than 5% fines ^C	Cu ≥ 4 and 1 ≤ Cc ≤ 3 ^E	GW	Well-graded gravel ^F
		Gravels with Fines: More than 12% fines ^C	Cu < 4 and/or [Cc < 1 or Cc > 3.0] ^E	GP	Poorly graded gravel ^F
			Fines classify as ML or MH	GM	Silty gravel ^{F, G, H}
		Sands: 50% or more of coarse fraction passes No. 4 sieve	Clean Sands: Less than 5% fines ^D	Fines classify as CL or CH	GC
	Cu ≥ 6 and 1 ≤ Cc ≤ 3 ^E			SW	Well-graded sand ^I
	Sands with Fines: More than 12% fines ^D		Cu < 6 and/or [Cc < 1 or Cc > 3.0] ^E	SP	Poorly graded sand ^I
			Fines classify as ML or MH	SM	Silty sand ^{G, H, I}
	Fine-Grained Soils: 50% or more passes the No. 200 sieve	Silts and Clays: Liquid limit less than 50	Inorganic:	PI > 7 and plots above "A" line ^J	CL
PI < 4 or plots below "A" line ^J				ML	Silt ^{K, L, M}
Organic:			$\frac{LL \text{ oven dried}}{LL \text{ not dried}} < 0.75$	OL	Organic clay ^{K, L, M, N} Organic silt ^{K, L, M, O}
			Silts and Clays: Liquid limit 50 or more	Inorganic:	PI plots on or above "A" line
PI plots below "A" line		MH			Elastic silt ^{K, L, M}
Organic:		$\frac{LL \text{ oven dried}}{LL \text{ not dried}} < 0.75$		OH	Organic clay ^{K, L, M, P} Organic silt ^{K, L, M, Q}
		Highly organic soils:		Primarily organic matter, dark in color, and organic odor	

^A Based on the material passing the 3-inch (75-mm) sieve.

^B If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

^C Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

^D Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

^E $Cu = \frac{D_{60}}{D_{10}}$ $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

^F If soil contains ≥ 15% sand, add "with sand" to group name.

^G If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

^H If fines are organic, add "with organic fines" to group name.

^I If soil contains ≥ 15% gravel, add "with gravel" to group name.

^J If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

^K If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

^L If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

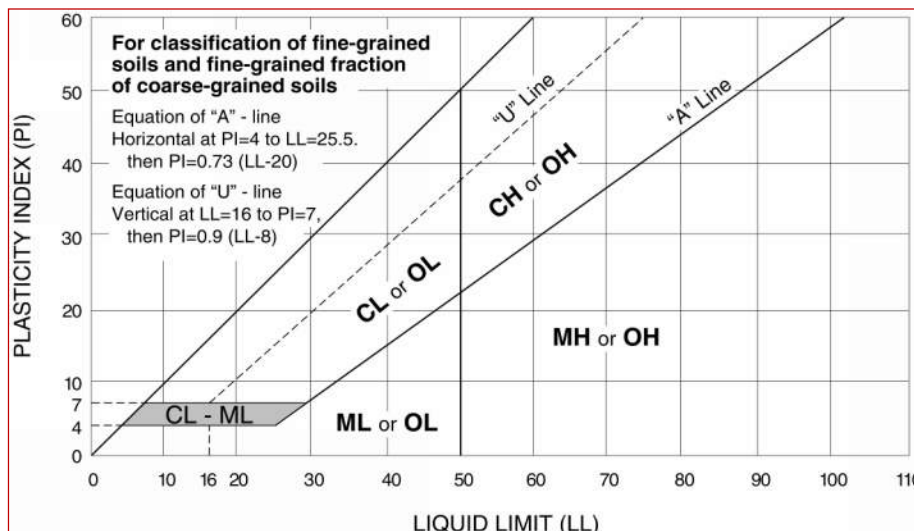
^M If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

^N PI ≥ 4 and plots on or above "A" line.

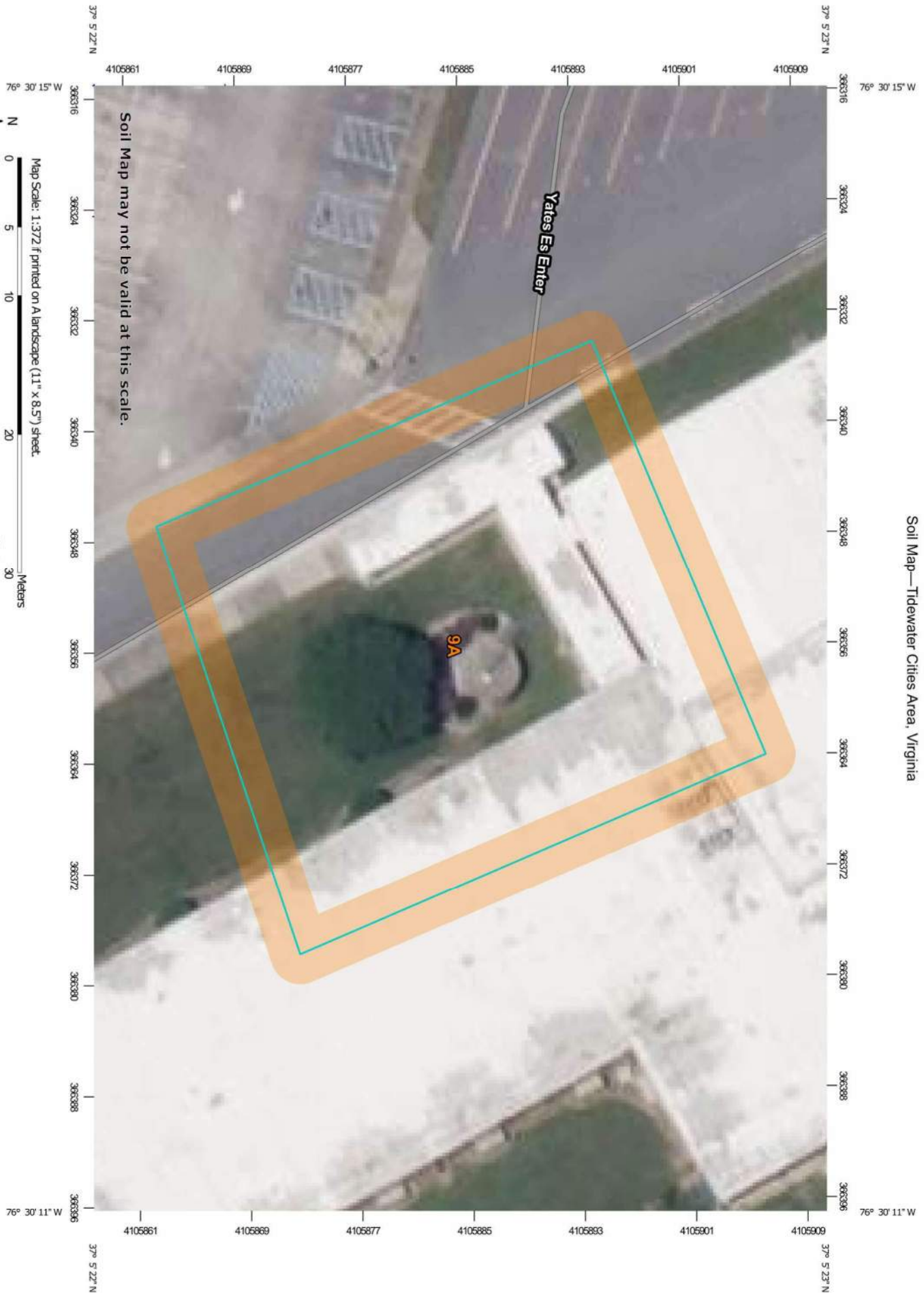
^O PI < 4 or plots below "A" line.

^P PI plots on or above "A" line.

^Q PI plots below "A" line.



Soil Map—Tidewater Cities Area, Virginia




























Map Scale: 1:372 if printed on A landscape (11" x 8.5") sheet.

0 5 10 20 30 60 90
Feet

0 5 10 20 30
Meters

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

	Area of Interest (AOI)		Spoil Area
	Area of Interest (AOI)		Stony Spot
Soils			Very Stony Spot
	Soil Map Unit Polygons		Wet Spot
	Soil Map Unit Lines		Other
	Soil Map Unit Points		Special Line Features
Special Point Features		Water Features	
	Blowout		Streams and Canals
	Borrow Pit	Transportation	
	Clay Spot		Rails
	Closed Depression		Interstate Highways
	Gravel Pit		US Routes
	Gravelly Spot		Major Roads
	Landfill		Local Roads
	Lava Flow	Background	
	Marsh or swamp		Aerial Photography
	Mine or Quarry		
	Miscellaneous Water		
	Perennial Water		
	Rock Outcrop		
	Saline Spot		
	Sandy Spot		
	Severely Eroded Spot		
	Sinkhole		
	Slide or Slip		
	Sodic Spot		

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Tidewater Cities Area, Virginia
 Survey Area Data: Version 21, Sep 5, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 21, 2022—Jul 13, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
9A	Craven-Urban land complex, 0 to 2 percent slopes	0.3	100.0%
Totals for Area of Interest		0.3	100.0%

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. The work under this Section applies thereto.

1.3 JOB CONDITIONS:

- A. Occupancy: Owner will **not** be occupying the building during the work during summer recess; however, any selective work permitted while school is in session shall be performed after-hours when there are no students inside the building.
- 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 in and adjacent to the work area with suitable coverings, including, but not less than "Ramboard" or similar and equal products.
 - 4. Provide temporary weather protection during interval between demolition and removal of existing construction on exterior surfaces, and installation of

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new construction to ensure that no water leakage or damage occurs to structure or interior areas of existing building.

5. Remove protections at completion of work. Restore existing flooring and wall surfaces to original condition.
- 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 roads, 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

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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.

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."
 - 2. Maintain electrical service to the existing well/water supply on-site.

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- 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 REMOVAL OF EXISTING ROOFING:

- A. At roof areas to be repaired or new roof top equipment installed remove the existing roofing system as indicated on the drawings. Removal shall include, but not be limited to roof insulation, wood blocking, flashings (unless otherwise noted) at edge flashings, roof top equipment and roof accessories and all other items incorporated therein. Contractor must repair, at his expense, any roof deck that he damages.
- B. **Remove only as much roofing as can be replaced with a completely new roof system and made watertight in a single day.**
- C. Clean all roof deck surfaces of loose material and other impediments that will be detrimental to application of the new materials.

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- D. Damaged deck shall be repaired before reroofing, in compliance with other requirements of these specifications.

3.5 ELECTRICAL DEMOLITION OF SPECIAL AND AUXILIARY SYSTEMS

- A. The Owner requires that the following items, where indicated on the demolition drawings to be removed shall be salvaged for reinstallation under new work where indicated on the Electrical Drawings, or be turned over to the Owner if they are not otherwise shown to be reinstalled:
 - 1. Existing fire alarm smoke detectors and ceiling strobe alarms.
 - 2. The cable modem and coaxial cabling located in the existing office – for television at a monitor. This shall be salvaged for reinstallation at a television to be located in the new Office.
 - 3. Existing ceiling-mounted speakers.
 - 4. Existing CCTV camera(s).
 - 5. Existing Wi-Fi emitters.
 - 6. Power poles (from the existing Main Office).
 - 7. Bogen console phones: one at the Public Address rack shall remain, and the one in the existing main office shall relocate to the new Office.
 - 8. Panic buttons: Two are located within the existing Main Office and these shall relocate to the new Office – one at a secretarial station and the other at the Principal's Office or as otherwise directed by the Owner.

3.6 SALVAGE OF SPECIFIC MATERIALS AND/OR ITEMS FOR REUSE OR TO TURN OVER TO THE OWNER

- A. The Owner requires that the following items, where indicated to be removed shall be salvaged and turned over to its personnel at the construction site:
 - 1. All existing door locks and locksets, including strike plates and screws.
 - 2. All existing door exit devices, including exterior handsets, pulls, strike plates and mounting screws.
 - 3. All existing exterior door closers, including mounting hardware and screws.
 - 4. Existing main office Reception Counter: This is to be salvaged, relocated to existing Classroom #29 (located in a portable outside the main school) and positioned where directed by the NNPS representative. This classroom shall serve as a temporary administrative office throughout duration of the work. Upon completion of the work and after staff's move into the new Addition, the Contractor shall remove and dispose of the reception counter.
 - 5. Mail cabinet at the Main Office (save for reinstallation under New Work).
 - 6. Dedication plaque at the existing Lobby shall remain in its current location unless directed to be relocated by the Owner.
 - 7. Precast concrete members at top of existing exterior planters (next to main entrance).
 - 8. Existing flagpole in front of school (if can be reinstalled in new location).

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3.7 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.

3.8 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 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes.
- B. Related Sections include the following:
 - 1. Division 2 Section "Earthwork" for drainage fill under slabs-on-grade.
 - 2. Division 2 Section "Cement Concrete Pavement" for concrete pavement and walks.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

1.4 SUBMITTALS

- A. Product Data: For each type of manufactured material and product indicated.
- B. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mix water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.
- D. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:

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- E. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
1. Cementitious materials and aggregates.
 2. Form materials and form-release agents.
 3. Steel reinforcement and reinforcement accessories.
 4. Fiber reinforcement.
 5. Admixtures.
 6. Waterstops.
 7. Curing materials.
 8. Floor and slab treatments.
 9. Bonding agents.
 10. Adhesives.
 11. Vapor retarders.
 12. Epoxy joint filler.
 13. Joint-filler strips.
 14. Repair materials.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed concrete Work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
1. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the 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-1 or an equivalent certification program.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.
- E. ACI Publications: Comply with the following, unless more stringent provisions are indicated:
1. ACI 301, "Specification for Structural Concrete."

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2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 1. Plywood, metal, or other approved panel materials.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- D. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- E. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of the exposed concrete surface.
 2. Furnish ties that, when removed, will leave holes not larger than 1 inch in diameter in concrete surface.
 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

2.3 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic,

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or precast concrete or fiber-reinforced concrete 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 or CRSI Class 2 stainless-steel bar supports.
- B. Joint Dowel Bars: Plain-steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.

2.4 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I/II.
- B. Normal-Weight Aggregate: ASTM C 33, uniformly graded, and as follows:
 1. Class: Moderate weathering region, but not less than 3M.
 2. Nominal Maximum Aggregate Size: 3/4 inch.
- C. Water: Potable and complying with ASTM C 94.

2.5 ADMIXTURES

- A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.
- B. Air-Entraining Admixture: ASTM C 260.
- C. Water-Reducing Admixture: ASTM C 494, Type A.
- D. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
- E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
- F. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

2.6 FIBER REINFORCEMENT

- A. Carbon-Steel Fiber: ASTM A 820, deformed, minimum 2.4 inches long, and have diameter or effective diameter indicated.
 1. Fiber: Type 1, cold-drawn wire.
 2. Fiber: Type 2, cut sheet.
 3. Fiber: Type 1, cold-drawn wire, or Type 2, cut sheet.
- B. Synthetic Fiber: Fibrillated polypropylene fibers engineered and designed for use in concrete, complying with ASTM C 1116, Type III, 1/2 to 1-1/2 inches long.

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- C. Synthetic Fiber: Fibrillated or monofilament polypropylene fibers engineered and designed for use in concrete, complying with ASTM C 1116, Type III, 1/2 to 1-1/2 inches long.
- D. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Carbon-Steel Fibers:
 - a. Dramix; Bekaert Corporation.
 - b. Fibercon; Fibercon International.
 - c. Zorex; Novocon International Inc.
 - 2. Fibrillated Fibers:
 - a. Fibrasol F; Axim Concrete Technologies.
 - b. Fibermesh; Fibermesh, Div. of Synthetic Industries.
 - c. Forta; Forta Corporation.
 - d. Grace Fibers; W. R. Grace & Co., Construction Products Div.
 - 3. Monofilament Fibers:
 - a. Fibrasol IIP; Axim Concrete Technologies.
 - b. Fiberstrand 100; Euclid Chemical Co.
 - c. Fibermix Stealth; Fibermesh, Div. of Synthetic Industries.
 - d. Forta Mono; Forta Corporation.
 - e. Grace MicroFiber; W. R. Grace & Co., Construction Products Div.
 - f. Hi-Tech PPM Fiber; Hi-Tech Fibers, Div. of Martin Color-Fi, Inc.
 - g. Polystrand 1000; Metalcrete Industries.

2.7 WATERSTOPS

- A. Flexible Rubber Waterstops: CE CRD-C 513, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
 - 1. Profile: Flat, dumbbell without center bulb.
- B. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
 - 1. Profile: Flat, dumbbell without center bulb.
- C. 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:

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- D. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Rubber Waterstops:
 - a. Greenstreak.
 - b. Progress Unlimited Inc.
 - c. Westec Barrier Technologies; Div. of Western Textile Products, Inc.
 - d. Williams Products, Inc.
 2. PVC Waterstops:
 - a. Greenstreak.
 - b. Meadows: W. R. Meadows, Inc.
 - c. Murphy: Paul Murphy Plastics Co.
 - d. Progress Unlimited Inc.
 - e. Sternson Group.
 - f. Tamms Industries Co.; Div. of LaPorte Construction Chemicals North America, Inc.
 - g. Vinylex Corporation.
 - h. Westec Barrier Technologies; Div. of Western Textile Products, Inc.
- E. Self-Expanding Strip Waterstops: Manufactured rectangular or trapezoidal strip, sodium bentonite or other hydrophylic material for adhesive bonding to concrete.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Volclay Waterstop-RX; Colloid Environmental Technologies Co.
 - b. Conseal CS-231; Concrete Sealants Inc.
 - c. Swellseal Joint; De Neef Construction Chemicals (U.S.) Inc.
 - d. Hydrotite; Greenstreak.
 - e. Mirastop; Mirafi Moisture Protection, Div. of Royal Ten Cate (USA), Inc.
 - f. Adeka Ultra Seal; Mitsubishi International Corporation.
 - g. Superstop; Progress Unlimited Inc.

2.8 VAPOR RETARDERS

- A. Vapor Retarder: ASTM E 1745, Class B, five-ply, nylon- or polyester-cord-reinforced, high-density polyethylene sheet; 10 mils thick.
- B. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a No. 4 sieve and 10 to 30 percent passing a No. 100 sieve; meeting deleterious substance limits of ASTM C 33 for fine aggregates.

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- C. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

2.9 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. dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Solvent-Borne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
- F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
- G. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 22 percent solids.
- H. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
- I. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
- J. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Evaporation Retarder:
 - a. Cimfilm; Axim Concrete Technologies.
 - b. Finishing Aid Concentrate; Burke Group, LLC (The).
 - c. Spray-Film; ChemMasters.
 - d. Aquafilm; Conspec Marketing & Manufacturing Co., Inc.
 - e. Sure Film; Dayton Superior Corporation.
 - f. Eucobar; Euclid Chemical Co.
 - g. Vapor Aid; Kaufman Products, Inc.
 - h. Lambco Skin; Lambert Corporation.
 - i. E-Con; L&M Construction Chemicals, Inc.
 - j. Confilm; Master Builders, Inc.
 - k. Waterhold; Metalcrete Industries.
 - l. Rich Film; Richmond Screw Anchor Co.
 - m. SikaFilm; Sika Corporation.

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- n. Finishing Aid; Symons Corporation.
 - o. Certi-Vex EnvioAssist; Vexcon Chemicals, Inc.
2. Clear, Solvent-Borne, Membrane-Forming Curing Compound:
- a. AH Clear Cure; Anti-Hydro International, Inc.
 - b. Spartan-Cote; Burke Group, LLC (The).
 - c. Spray-Cure & Seal 15; ChemMasters.
 - d. Conspec #1-15 percent solids; Conspec Marketing & Manufacturing Co., Inc.
 - e. Day-Chem Cure and Seal; Dayton Superior Corporation.
 - f. Diamond Clear; Euclid Chemical Co.
 - g. Nitocure S; Fosroc.
 - h. Cure & Seal 309; Kaufman Products Inc.
 - i. Lambco 120; Lambert Corporation.
 - j. L&M Dress & Seal 18; L&M Construction Chemicals, Inc.
 - k. CS-309; W. R. Meadows, Inc.
 - l. Seal N Kure; Metalcrete Industries.
 - m. Rich Seal 14 percent UV; Richmond Screw Anchor Co.
 - n. Kure-N-Seal; Sonneborn, Div. of ChemRex, Inc.
 - o. Flortec 14; Sternson Group.
 - p. Cure & Seal 14 percent; Symons Corporation.
 - q. Clear Seal 150; Tamms Industries Co., Div. of LaPorte Construction Chemicals of North America, Inc.
 - r. Acrylic Cure; Unifex.
 - s. Certi-Vex AC 309; Vexcon Chemicals, Inc.
3. Clear, Waterborne, Membrane-Forming Curing Compound:
- a. AH Clear Cure WB; Anti-Hydro International, Inc.
 - b. Klear Kote WB II Regular; Burke Chemicals.
 - c. Safe-Cure & Seal 20; ChemMasters.
 - d. High Seal; Conspec Marketing & Manufacturing Co., Inc.
 - e. Safe Cure and Seal; Dayton Superior Corporation.
 - f. Aqua Cure VOX; Euclid Chemical Co.
 - g. Cure & Seal 309 Emulsion; Kaufman Products Inc.
 - h. Glazecote Sealer-20; Lambert Corporation.
 - i. Dress & Seal WB; L&M Construction Chemicals, Inc.
 - j. Vocomp-20; W. R. Meadows, Inc.
 - k. Metcure; Metalcrete Industries.
 - l. Cure & Seal 150E; Nox-Crete Products Group, Kinsman Corporation.
 - m. Rich Seal 14 percent E; Richmond Screw Anchor Co.
 - n. Kure-N-Seal WB; Sonneborn, Div. of ChemRex, Inc.
 - o. Florseal W.B.; Sternson Group.
 - p. Cure & Seal 14 percent E; Symons Corporation.
 - q. Seal Cure WB 150; Tamms Industries Co., Div. of LaPorte Construction Chemicals of North America, Inc.

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- r. Hydro Seal; Unitex.
 - s. Starseal 309; Vexcon Chemicals, Inc.
4. Clear, Waterborne, Membrane-Forming Curing Compound, 18 to 22 Percent Solids:
- a. Klear Kote WB II 20 percent; Burke Chemicals.
 - b. Safe-Cure & Seal 20; ChemMasters.
 - c. Conspec 21; Conspec Marketing & Manufacturing Co., Inc.
 - d. Diamond Clear VOX; Euclid Chemical Co.
 - e. SureCure Emulsion; Kaufman Products Inc.
 - f. Glazecote Sealer-20; Lambert Corporation.
 - g. Dress & Seal WB; L&M Construction Chemicals, Inc.
 - h. Vocomp-20; W. R. Meadows, Inc.
 - i. Metcure 0800; Metalcrete Industries.
 - j. Cure & Seal 200E; Nox-Crete Products Group, Kinsman Corporation.
 - k. Rich Seal 18 percent E; Richmond Screw Anchor Co.
 - l. Kure-N-Seal W; Sonneborn, Div. of ChemRex, Inc.
 - m. Florseal W.B.; Sternson Group.
 - n. Cure & Seal 18 percent E; Symons Corporation.
 - o. Seal Cure WB STD; Tamms Industries Co., Div. of LaPorte Construction Chemicals of North America, Inc.
 - p. Hydro Seal 800; Unitex.
 - q. Starseal 0800; Vexcon Chemicals, Inc.
5. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound:
- a. Spray-Cure & Seal Plus; ChemMasters.
 - b. UV Super Seal; Lambert Corporation.
 - c. Lumiseal Plus; L&M Construction Chemicals, Inc.
 - d. CS-309/30; W. R. Meadows, Inc.
 - e. Seal N Kure 30; Metalcrete Industries.
 - f. Rich Seal 31 percent UV; Richmond Screw Anchor Co.
 - g. Cure & Seal 31 percent UV; Symons Corporation.
 - h. Certi-Vex AC 1315; Vexcon Chemicals, Inc.
6. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound:
- a. Klear-Kote Cure-Sealer-Hardener, 30 percent solids; Burke Group, LLC (The).
 - b. Polyseal WB; ChemMasters.
 - c. UV Safe Seal; Lambert Corporation.
 - d. Lumiseal WB Plus; L&M Construction Chemicals, Inc.
 - e. Vocomp-30; W. R. Meadows, Inc.
 - f. Metcure 30; Metalcrete Industries.
 - g. Vexcon Starseal 1315; Vexcon Chemicals, Inc.

2.10 RELATED MATERIALS

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- A. 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 and grade to suit requirements, and as follows:
 - 1. Type II, non-load bearing, for bonding freshly mixed concrete to hardened concrete.
 - 2. Types II, non-load bearing, and I for bonding hardened or freshly mixed concrete to hardened concrete.
 - 3. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.11 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
 - 4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Topping: Traffic-bearing, cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch.
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
 - 4. Compressive Strength: Not less than 5700 psi at 28 days when tested according to ASTM C 109/C 109M.

2.12 CONCRETE MIXES

- A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:

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1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.
 2. Proportion lightweight structural concrete according to ACI 211.2 and ACI 301.
- B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.
- C. Footings and Foundation Walls: Proportion normal-weight concrete mix as follows:
1. Compressive Strength (28 Days): 3000 psi.
 2. Maximum Slump: 4 inches.
 3. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8 inches after admixture is added to concrete with 2- to 4-inch slump.
- D. Slab-on-Grade: Proportion normal-weight concrete mix as follows:
1. Compressive Strength (28 Days): 3000 psi.
 2. Minimum Cementitious Materials Content: 520 lb/cu. yd.
 3. Maximum Slump: 4 inches.
- E. Cementitious Materials: For concrete exposed to deicers, limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements.
- F. 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.
 5. Silica Fume: 10 percent.
 6. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
 7. Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 50 percent portland cement minimum, with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
- G. Maximum Water-Cementitious Materials Ratio: 0.50 for concrete required to have low water permeability.

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- H. Maximum Water-Cementitious Materials Ratio: 0.40 for corrosion protection of steel reinforcement in concrete exposed to chlorides from deicing chemicals, salt, saltwater, brackish water, seawater, or spray from these sources.
- I. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 2 to 4 percent, unless otherwise indicated.
- J. Do not air entrain concrete to trowel-finished interior floors and suspended slabs. Do not allow entrapped air content to exceed 3 percent.
- K. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- L. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1 lb/cu. yd.
- M. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) 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, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
 - 4. Use corrosion-inhibiting admixture in concrete mixes where indicated.

2.13 FABRICATING REINFORCEMENT

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

2.14 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.
 - 1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least one and one-half minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.

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2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix 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 concrete 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. Construct forms tight enough to prevent loss of concrete mortar.
- D. 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. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.
 1. Do not use rust-stained steel form-facing material.
- E. 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.
- F. 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.
- G. Chamfer exterior corners and edges of permanently exposed concrete.
- H. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- I. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- J. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

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- K. 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.
 - 1. Install anchor bolts, accurately located, to elevations required.
 - 2. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.3 SHORES AND RESHORES

- A. Comply with ACI 318, ACI 301, and recommendations in ACI 347R for design, installation, and removal of shoring and reshoring.

3.4 VAPOR RETARDERS

- A. Vapor Retarder: Place, protect, and repair vapor-retarder sheets according to ASTM E 1643 and manufacturer's written instructions.
- B. Fine-Graded Granular Material: Cover vapor retarder with fine-graded granular material, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus 3/4 inch.
- C. Granular Fill: Cover vapor retarder with granular fill, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus 3/4 inch.
 - 1. Place and compact a 1/2-inch- thick layer of fine-graded granular material over granular fill.

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.

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- 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 fabric 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. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- 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. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- 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.

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- E. Dowel Joints: Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated.
 - 1. Use dowel sleeves or lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 WATERSTOPS

- A. Flexible Waterstops: Install in construction joints as indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of Work. Field-fabricate joints in waterstops according to manufacturer's written instructions.
- B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, bonding or mechanically fastening and firmly pressing into place. Install in longest lengths practicable.

3.8 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 placing concrete, water may be added at Project site, subject to limitations of ACI 301.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mix.
- C. Deposit concrete continuously or in 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 specified. Deposit concrete to avoid segregation.
- 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, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

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- 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 air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
 - 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 mix designs.

- F. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:
 - 1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 - 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.9 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ACI 347R limits for class of surface specified.
- 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 defective areas. Remove fins and other projections exceeding 1/8 inch in height.
 - 1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.
 - 2. Do not apply rubbed finish to smooth-formed finish.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of

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formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.10 FINISHING FLOORS AND SLABS

- A. General: Comply with recommendations in ACI 302.1R for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes.
 - 1. Apply scratch finish to surfaces indicated and to surfaces to receive concrete floor topping or mortar setting beds for ceramic or quarry tile, portland cement terrazzo, and other bonded cementitious floor finishes.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- D. Trowel Finish: After applying float finish, apply first trowel finish 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 indicated and to floor and slab 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
 - 2. Finish and measure surface so gap at any point between concrete surface and an unlevelled freestanding 10-foot- long straightedge, resting on two high spots and placed anywhere on the surface, does not exceed the following:
 - a. 3/16 inch .
- E. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

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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.
- G. Mineral Dry-Shake Floor Hardener Finish: After initial floating, apply mineral dry-shake materials to surfaces according to manufacturer's written instructions and as follows:
 1. Uniformly apply mineral dry-shake materials at a rate of 100 lb/100 sq. ft., unless greater amount is recommended by manufacturer.
 2. Uniformly distribute approximately two-thirds of mineral dry-shake materials over surface by hand or with mechanical spreader, and embed by power floating. Follow power floating with a second mineral dry-shake application, uniformly distributing remainder of material, and embed by power floating.
 3. After final floating, apply a trowel finish. Cure concrete with curing compound recommended by dry-shake material manufacturer and apply immediately after final finishing.

3.11 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 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 of manufacturer furnishing machines and equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.12 CONCRETE PROTECTION 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 with recommendations in ACI 305R 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 before and during finishing operations. Apply according to manufacturer's written

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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 by one or a combination of the following methods:
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, 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 lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period 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 recommends for use with floor coverings.
 - 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.
 - 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.

3.13 LIQUID FLOOR TREATMENTS

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- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
 - 1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 - 2. Do not apply to concrete that is less than seven days old.
 - 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.
- B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.14 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 six 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 epoxy joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.15 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 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding

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- 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 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 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 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 3/4 inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix 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 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

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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.

3.16 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.
- B. Testing Services: 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 one composite sample for each day's pour of each concrete mix exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 - 2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
 - 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
 - 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
 - 5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
 - 6. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.
 - a. Cast and field cure one set of four standard cylinder specimens for each composite sample.
 - 7. Compressive-Strength Tests: ASTM C 39; test two laboratory-cured specimens at 7 days and two at 28 days.
 - a. Test two field-cured specimens at 7 days and two at 28 days.

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- b. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.
- C. 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.
- D. Strength of each concrete mix 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.
- E. 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 mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.
- F. 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.
- G. 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 or by other methods as directed by Architect.

END OF SECTION 033000

SECTION 034500 - PRECAST ARCHITECTURAL 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. Section Includes:

- 1. Architectural precast concrete masonry accent units.

- B. Related Requirements:

- 1. Section 033000 "Cast-in-Place Concrete" for installing connection anchors in concrete.
 - 2. Section 042000 "Unit Masonry" for unit masonry and brick veneer upon which precast watertable/sills shall bear.
 - 3. Section 076200 "Sheet Metal Flashing and Trim" for metal flashings beneath adjacent construction that extend over top of watertable/sills.
 - 4. Section 079200 "Joint Sealants" for joint sealants used at precast concrete watertable/sills.

1.3 DEFINITIONS

- A. Design Reference Sample: Sample of approved architectural precast concrete color, finish and texture, preapproved by Architect.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each precast concrete mixture. Include compressive strength and water-absorption tests.
- C. Shop Drawings:

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1. Detail fabrication and installation of architectural precast concrete units.
2. Indicate locations, plans, elevations, dimensions, shapes, and cross sections of each unit.
3. Indicate joints, reveals, drips, chamfers, and extent and location of each surface finish.
4. Indicate details at building corners.
5. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
6. Indicate relationship of architectural precast concrete units to adjacent materials.

- D. Samples: Design reference samples for initial verification of design intent, for each type of finish indicated on exposed surfaces of architectural precast concrete units, in sets of three, representative of finish, color, and texture variations expected; approximately 12 by 12 by 2 inches (300 by 300 by 50 mm).

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.
- B. Material Certificates: For the following items:
1. Cementitious materials.
 2. Reinforcing materials and prestressing tendons.
 3. Admixtures.

1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm that assumes responsibility for engineering architectural precast concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings.
- B. Sample Units: After sample approval and before fabricating architectural precast concrete units, produce a minimum of two sample units not more than four (4) feet long or shorter than 3 feet in length for review by Architect. Incorporate full-scale details of architectural features, finishes, textures, and transitions in sample panels.
1. Units may be incorporated into the work.
 2. Locate panels where indicated or, if not indicated, as directed by Architect.
 3. After acceptance of repair technique, maintain one (1) sample panel at manufacturer's plant and one at Project site in an undisturbed condition as a standard for judging the completed Work.

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1.8 COORDINATION

- A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver architectural precast concrete units in such quantities and at such times to limit unloading units temporarily on the ground or other rehandling.
- B. Support units during shipment on nonstaining shock-absorbing material.
- C. Store units with adequate dunnage and bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.
- D. Place stored units so identification marks are clearly visible, and units can be inspected.
- E. Handle and transport units in a manner that avoids excessive stresses that cause cracking or damage.
- F. Lift and support units only at designated points indicated on Shop Drawings.

PART 2 - PRODUCTS

- A. Design Standards: Comply with ACI 318 (ACI 318M) and design recommendations of PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of architectural precast concrete units indicated.
- B. Structural Performance: Provide architectural precast concrete units and connections capable of withstanding the following design conditions indicated:
 - 1. Design precast concrete units and connections to maintain clearances at openings, to allow for fabrication and construction tolerances, shrinkage and creep of primary building structure, and other building movements as follows:
 - a. Upward and downward movement of 1/2 inch (13 mm).
 - 2. Thermal Movements: Provide for in-plane thermal movements resulting from annual ambient temperature changes of 80 deg F (26 deg C).

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2.2 MOLD MATERIALS

- A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that provides continuous and true precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.
 - 1. Mold-Release Agent: Commercially produced form-release agent that does not bond with, stain or adversely affect precast concrete surfaces and does not impair subsequent surface or joint treatments of precast concrete.
- B. Form Liners: Units of face design, texture, arrangement, and configuration to match those used for the approved precast concrete design reference sample. Use with manufacturer's recommended form-release agent that does not bond with, stain, or adversely affect precast concrete surfaces and does not impair subsequent surface or joint treatments of precast concrete.
- C. Surface Retarder: Chemical set retarder, capable of temporarily delaying final hardening of newly placed concrete mixture to depth of reveal specified.

2.3 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A615/A615M, Grade 60 (Grade 420), deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A706/A706M, deformed.
- C. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 117.

2.4 CONCRETE MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I or Type III, white or off-white, unless otherwise indicated.
 - 1. For surfaces exposed to view in finished structure, use white cement, of same type, brand, and mill source.
- B. Supplementary Cementitious Materials:
 - 1. Fly Ash: ASTM C618, Class C or F, with maximum loss on ignition of 3 percent.
 - 2. Metakaolin: ASTM C618, Class N.
 - 3. Silica Fume: ASTM C1240, with optional chemical and physical requirement.
 - 4. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120.
 - 5. Blended Hydraulic Cement: ASTM C595, Type IP, portland-pozzolan or Type I (PM), pozzolan-modified portland cement.

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- C. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C33/C33M, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.
- D. Lightweight Aggregates: Except as modified by PCI MNL 117, ASTM C330/C330M, with absorption less than 11 percent.
- E. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.
- F. Air-Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures.
- G. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.
 - 1. Water-Reducing Admixtures: ASTM C494/C494M, Type A.
 - 2. Retarding Admixture: ASTM C494/C494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
 - 4. Water-Reducing and Accelerating Admixture: ASTM C494/C494M, Type E.
 - 5. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
 - 6. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
 - 7. Plasticizing Admixture: ASTM C1017/C1017M, Type I.
 - 8. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.
 - 9. Corrosion Inhibiting Admixture: ASTM C1582/C1582M.

2.5 STEEL CONNECTION MATERIALS

- A. Carbon-Steel Shapes and Plates: ASTM A36/A36M.
- B. Wrought Carbon-Steel Bars: ASTM A675/A675M, Grade 65 (Grade 450).
- C. Deformed-Steel Wire or Bar Anchors: ASTM A496/A496M or ASTM A706/A706M.
- D. Zinc-Coated Finish: For exterior steel items, steel in exterior walls,] and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A123/A123M or ASTM A153/A153M or electrodeposition according to ASTM B633, SC 3, Types 1 and 2.
 - 1. For steel shapes, plates, and tubing to be galvanized, limit silicon content of steel to less than 0.03 percent or to between 0.15 and 0.25 percent or limit sum of silicon and 2.5 times phosphorous content to 0.09 percent.
 - 2. Galvanizing Repair Paint: High-zinc-dust-content paint with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035B or SSPC-Paint 20.

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2.6 BEARING PADS

- A. Provide one of the following bearing pads for architectural precast concrete units as recommended by precast fabricator for application:
1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, Type A durometer hardness of 50 to 70, ASTM D2240, minimum tensile strength 2250 psi (15.5 MPa), ASTM D412.
 2. Random-Oriented-Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. Type A durometer hardness of 70 to 90, ASTM D2240; capable of supporting a compressive stress of 3000 psi (20.7 MPa) with no cracking, splitting, or delaminating in the internal portions of pad. Test one specimen for every 200 pads used in Project.
 3. Frictionless Pads: PTFE, glass-fiber reinforced, bonded to stainless or mild-steel plate, or random-oriented-fiber-reinforced elastomeric pads; of type required for in-service stress.
 4. High-Density Plastic: Multi-monomer, non-leaching, plastic strip.

2.7 ACCESSORIES

- A. Precast Accessories: Provide clips, hangers, high-density plastic or steel shims, and other accessories required to install architectural precast concrete units.

2.8 CONCRETE MIXTURES

- A. Prepare design mixtures for each type of precast concrete required.
1. Use a single design mixture for units with more than one major face or edge exposed.
 2. Where only one face of unit is exposed use either a single design mixture or separate mixtures for face and backup.
- B. Limit use of fly ash and ground granulated blast-furnace slag to 20 percent of portland cement by weight; limit metakaolin and silica fume to 10 percent of portland cement by weight.
- C. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at architectural precast concrete fabricator's option.
- D. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 (ACI 318M) or PCI MNL 117 when tested according to ASTM C1218/C1218M.
- E. Normal-Weight Concrete Mixtures: Proportion full-depth mixture by either laboratory trial batch or field test data methods according to ACI 211.1, with

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materials to be used on Project, to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 5,000 psi (34.5 MPa) minimum.
 2. Maximum Water-Cementitious Materials Ratio: 0.45.
- F. Water Absorption: 6 percent by weight or 14 percent by volume, tested according to ASTM C642, except for boiling requirement.
- G. Lightweight Concrete Backup Mixtures: Proportion mixtures by either laboratory trial batch or field test data methods according to ACI 211.2, with materials to be used on Project, to provide lightweight concrete with the following properties:
1. Compressive Strength (28 Days): 5,000 psi (34.5 MPa).
 2. Unit Weight: Calculated equilibrium unit weight of 115 lb/cu. ft. (1842 kg/cu. m), plus or minus 3 lb/cu. ft. (48 kg/cu. m), according to ASTM C567.
- H. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.
- I. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

2.9 MOLD FABRICATION

- A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.
1. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during concrete placement. Coat form liner with form-release agent.
- B. Maintain molds to provide completed architectural precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.
1. Form joints are not permitted on faces exposed to view in the finished work.
 2. Edge and Corner Treatment: Uniformly chamfered.

2.10 FABRICATION

- A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage

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hardware where it does not affect position of main reinforcement or concrete placement.

1. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."
- B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing architectural precast concrete units to supporting and adjacent construction.
- C. Reinforcement: Comply with recommendations in PCI MNL 117 for fabricating, placing, and supporting reinforcement.
1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcing exceeds limits specified in ASTM A775/A775M, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
 2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
- D. Reinforce architectural precast concrete units to resist handling, transportation, and erection stresses and specified in-place loads.
- E. Comply with requirements in PCI MNL 117 and requirements in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.
- F. Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete units.
- G. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 117.
- H. Comply with PCI MNL 117 for hot- and cold-weather concrete placement.
- I. Identify pickup points of architectural precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each architectural precast concrete unit on a surface that does not show in finished structure.
- J. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until compressive strength is high enough

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to ensure that stripping does not have an effect on performance or appearance of final product.

- K. Discard and replace architectural precast concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 117 and Architect's approval.

2.11 FABRICATION TOLERANCES

- A. Fabricate architectural precast concrete units to shapes, lines, and dimensions indicated so each finished unit complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.
- B. Fabricate architectural precast concrete units to shapes, lines, and dimensions indicated so each finished unit complies with the following product tolerances:
 - 1. Overall Height and Width of Units, Measured at the Face Exposed to View: As follows:
 - a. 5 feet (1.5 m) or under, plus or minus 1/8 inch (3 mm).
 - 2. Total Thickness: Plus 1/8 inch (3 mm), minus 1/8 inch (3 mm).
 - 3. Local Smoothness: 1/16 inch/5 feet (1.5 mm/1.5 m).
 - 4. Warping: 1/16 inch/12 inches (1.5 mm/300 mm) of distance from nearest adjacent corner.
 - 5. Dimensions of Architectural Features and Rustications: Plus or minus 1/16 inch (1.5 mm).
- C. Position Tolerances: For cast-in items measured from datum line location, as indicated on Shop Drawings.
 - 1. Inserts: Plus or minus 1/2 inch (13 mm).
 - 2. Reinforcing Steel: Plus or minus 1/4 inch (6 mm) where position has structural implications or affects concrete cover; otherwise, plus or minus 1/4 inch (6 mm).
 - 3. Location of Bearing Surface from End of Member: Plus or minus 1/8 inch (3 mm).

2.12 FINISHES

- A. Exposed faces shall be free of joint marks, grain, and other obvious defects. Corners, including false joints shall be uniform, straight, and sharp. Finish exposed-face surfaces of architectural precast concrete units to match approved sample panels and as follows:
 - 1. As-Cast Surface Finish: Provide surfaces to match approved sample for acceptable surface, air voids, sand streaks, and honeycomb.

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- B. Finish exposed and end surfaces of architectural precast concrete units to match face-surface finish.

2.13 SOURCE QUALITY CONTROL

- A. Defective Units: Discard and replace recast architectural concrete units that do not comply with acceptability requirements in PCI MNL 117, including concrete strength, manufacturing tolerances, and color and texture range. Chipped, spalled, or cracked units may be repaired, subject to Architect's approval. Architect reserves the right to reject precast units that do not match approved samples, sample panels, and mockups. Replace unacceptable units with precast concrete units that comply with requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, bearing surface tolerances, and other conditions affecting performance of the Work.
- B. Do not install precast concrete units until supporting brick veneer has attained minimum allowable design compressive strength and supporting steel or other structure is structurally ready to receive loads from precast concrete units. Under any circumstances, do not install precast concrete watertable/sill members until a minimum of seven (7) calendar days has passed since completion of all brick veneer below the watertable/sill members.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install clips, hangers, bearing pads, and other accessories required for connecting architectural precast concrete units to supporting members and backup materials.
- B. Erect architectural precast concrete units level, plumb, and square within specified allowable tolerances. Provide temporary supports and bracing as required to maintain position, stability, and alignment of units until permanent connections are completed.
 - 1. Install temporary steel or plastic spacing shims as precast concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.

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2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
3. Remove projecting lifting devices and grout fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
4. Unless otherwise indicated, maintain uniform joint widths of 3/4 inch (19 mm).

3.3 ERECTION TOLERANCES

- A. Erect architectural precast concrete units level, plumb, square, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 117, Appendix I.
- B. Erect architectural precast concrete units level, plumb, square, and in alignment, without exceeding the following noncumulative erection tolerances:
 1. Plan Location from Building Grid Datum: Plus or minus 1/4 inch (6 mm).
 2. Top Elevation from Nominal Top Elevation: As follows:
 - a. Exposed Individual Panel: Plus or minus 1/4 inch (6 mm).
 3. Support Elevation from Nominal Support Elevation: As follows:
 - a. Maximum Low: 1/4 inch (6 mm).
 - b. Maximum High: 1/4 inch (6 mm).
 4. Maximum Jog in Alignment of Matching Edges: 1/8 inch (3 mm).
 5. Joint Width (Governs over Joint Taper): Plus or minus 1/8 inch (3 mm).
 6. Maximum Joint Taper: 1/8 inch (3 mm).
 7. Maximum Jog in Alignment of Matching Faces: 1/16 inch (1.5 mm).

3.4 FIELD QUALITY CONTROL

- A. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
- B. Additional testing and inspecting, at Contractor's expense, shall be performed to determine compliance of replaced or additional work with specified requirements.

3.5 REPAIRS

- A. Repair architectural precast concrete units if permitted by Architect. Architect reserves the right to reject repaired units that do not comply with requirements.

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- B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet (6 m).
- C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A780/A780M.
- D. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.
- E. Remove and replace damaged architectural precast concrete units when repairs do not comply with requirements.

3.6 CLEANING

- A. Clean surfaces of precast concrete units exposed to view.
- B. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.
- C. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
 - 1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's recommendations. Protect other work from staining or damage due to cleaning operations.
 - 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION 034500

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Masonry work under this contract is limited to construction of a new interior wall above security doors, masonry repairs at interior of building and hole patching at previous pipe penetrations of exterior walls.

1.2 RELATED DOCUMENTS

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

1.3 SUMMARY

- A. This Section includes unit masonry assemblies consisting of the following:
 - 1. Concrete masonry units (CMUs, Concrete Block or Block).
 - 2. Face Brick.
 - 3. Mortar and grout.
 - 4. Ties and anchors.
 - 5. Embedded flashing.
 - 6. Miscellaneous masonry accessories.
- B. Related Sections include the following:
 - 1. Division 07 Section 076200, "Flashing and Sheet Metal" for exposed sheet metal flashing.
 - 2. Division 07 Section 078413, "Penetration Firestopping" for firestopping at openings in masonry walls.
 - 3. Division 07 Section 079200, "Joint Sealants" for sealing joints in unit masonry.

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.

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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."
 - 3. Hydro-Active Polyurethane Grout
- C. Samples for Verification: For each type and color of the following:
 - 1. Accessories embedded in masonry.
- D. 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.
- E. 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 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. Anchors, ties, and metal accessories.
- F. 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.

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2. Include test reports, per ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

G. 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.

1.6 QUALITY ASSURANCE

A. 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.

B. 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.

C. 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

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- 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 one 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 surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect floor surfaces from staining from mortar droppings.
- 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 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

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- 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 standard shapes indicated and as follows:
 - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 - 2. Bullnose Corners: Provide 1-inch-radius vertical edges at **all** exposed outside corners, typically, **except** where a door jamb is concealed by vertical steel channel or angle.
- 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 MASONRY LINTELS

- A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam concrete masonry units 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, with exposed surfaces matching finish and color of exposed faces of adjacent units:
 - 1. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
- B. Face Brick: Facing brick complying with ASTM C 216, wirecut, flashed. Sand finish brick is not permitted.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. For facebrick to be installed at **exterior** of the building, provide an orangish/reddish-brown with flash and texture between units. Product/color shall closely match the existing exterior brick and be from

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among those listed below or equal selected and approved by the Architect and Owner's Representative from a range of product samples submitted by the Contractor:

- 1) Continental Brick Company, "Light-Flashed Range of Rose," SMC 470, Modular (Martinsburg, WV plant).
2. Grade: SW.
3. Type: FBS, extruded.
4. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
5. 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 (3 m).
6. Size (Actual Dimensions): Modular sized brick: 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.
7. Special Shapes: Provide special shapes in brick units that identically match color and texture of conventional brick units as shown on the drawings or specified herein.
 - a. Solid Units: Provide solid brick units at exposed ends of rowlock and soldier units, or wherever the bed- (cored) side of the brick would otherwise be exposed to view.

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 gray cement as required to produce mortar that closely matches the color of 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. Titan America/Roanoke Cement Company
 - b. Workrite Cements/York Building Products Colored Masonry Cement
 - c. Capital Materials Corporation; Flamingo Color Masonry Cement.
 - d. Essroc, Italcementi Group; Brixment or Velvet.
 - e. Holcim (US) Inc.; Mortamix Masonry Cement.
 - f. Lafarge North America Inc.; Magnolia Masonry Cement.
 - g. Lehigh Cement Company; Lehigh Masonry Cement.
 - h. National Cement Company, Inc.; Coosa Masonry Cement.

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- E. Mortar Cement: ASTM C 1329.
 - 1. Available Products:
 - a. For use at general (orangish-red) facebrick: Workrite Cements/York Building Products Colored Masonry Cement standard Light Gray, Color #WR280 (Glacier) or as selected by Architect from manufacturer's standard products.
- F. 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.
- G. Aggregate for Grout: ASTM C 404.
- H. Water: Potable.

2.7 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.
- B. Masonry Joint Reinforcement, General: ASTM A 951.
 - 1. Interior Walls: Hot-dip galvanized, carbon steel.
 - 2. Exterior Walls: Hot-dip galvanized, carbon steel.
 - 3. Wire Size for Side Rods: W2.8 or 0.188-inch diameter.
 - 4. Wire Size for Cross Rods: W2.8 or 0.188-inch diameter.
 - 5. Wire Size for Veneer Ties: W2.8 or 0.188-inch diameter.
 - 6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
 - 7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.
- C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.
- D. 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. Tab type, either ladder or truss design, with 1 side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.

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2.8 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with sub-paragraphs below, unless otherwise indicated.
1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153/A 153M, Class B-2 coating.
 2. Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 zinc coating.
 3. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, hot-dip galvanized after fabrication to comply with ASTM A 153/A 153M.
- 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.
- C. Column Ties: Provide column ties at all intersections between CMU walls and steel columns as follows: 3/16-inch diameter formed metal wires with adjustable-height wire or flattened bar straps, hot-dip galvanized, equal to Hohmann & Barnard #301W ties and #359 column straps. Located ties at 1'-4" on center vertically. Provide ties of width to suit width of concrete masonry wythes (typically two inches less than nominal block width). Provide length appropriate to application such:
1. When ends of CMU wall abut column: Tie is not less than 8 inches long nor more than 10 inches long. Center tie in the wall.
 2. When face of CMU wall runs past the column: Tie length is equal to the gap distance between column face, flange or web and abutting face of masonry plus four inches. Center tie along the column axis.
- D. Metal Brick Veneer Ties for Attachment to Cold-Formed Metal Stud-Framed Walls: Wing-nut type anchor with adjustable pintle wires and polymer-coated threaded screw for anchoring through sheathing to metal studs, Hoops shall be 3/16-inch diameter hot-dipped galvanized steel with non-seismic hooks. Ties made from galvanized steel sheet may be used in interior walls, unless otherwise indicated. Provide the following product or equal submitted to and approved by the Architect:
1. Hohmann & Barnard "X-Seal" galvanized steel anchors with 3/6-inch diameter "Vee-Byna tie" wires, 1'-4" on center vertically and horizontally, staggered.

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.

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- 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 Through-Wall 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 interpolymers 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.
- B. 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.

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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 pre-blended 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.

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- D. 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.

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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. 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

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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.
- I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.
 - 1. At fire-rated partitions, treat joint between top of partition and underside of structure above to meet fire resistant construction requirements.

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 to match existing exterior brickwork, using a "ruled" or "grapevine" jointing tool slightly 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:

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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.
- 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 with 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 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. 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.

3.7 LINTELS

- A. Install steel lintels where indicated.
- B. Provide masonry lintels where shown and where openings of more than 8 inches for brick-size units and 16 inches for block-size units are shown without structural steel or other supporting lintels.

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- C. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.8 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.

3.9 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.

3.10 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

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- B. Inspections: Level 1 special inspections according to the "International Building Code," 2009 edition for all reinforced masonry and grouting.
 - 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 - 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 - 3. Place grout only after inspectors have verified proportions of site-prepared grout.
 - C. Testing Prior to Construction: One set of tests.
 - D. Testing Frequency: One set of tests for each 5000 sq. ft. (464 sq. m) of wall area or portion thereof.
 - E. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C 67 for compressive strength.
 - F. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
 - G. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
 - H. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.
 - I. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.
 - J. Prism Test: For each type of construction provided, according to ASTM C 1314 at 28 days.
- 3.11 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.

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- 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 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 concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.12 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

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SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Structural steel.
2. Prefabricated building columns.
3. Grout.

B. Related Sections:

1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
2. Division 05 Section "Architecturally Exposed Structural Steel Framing" for additional requirements for architecturally exposed structural steel.
3. Division 05 Section "Steel Decking" for field installation of shear connectors through deck.
4. Division 05 Section "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame miscellaneous steel fabrications and other metal items not defined as structural steel.
5. Division 09 painting Sections for surface-preparation and priming requirements.

1.3 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.4 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand loads indicated and comply with other information and restrictions indicated.

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1. Select and complete connections using AISC 360.
 2. Use LRFD; data are given at factored-load level.
- B. Moment Connections: Type FR, fully restrained.
- C. Construction: Combined system of moment frame, braced frame, and shear walls.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication of structural-steel components.
1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 2. Include embedment drawings.
 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pre-tensioned and slip-critical high-strength bolted connections.
 5. For structural-steel connections indicated to comply with design loads, include structural design data.
- C. Qualification Data: For qualified Installer and fabricator.
- D. Welding certificates.
- E. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- F. Mill test reports for structural steel, including chemical and physical properties.
- G. Product Test Reports: For the following:
1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 2. Shear stud connectors.
 3. Shop primers.
 4. Nonshrink grout.
- H. Source quality-control reports.

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1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
- B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE or CSE.
- C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1, P2, P3 or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."
- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- E. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC 303.
 - 2. AISC 360.
 - 3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- F. Preinstallation Conference: Conduct conference at Project site.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 - 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 - 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

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1.8 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992/A 992M.
- B. Channels, Angles ASTM A 36/A 36M.
- C. Plate and Bar: ASTM A 36/A 36M.
- D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.
- E. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
 - 1. Weight Class: Standard, Extra strong.
- F. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.
- B. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers.
 - 1. Finish: dip zinc coating.
- C. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

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- D. Headed Anchor Rods: ASTM F 1554, Grade 36 straight.
 - 1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
 - 2. Plate Washers: ASTM A 36/A 36M carbon steel.
 - 3. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
 - 4. Finish: Plain.

- E. Threaded Rods: ASTM A 36/A 36M, A 572/A 572M, Grade 50 (345).
 - 1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
 - 2. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
 - 3. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

- F. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.

2.3 PRIMER

- A. Primer: Comply with Division 09 painting Sections.
- B. Primer: SSPC-Paint 25, Type I or Type II, zinc oxide, alkyd, linseed oil primer.
- C. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- D. Galvanizing Repair Paint: ASTM A 780.

2.4 GROUT

- A. Metallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.
- B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
 - 1. Fabricate beams with rolling camber up.
 - 2. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
 - 3. Mark and match-mark materials for field assembly.

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4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 2, "Hand Tool Cleaning" or SSPC-SP 3, "Power Tool Cleaning."
- F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.
- G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
 1. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 2. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 1. Joint Type: Snug tightened.

2.7 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
 2. Surfaces to be field welded.
 3. Surfaces to be high-strength bolted with slip-critical connections.
 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
 5. Galvanized surfaces.

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- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 - 1. SSPC-SP 2, "Hand Tool Cleaning."
 - 2. SSPC-SP 3, "Power Tool Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
- D. Painting: Prepare steel and apply a one-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils (0.038 mm).

2.8 SOURCE QUALITY CONTROL

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

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1. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Base Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 2. Weld plate washers to top of baseplate.
 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.

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4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 1. Level and plumb individual members of structure.
 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 1. Joint Type: Snug tightened.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.
- B. Bolted Connections: Bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

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- C. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.
 - 1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.
- D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
 - 1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 - 2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.
- E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.
- B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
- C. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections.

END OF SECTION 051200

SECTION 053100 - STEEL DECKING

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. Roof deck.

- B. Related Requirements:

- 1. Division 03 Section "Cast-in-Place Concrete" for normal-weight and lightweight structural concrete fill over steel deck.
- 2. Division 05 Section "Structural Steel Framing" for shop- and field-welded shear connectors.
- 3. Division 05 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
- 4. Division 09 painting Sections for repair painting of primed deck and finish painting of deck.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.

- B. Shop Drawings:

- 1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

- B. Product Certificates: For each type of steel deck.

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- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
 - 1. Power-actuated mechanical fasteners.
 - 2. Acoustical roof deck.
- D. Evaluation Reports: For steel deck.
- E. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."
- C. FM Global Listing: Provide steel roof deck evaluated by FM Global and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

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- C. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 30 percent.
- D. Low-Emitting Materials: Paints and coatings 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."

2.2 ROOF DECK

- 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. ASC Profiles, Inc.; a Blue Scope Steel company.
 - 2. Canam United States; Canam Group Inc.
 - 3. CMC Joist & Deck.
 - 4. Consolidated Systems, Inc.; Metal Dek Group.
 - 5. Cordeck.
 - 6. DACS, Inc.
 - 7. Epic Metals Corporation.
 - 8. Marlyn Steel Decks, Inc.
 - 9. New Millennium Building Systems, LLC.
 - 10. Nucor Corp.; Vulcraft Group.
 - 11. Roof Deck, Inc.
 - 12. Valley Joist; Subsidiary of EBSCO Industries, Inc.
 - 13. Verco Manufacturing Co.
 - 14. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.
- B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
 - 1. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 33 (230) minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: Manufacturer's standard.
 - 2. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) at roof, G90 (Z275) at awning zinc coating.
 - a. Color: Manufacturer's standard.

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3. Aluminum-Zinc-Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Structural Steel (SS), Grade 33 (230) minimum, AZ50 (AZ150) aluminum-zinc-alloy coating.
4. Deck Profile: As indicated.
5. with bottom plate.
6. Profile Depth: As indicated.
7. Design Uncoated-Steel Thickness: As indicated.
8. Span Condition: As indicated.
9. Side Laps: Overlapped.

2.3 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 12 (4.8-mm) minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.
- G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
- H. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0747 inch (1.90 mm) thick, with factory-punched hole of 3/8-inch (9.5-mm) minimum diameter.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

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- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Locate deck bundles to prevent overloading of supporting members.
- C. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- D. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- E. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- F. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- G. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches (38 mm) long, and as follows:
 - 1. Weld Diameter: 5/8 inch (16 mm), nominal.
 - 2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds as indicated.
 - 3. Weld Washers: Install weld washers at each weld location.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports as indicated, and as follows:
 - 1. Mechanically fasten with self-drilling, No. 12 (4.8-mm-) diameter or larger, carbon-steel screws.

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- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:
 - 1. End Joints: Lapped 2 inches (51 mm) minimum.
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld or mechanically fasten flanges to top of deck. Space welds or mechanical fasteners not more than 12 inches (305 mm) apart with at least one weld or fastener at each corner.
 - 1. Install reinforcing channels or zees in ribs to span between supports and weld.
- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.
 - 1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.
- F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FLOOR-DECK INSTALLATION

- A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
 - 1. Weld Diameter: 5/8 inch (16 mm), nominal.
 - 2. Weld Spacing: Space and locate welds as indicated.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals, as indicated:
 - 1. Mechanically fasten with self-drilling, No. 12 (4.8-mm-) diameter or larger, carbon-steel screws.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:
 - 1. End Joints: Lapped.
- D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.

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- E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Field welds will be subject to inspection.
- C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
 - 1. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Division 09.
- C. Repair Painting: Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Division 09.
- D. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 053100

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SECTION 054000 - COLD-FORMED 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 the following:

1. Exterior load-bearing wall framing.
2. Interior load-bearing wall framing.
3. Exterior non-load-bearing wall framing.
4. Roof rafter framing.
5. Ceiling joist framing.

- B. Related Sections include the following:

1. Division 05 Section "Structural Steel Framing" for structural steel columns, beams, channels and other framing to which cold-formed metal framing may be attached and braced.
2. Division 05 Section "Metal Fabrications" for masonry shelf angles and connections.
3. Division 09 Section "Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.
4. Division 09 Section "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated:

2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/600 of the wall height.

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- b. Ceiling Joist Framing: Vertical deflection of 1/360 of the span.
 - 3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).
 - 4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Upward and downward movement of 1/2 inch (13 mm).
 - B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."
 - 1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."
 - 2. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
- 1.4 SUBMITTALS
- A. Product Data: For each type of cold-formed metal framing product and accessory indicated.
 - B. LEED Submittal:
 - 1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - a. Include statement indicating costs for each product having recycled content.
 - C. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
 - 1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - D. Welding certificates.

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- E. Qualification Data: For professional engineer.
- F. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:
 - 1. Steel sheet.
 - 2. Expansion anchors.
 - 3. Power-actuated anchors.
 - 4. Mechanical fasteners.
 - 5. Vertical deflection clips.
 - 6. Horizontal drift deflection clips
 - 7. Miscellaneous structural clips and accessories.
- G. Research/Evaluation Reports: For cold-formed metal framing.

1.5 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated.
- D. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- E. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."
- F. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

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- G. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."
 - 1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."
- H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following:
 - 1. Allied Studco.
 - 2. AllSteel Products, Inc.
 - 3. Clark Steel Framing.
 - 4. Consolidated Fabricators Corp.; Building Products Division.
 - 5. Craco Metals Manufacturing, LLC.
 - 6. Custom Stud, Inc.
 - 7. Dale/Incor.
 - 8. Design Shapes in Steel.
 - 9. Dietrich Metal Framing; a Worthington Industries Company.
 - 10. Formetal Co. Inc. (The).
 - 11. Innovative Steel Systems.
 - 12. MarinoWare; a division of Ware Industries.
 - 13. Quail Run Building Materials, Inc.
 - 14. SCAFCO Corporation.
 - 15. Southeastern Stud & Components, Inc.
 - 16. Steel Construction Systems.

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17. Steeler, Inc.
18. Super Stud Building Products, Inc.
19. United Metal Products, Inc.

2.2 MATERIALS

- A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 30 percent.
- B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 1. Grade: ST50H (ST340H).
 2. Coating: G60 (Z180).
- C. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
 1. Grade: As required by structural performance.
 2. Coating: G90 (Z275).

2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm).
 2. Flange Width: 1-5/8 inches (41 mm).
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm).
 2. Flange Width: 1-1/4 inches (32 mm).
- C. Vertical Deflection Clips: Manufacturer's standard head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
 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:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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- a. Dietrich Metal Framing; a Worthington Industries Company.
 - b. MarinoWare, a division of Ware Industries.
 - c. SCAFCO Corporation
 - d. The Steel Network, Inc.
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:
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:
 2. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm).
 3. Flange Width: 1 inch (25 mm) plus the design gap for 1-story structures and 1 inch (25 mm) plus twice the design gap for other applications.
- E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure.

2.4 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
1. Supplementary framing.
 2. Bracing, bridging, and solid blocking.
 3. Web stiffeners.
 4. Anchor clips.
 5. End clips.
 6. Foundation clips.
 7. Gusset plates.
 8. Stud kickers, knee braces, and girts.
 9. Joist hangers and end closures.
 10. Hole reinforcing plates.
 11. Backer plates.

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2.5 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
- C. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.
- D. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- E. Welding Electrodes: Comply with AWS standards.

2.6 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A 780.
- B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.
- C. Shims: Load bearing, high-density multimonomer plastic, nonleaching.
- D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.7 FABRICATION

- A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.

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3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
 4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

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- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.
- C. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.
- D. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).
- D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain

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braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

- G. Install insulation, specified in Division 07 Section "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- H. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.
- I. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: As indicated.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Install single-leg deflection tracks and anchor to building structure.
 - 2. Connect vertical deflection clips to infill studs and anchor to building structure.
 - 3. Connect drift clips to cold formed metal framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.
 - 1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches (305 mm) of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or

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stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.

2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 3. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 4. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.5 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace work where test results indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.6 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

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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. Loose steel beams.
4. Roof ladder.
5. Steel pipe railings and handrails.
6. 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:

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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

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- 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.

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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:

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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 ROOF LADDER

A. General:

1. Comply with ANSI A14.3 unless otherwise indicated.

B. Steel Ladders:

1. Space siderails 18 inches (457 mm) apart unless otherwise indicated.
2. Siderails: Continuous, 3/8-by-2-1/2-inch (9.5-by-64-mm) steel flat bars, with eased edges.
3. Rungs: 3/4-inch- (19-mm-) diameter steel bars.
4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
6. Provide platforms as indicated fabricated from welded or pressure-locked steel bar grating, supported by steel angles. Limit openings in gratings to no more than 3/4 inch (19 mm) in least dimension.
7. Support each ladder at top and bottom and not more than 60 inches (1500 mm) o.c. with welded steel brackets.
8. Galvanize exterior ladders, including brackets and fasteners.

2.7 STEEL PIPE RAILINGS AND HANDRAILS

- A. General: Fabricate pipe railings and handrails to comply with ASTM E 935 requirements indicated for design, dimensions, details, finish, and member sizes,

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including wall thickness of pipe, post spacings, and anchorage, but not less than that required to support structural loads.

B. Performance Requirements:

1. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated for Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
 - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
2. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes as follows:
 - a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C, material surfaces).

C. Steel and Iron

1. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads. Provide galvanized finish for exterior installations and where indicated.
2. Plates, Shapes, and Bars: ASTM A 36/A 36M. Provide galvanized finish for exterior installations and where indicated.

D. Interconnect railing and handrail members by butt-welding or welding with internal connectors, at fabricator's option, unless otherwise indicated.

1. At tee and cross intersections, notch ends of intersecting members to fit contour of pipe to which end is joined and weld all around.

E. Form changes in direction of railing members as follows:

1. By mitering at elbow bends.

F. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated.

G. Close exposed ends of pipe by welding 3/16 inch thick steel plate in place or by use of prefabricated fittings, except where clearance of end of pipe and adjoining wall surface is 1/4 inch or less.

H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnections of pipe and attachment of

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railings and handrails to other work. Furnish inserts and other anchorage devices for connecting railings and handrails to the related structure.

- I. Fillers: Provide steel sheet or plate fillers of thickness and size indicated or required to support structural loads of handrails where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses. Size fillers to produce adequate bearing to prevent bracket rotation and overstressing of substrate.
- J. Following fabrication, galvanize exterior rails, fittings, brackets, fasteners, and sleeves by hot-dip method, ASTM A 153.

2.8 MISCELLANEOUS FRAMING 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.

2.9 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

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- 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 SAFETY RAILING INSTALLATION

- A. Install safety rail(s) where indicated on the Drawings. Bolt base plates securely to roof deck where welded to existing joists, or bolt directly to roof joists. Install with 1/2-inch diameter galvanized steel bolts. Anchor securely through the roof membrane to existing steel structure below the roof. Provide blocking around pipe penetrations and roof flashing as detailed on the drawings. Patch roofing and apply liquid flashing up the lower 12 inches of each pipe railing.

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

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- 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

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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. Wood blocking, cants and nailers.
2. Fire-retardant concealed wood blocking used for backing inside of walls, above ceilings and other locations where needed for anchorage of various items such as toilet partitions, toilet accessories, visual display devices, mounting brackets for devices, and similar features.

- 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. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

- A. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.

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1.3 DELIVERY, STORAGE, AND HANDLING:

- A. Delivery and Storage: Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces.
- B. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

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.
- C. Plywood: DOC PS 1.

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.

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- 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: AWP C2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWP 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: Comply with performance requirements in AWP C20 (lumber) and AWP C27 (plywood).
 - 1. Use Exterior type for exterior locations and where indicated.
 - 2. Fire-retardant treat ALL concealed wood blocking for use at interior locations.
- B. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

2.5 DIMENSION LUMBER FRAMING

- A. Preservative Treatment: Comply with applicable requirements of AWP 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, marine grade with

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waterproof glue for use in conjunction with roof sheathing, thickness indicated on the drawings.

- C. Inspect each piece of treated lumber or plywood after drying and discard damaged or defective pieces.

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

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remain, overlap wood members to integrate with existing work.

END OF SECTION 061000

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SECTION 061643 - GLASS-MAT FACED GYPSUM SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Exterior Wall Gypsum Sheathing Board.
 - 2. Sheathing joint and penetration treatment.
- B. Related Sections include the following:
 - 1. Division 05 Section 054000, "Cold-Formed Metal Framing."

1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM C 954: Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 inch to 0.110 inch in Thickness
 - 2. ASTM C 1002: Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
 - 3. ASTM C 1177: Standard Specification for Glass Mat Gypsum – Substrate for use as Sheathing.
 - 4. ASTM C 1280: Standard Specification for Application of Gypsum Sheathing.
 - 5. ASTM C 1396: Standard Specification for Gypsum Board.
 - 6. ASTM D 226: Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
 - 7. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 8. ASTM E 119: Test Method for Fire Tests of Building Construction and Materials.
- B. Gypsum Association:

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1. GA 253: Recommended Specification for the Application of Gypsum Sheathing.

1.4 SUBMITTALS

- A. General: Submit in accordance with Section 013300.
- B. Product Data: Submit manufacturer's current technical literature for product specified.
- C. Product Samples: Submit manufacturer's 4-inch by 4-inch samples of each product specified herein.

1.5 QUALITY ASSURANCE

- A. Single source Responsibility: Obtain gypsum board products, joint treatment and accessories from single manufacturer or from manufacturers recommended by prime manufacturer of gypsum board products.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. All materials shall be delivered in their original unopened packages and stored in an enclosed shelter providing protection from damage and exposure to the elements.
- B. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

1.7 WARRANTY

- A. Manufacturer's standard warranty for product exposed to weather without failure, when installed in accordance with manufacturer's requirements, for period of not less than 12 months.

PART 2 - PRODUCTS

2.1 WALL SHEATHING

- A. Glass Mat Gypsum Sheathing: ASTM C 1177 gypsum sheathing.
 1. Product: Subject to compliance with requirements specified herein, provide products buy one of the following manufacturers:

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- a) SECUROCK Brand Glass Mat Sheathing by United States Gypsum Company.
- b) DENS-GLAS Sheathing by Georgia Pacific Building Products.
- c) GLAS-ROC Sheathing by Certaineed/Saint-Gobain
- d) M-GLASS Sheathing by American Gypsum.

- 2. Thickness: 5/8 inch thick.
- 3. Size: 48 by 96 inches with square edge.

2.2 SHEATHING JOINT AND PENETRATION TREATMENT MATERIALS

- A. Silicone Emulsion Sealant: Meeting ASTM C 920, Type S, Grade NS, compatible with glass fiber mesh tape and for covering exposed fasteners.
- B. Glass-Fiber Mesh Tape: Self-adhering glass-fiber tape, nominal 2 inches (50mm) wide, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing board and with a history of successful in-service use

2.3 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and application.
- B. Screws for Fastening Sheathing to Cold-Formed Metal Framing: #6 2-1/4 inch with corrosion-resistance of more than 800 hours per ASTM B117 (Minimum).
 - 1. For steel framing less than 0.0329 inch thick, attach sheathing to comply with ASTM C 1002.
 - 2. For steel framing from 0.033 to 0.112 inch thick, attach sheathing to comply with ASTM C 954.

2.4 MISCELLANEOUS MATERIALS

- A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film.
- B. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.

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PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit closely against abutting construction, unless otherwise indicated.
- C. Coordinate wall sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- D. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- E. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 GYPSUM SHEATHING INSTALLATION

- A. Comply with ASTM C 1280, GA-253 and manufacturer's written instructions.
 - 1. Fasten sheathing to cold-formed metal framing with screws.
 - 2. Install boards with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
 - 3. Install boards with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Apply fasteners so heads bear tightly against face of sheathing boards but do not cut into facing.
- C. Sheathing may be installed with the long dimension of the sheathing either parallel or perpendicular to framing. Board orientation to be dictated by performance requirements. Abut ends and/or edges of the boards centered over face of framing members. Offset board joints by not less than one stud spacing
 - 1. Space fasteners a maximum of 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards. Adjust spacing of fasteners to meet specific fire or structural performance requirements.
 - 2. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.
- D. Seal sheathing joints according to sheathing manufacturer's written instructions.

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1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

3.3 FLEXIBLE FLASHING INSTALLATION

- A. Apply flexible flashing where indicated to comply with manufacturers written instructions.
 1. Prime substrates as recommended by flashing manufacturer.
 2. Lap seams and junctures with other materials at least 4 inches, except that at flashing flanges of other construction, laps need not exceed flange width.
 3. Lap flashing over weather-resistant building paper at bottom and sides of openings.
 4. Lap weather-resistant building paper over flashing at heads of openings.
 5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

END OF SECTION 061643

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SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

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. Exposed hardwood veneer plywood casework.
- 2. Cabinet & shelving hardware.
- 3. Plastic-laminate countertops, backsplash and end splashes.

- B. Related Sections include the following:

- 1. Division 06 Section 061000, "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.
- 2. Division 06 Section 099300 "Staining and Transparent Finishing" for preparation of interior wood surfaces and application of transparent finish(es).

1.3 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections, to ensure that interior architectural woodwork can be supported and installed as indicated.

1.4 SUBMITTALS

- A. Product Data: For panel products high-pressure decorative laminate adhesive for bonding plastic laminate and finishing materials and processes.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - 1. Show details full size.

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2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for items installed in architectural woodwork.

C. Samples for Initial Selection:

1. Shop-applied transparent finishes.
2. Plastic laminates.

D. Samples for Verification:

1. Lumber with or for transparent finish, not less than 50 sq. in. (300 sq. cm) species and cut, finished on 1 side and 1 edge.
2. Plastic laminates, 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish.

E. Product Certificates: For each type of product, signed by product manufacturer.

F. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

G. Qualification Data: For fabricator.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.

B. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1. Provide AWI Quality Certification Program labels and certificates indicating that woodwork, including installation, complies with requirements of grades specified.

C. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

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1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 43 and 70 percent during the remainder of the construction period.
- B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
 - 2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
- B. Wood Species and Cut for Transparent Finish: Plain sliced, select (natural) birch.

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- C. Wood Species for Opaque Finish: Poplar
- D. Wood Products: Comply with the following:
 - 1. Hardboard: AHA A135.4.
 - 2. Veneer-Faced Panel Products (Medium-Density Fiberboard (HDF) Plywood): ANSI A208.2, not less than 50 lbs./cu. ft., ≤ 0.13 PPM urea/ formaldehyde with no-added UF (or UF-free). Basis of design is MDF panels by Georgia-Pacific "Ultrastock MR50+ Free," or equal approved by the Architect.
 - 3. All plywood used in construction of countertops shall be made using waterproof glue.
- E. High-Pressure Decorative Laminate (Countertops, Back and End Splashes): NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering high-pressure decorative laminates that may be incorporated into the Work include, but are not limited to, the following:
 - a. Formica Corporation.
 - b. Pionite, Inc.
 - c. Nevamar Company, LLC; Decorative Products Div.
 - d. Wilsonart International; Div. of Premark International, Inc.
 - 2. Colors: Refer to Color Schedule on the Drawings.
- C. Edge Bands of All Cabinet Doors, Shelves and Verticals: PVC, as specified herein under paragraph entitled "PVC Edge Bands for all Plastic-Laminated Shelves, Door Edges, Fixed Divider and Cabinet Edges."

2.2 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 08 Section "Door Hardware (Scheduled by Describing Products)."
- B. Shelf Rests: BHMA A156.9, B04013; metal.
- C. Cabinet Door Hinges: BHMA A156.9, B01521-3; Semi-concealed, "full wrap" overlay hinges, self-closing, 2-1/4 inches high, satin nickel finish. Provide minimum two hinges per door; provide hinges at 2'-0" on center vertically for cabinet doors up to nominal 3'-0" high. Provide three (3) hinges per door at full height wall cabinet doors up to 6'-8" in height. Provide 1/4-inch overlay at intermediate joints (where one cabinet door edge abuts another) and 1/2-inch overlay at ends of cabinets. Provide similar to Amerock Hardware No. BPR7550G10.

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- D. Drawer Extensions: BHMA A156.9, side-mounted, full extension ball-bearing guides, two per drawer.
 - 1. Use B05051 for drawers over 6 inches (150 mm) deep.
 - 2. Use B05052 for drawers 3 to 6 inches (75 to 150 mm) deep.
 - 3. Use B05053 for drawers less than 3 inches (75 mm) deep.
- E. Cabinet Door and Drawer Pulls: Provide satin nickel or satin chrome wire pulls, 1/4-inch diameter by 4 inches long, with 1-inch projection from face of cabinet door or drawer front. Fasten by through-drilled screws from inside face of cabinet door or drawer front. Align all pulls consistently as follows:
 - 1. Base Cabinet Doors: Orient pulls vertically; locate top of pull two (2) inches from top edge of door. Laterally, locate pull centered two (2) inches from side edge of cabinet door.
 - 2. Base Cabinet Drawers: Orient pulls horizontally. Center pulls vertically and horizontally in face of drawer.
- F. Door/Drawer Silencers: ANSI A156.16, LO3011 or LO3031; two per door or drawer. Silencers set near top and bottom of jamb.
- G. Cabinet Door Locks: Where indicated on casework elevations, provide one (1) satin chrome or satin nickel, 1-3/16 inch disk tumbler cylinder cam lock with matching, offset, double-formed keeper, suitable for installation in cabinet doors up to 7/8-inch thickness. Key cabinet door locks at all locations alike unless directed otherwise by Owner's Representative. Provide six (6) brass keys. Turn all keys over to Owner in a labeled bag.
- H. Coat Hooks: Baldwin Hardware Model No. 0781.150, 3 1/4-inch projection with dual-prong robe hooks. Provide in satin chrome finish with countersunk screws for attachment to continuous, plainsliced birch mounting board with honey-tinted stain and satin, polyurethane varnish to match new interior wood doors.
- I. Closet Bar: ANSI A156.16, L03131 chrome finish of required length.
- J. Plastic Grommets: For cables; provide standard 3-inch diameter plastic grommets with snap-on adjustable caps. Caps shall have hole formations allowing cables to be gathered snugly around an adjustable hole. Grommets shall have plastic lined sleeves extending down through full depth of countertop. Provide grommets by Doug Mockett or equal, color: black. Provide in quantity and locations indicated on drawings.
- K. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - 1. Unless stated otherwise, provide Satin Stainless Steel: BHMA 630.

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2.3 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
- B. Adhesive for Bonding Plastic Laminate: Contact cement.

2.4 INTERIOR CABINETS FABRICATION, GENERAL

- A. Interior Woodwork Grade: Unless otherwise indicated, provide Custom-grade interior woodwork from exposed hardwood plywood complying with referenced quality standard. Exposed outside surfaces of cabinets shall be natural birch to receive a clear finish, including exposed ends, frames, edges, drawer and door fronts
- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - 1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch (19 mm) Thick or Less: 1/16 inch (1.5 mm).
 - 2. Unless otherwise indicated, Interior of cabinets, cabinet doors and drawers that are exposed to view shall receive shop-applied, white melamine plastic laminate finish.
- D. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 - 1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
 - 2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.
- E. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
 - 1. Seal edges of openings in countertops with a coat of varnish.

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2.8 PLASTIC-LAMINATE PANELS

- A. Grade: Custom. Reveal Dimension: As indicated.
- B. Wood Species and Cut: High-density MDF plywood.
- C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
 - i. Vertical Surfaces: Grade VGS.
 - ii. Edges: Grade VGS.
- D. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - i. As selected by Architect from laminate manufacturer's full range.

2.9 PVC EDGE BANDS FOR ALL PLASTIC-LAMINATED SHELVES, DOOR EDGES, FIXED DIVIDER AND CABINET EDGES

- A. Provide continuous PVC edge bands at all exposed edges of cabinets, doors and drawer fronts, including outward-facing shelves and fixed surfaces concealed by cabinet doors and drawers. Provide at all outside edges of bookcases and shelves, cubbies and mail bins. Provide 15/16-inch by 0.18-inch (3 mm) PVC edge bands that are fully and securely adhered to all edges. Color shall be a standard gray that is slightly darker than finish face of laminate on cabinet surfaces. Provide manufacturer's recommended adhesive, contact cement or bonding material.

2.10 PLASTIC-LAMINATE COUNTERTOPS

- A. Grade: Custom.
- B. High-Pressure Decorative Laminate Grade: HGS. Where indicated, provide laminated or solid metal surface material for use with interior panels.
- C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. As selected by Architect from manufacturer's full range.
- C. Edge Treatment: Plastic laminate covered plywood to match countertops.
- D. Splashes: Plastic laminate covered plywood to match countertops.
- E. Core Material: A-C grade hardwood (Birch, Poplar or Maple) plywood made with exterior, waterproof glue, 3/4-inch thickness. **All plastic-laminated countertops that receive recessed sinks shall be fabricated from 3/4-inch thick pressure treated**

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plywood. Pressure-treated plywood shall be used all around the sinks and up to a minimum of two (2) feet in each direction at sides of sinks that extend beyond.

- F. Adhesive for Bonding Plastic Laminate: Contact cement.
 - 1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.
- G. VOC Limits for Installation Adhesives and Sealants: Use products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Wood Glues: 30 g/L.
 - 2. Multipurpose Construction Adhesives: 70 g/L.
 - 3. Structural Wood Member Adhesive: 140 g/L.
 - 4. Architectural Sealants: 250 g/L.

2.11 FABRICATION

- A. Shop cut openings to maximum extent possible to receive appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
 - 1. Seal edges of openings in countertops with a coat of varnish.

2.12 SHOP FINISHING

- A. Grade: Provide finishes of same grades as items to be finished.
- B. General: Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.
- C. General: Shop finish transparent-finished interior architectural woodwork at fabrication shop as specified in this Section. Refer to Division 09 painting Sections for finishing opaque-finished architectural woodwork.
- D. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.
 - 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate, backing paper, or thermoset decorative panels.

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- E. Transparent Finish:
 - 1. Grade: Custom.
 - 2. WI Finish System 5: Catalyzed polyurethane.
 - 3. Staining: None required.
 - 4. Sheen: Gloss, 61-100 gloss units measured on 60-degree gloss meter per ASTM D 523.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.
- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

- A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.
- B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.
- C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).
- D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
- F. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base if finished.
- G. Standing and Running Trim:
 - 1. Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible.

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2. Do not use pieces less than 96 inches (2400 mm) long, except where shorter single-length pieces are necessary.
 3. Scarf running joints and stagger in adjacent and related members.
 4. Fill gaps, if any, between top of base and wall with plastic wood filler; sand smooth; and finish same as wood base if finished.
 5. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches (3 mm in 2400 mm).
- H. Paneling: Anchor paneling to supporting substrate as detailed. Do not use face fastening, unless indicated.
1. Install flush paneling with no more than 1/16 inch in 96-inch (1.5 mm in 2400-mm) vertical cup or bow and 1/8 inch in 96-inch (3 mm in 2400-mm) horizontal variation from a true plane.
- I. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches (400 mm) o.c.
- J. Countertops: Anchor securely by screwing through supports into underside of countertop.
1. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
 2. Secure backsplashes to walls with adhesive.
 3. Calk space between backsplash and wall with sealant specified in Division 07 Section 079200, "Joint Sealants."
- K. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.
- L. Refer to Division 09 Sections for final finishing of installed architectural woodwork not indicated to be shop finished.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064023

SECTION 072100 – THERMAL AND ACOUSTICAL 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 foam board foundation insulation.
 - 2. Batt insulation used for thermal insulation at metal-framed and CMU exterior walls.
 - 3. Batt insulation used for acoustical isolation at stud partitions.
 - 4. Vapor Retarder for use with unfaced batt insulation.

1.3 DEFINITIONS

- A. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers; produced in boards and blanket with latter formed into batts (flat-cut lengths) or rolls.
- B. Fiberglass Insulation: Insulation composed of glass fibers produced in boards and blankets with latter formed into batts (flat-cut lengths) or rolls.
- C. Faced Insulation: Board or batt/blanket insulation with an integral, reinforced polyethylene and/or aluminum foil scrim film applied to one side, intended for use as a vapor barrier. Such insulation shall be installed in a manner that the facing is applied over interior side of wall studs or suspended ceiling systems.

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

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- 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 plastic 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 plastic insulating materials to Project site before installation time.
 - 3. Complete installation and concealment of plastic 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 Insulation: ASTM C 578, of type and density indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively:

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1. Available Manufacturers:
 - a. DiversiFoam Products.
 - b. Dow Chemical Company.
 - c. Owens Corning.
 - d. Pactiv Building Products Division.
2. Type IV, 1.60 lb/cu. ft. (26 kg/cu. m): at new foundation walls and edges of concrete slabs. Provide a minimum thickness of 2 inches or R-10.0.

2.2 GLASS-FIBER BLANKET

- A. Glass-Fiber Blanket, Unfaced: ASTM C665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E84; passing ASTM E136 for combustion characteristics. The unfaced option may be used, but only with separate vapor barrier applied at interior face of studs after insulation is placed in stud cavities.
- B. Glass-Fiber Blanket, Polypropylene-Scrim-Kraft Faced: ASTM C665, Type II (non-reflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier).

2.3 MINERAL WOOL BATT OR BLANKET INSULATION

- A. Available Manufacturers:
 1. CertainTeed Corporation.
 2. Roxul, Inc.
 3. Johns Manville.
 4. Thermafiber.
 5. Owens Corning.
- B. Faced, Mineral-Wool Blanket Insulation: Non-combustible, ASTM C 665 (Type I mineral wool blankets with reflective membrane facing), Class A (membrane-faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil-scrim vapor-retarder membrane on 1 face. Omit facings at all batt-type insulation to be installed at interior partitions for purpose of acoustical privacy.
- C. Where batt or blanket insulation is indicated by the following thicknesses, provide blankets in batt or roll form with thermal resistances indicated:
 1. 3-1/2 inches thick with a thermal resistance of R13; required for use at interior stud partitions of 3-1/2 inches or 4 inches in width.
 2. 6 inches thick with a thermal resistance of R-19; required at exterior stud walls of 5-1/2 inches or 6 inches in width, and above all exterior soffits adjacent to heated interior spaces.
 3. 9 inches thick with a thermal resistance of R30; required in Attic above ceilings where indicated or scheduled.

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2.4 FIRE-RETARDANT, REINFORCED-POLYETHYLENE VAPOR RETARDERS

- A. Fire-Retardant, Reinforced-Polyethylene Vapor Retarders: **For use only when applying unfaced glass fiber or mineral fiber batts for thermal insulation in exterior walls.** Provide sheet with outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nonwoven grid of nylon cord or polyester scrim and weighing not less than 20 lb./1000 sq. ft. (9 kg/100 sq. m) with maximum permeance rating of 0.1 perm (5.7 ng/Pa x s x sq. m).
1. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indexes of [75 and 200] <Insert values>, respectively, per ASTM E84.

2.5 AUXILIARY INSULATING MATERIALS

- A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by insulation manufacturers for sealing joints and penetrations in vapor-retarder facings.
- B. 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.

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- 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. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
- E. 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.

3.5 INSTALLATION OF GENERAL BUILDING INSULATION

- F. 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.
- G. Seal joints between foam-plastic 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.
- H. Install mineral-wool 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.
 - 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures.
 - 4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
 - 5. For wood-framed construction, install mineral-fiber blankets according to ASTM C 1320 and as follows:
 - a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.

3.6 PROTECTION

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- 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 072413 – POLYMER-BASED EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

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. Materials and Installation of an Exterior Insulation and Finish System (EIFS) field applied over Gypsum Sheathing substrate.

- B. Related Sections:

- 1. DIVISION 05 Section 054000, "Cold-Formed Metal Framing."
 - 2. DIVISION 06 Section 061643, "Glass-Mat Faced Gypsum Sheathing."
 - 3. DIVISION 07 Section 076000, "Flashing and Sheet Metal."
 - 4. DIVISION 07 Section 079200, "Joint Sealants."

1.3 DEFINITIONS

- A. Definitions in ASTM E 2110 apply to Work of this Section.
- B. EIFS: Exterior insulation and finish system(s).
- C. IBC: International Building Code.
- D. Polymer-Based Exterior Insulation and Finish System: Class PB EIFS, as defined in ASTM E 2568.

1.4 PREINSTALLATION MEETINGS

- A. Pre-installation Conference: Conduct conference at Project site.

1.5 SUBMITTALS

- A. Product Data: For each EIFS component, trim, and accessory to be used, including: preparation instructions and recommendations; storage and handling requirements and recommendations; and installation methods.

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- B. Shop Drawings: Submit Manufacturer's drawings detailing the approved methods for flashing and waterproofing all conditions applicable to the work listed in this section.
 - C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
 - D. Samples for Verification: 24-inch-square panels for each type of finish-coat color and texture indicated, prepared using same tools and techniques intended for actual work including custom trim, each profile, and an aesthetic reveal.
 - 1. Include exposed trim and accessory Samples to verify color selected.
 - 2. Include a typical control joint filled with sealant of color selected, as specified in Section 079200 "Joint Sealants."
 - E. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
 - F. Closeout Submittals: Provide manufacturer's moisture drainage and limited materials warranty against defective material.
 - G. Manufacturer Certificates: Signed by EIFS manufacturer certifying the following:
 - 1. EIFS substrate is acceptable to EIFS manufacturer.
 - 2. Accessory products installed with EIFS, including joint sealants, flashing, water-resistant barriers, trim whether or not furnished by EIFS manufacturer and whether or not specified in this Section, are acceptable to EIFS manufacturer.
 - H. Product Certificates: For cementitious materials and aggregates and for insulation.
 - I. Product Test Reports: For each EIFS assembly and component, for tests performed by a qualified testing agency.
 - J. Field quality-control reports and special inspection reports.
 - K. Evaluation Reports: For EIFS, including insulation fasteners, flexible membrane flashing, from ICC-ES.
 - L. Sample Warranty: For manufacturer's special warranty.
 - M. Maintenance Data: For EIFS to include in maintenance manuals.
- 1.6 QUALITY ASSURANCE
- A. Installer Qualifications: An installer certified in writing by EIFS manufacturer as qualified to install manufacturer's system using trained workers.
 - B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, to set quality standards for materials and execution, and to set quality standards for fabrication and installation.

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1. 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. Deliver materials in original, unopened packages with manufacturers' labels intact and clearly identifying products.
- B. Store materials inside and under cover; keep them dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, construction traffic, and other causes.
 1. Stack insulation board flat and off the ground.
 2. Protect plastic insulation against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
 3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.8 PROJECT CONDITIONS

- A. Weather Limitations: Maintain ambient temperatures above 40 deg F for a minimum of 24 hours before, during, and after adhesives or coatings are applied. Do not apply EIFS adhesives or coatings during rainfall. Proceed with installation only when existing and forecasted weather conditions and ambient outdoor air, humidity, and substrate temperatures permit EIFS to be applied, dried, and cured according to manufacturers' written instructions and warranty requirements.

1.9 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace EIFS that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Bond integrity and weather-tightness.
 - b. Deterioration of EIFS finishes and other EIFS materials beyond normal weathering.
 2. Warranty coverage includes the following EIFS components:
 - a. EIFS finish, including base and finish coats and reinforcing mesh.
 - b. Insulation installed as part of EIFS including build-outs.
 - c. Insulation adhesive and mechanical fasteners.
 - d. EIFS accessories, including trim components and flashing.
 3. Warranty Period: 10 years from date of Substantial Completion.

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PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The following are acceptable manufacturers:
 - 1. STO Corporation – EIFS
 - 2. Dryvit Systems Inc.
 - 3. Parex, USA, Inc.
- B. Source Limitations: Obtain EIFS from single source from single EIFS manufacturer and from sources approved by EIFS manufacturer as tested and compatible with EIFS components.
- C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 PERFORMANCE REQUIREMENTS

- A. EIFS Performance: Comply with ASTM E 2568 and ICC-ES AC219 and with the following:
 - 1. Weathertightness: Resistant to water penetration from exterior.
 - 2. Structural Performance: EIFS assembly and components shall comply with ICC-ES AC219 when tested according to ASTM E 2568.
 - a. Wind Loads: Design for maximum allowable system deflection, normal to the plane of the wall, of L/240.
 - 3. Impact Performance: ASTM E 2568, Standard impact resistance.
 - 4. Bond integrity: Free from bond failure within EIFS components or between EIFS and substrates resulting from exposure to weather, wind loads or other conditions.

2.3 EIFS MATERIALS

- A. Primer/Sealer: EIFS manufacturer's standard substrate conditioner designed to protect substrates from moisture penetration and to improve the bond between substrate and insulation adhesive. Acrylic based tintable primer for roller or spray application.
- B. Flexible-Membrane Flashing: Cold-applied, self-adhering, self-healing, rubberized-asphalt and polyethylene-film composite sheet or tape and primer; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer.
- C. Adhesive: EIFS manufacturer's standard formulation designed for indicated use; compatible with substrate and complying with one of the following:

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1. Job-mixed formulation of Portland cement complying with ASTM C 150/C 150M, Type I, and polymer-based adhesive specified for base coat.
 2. Factory-blended dry formulation of Portland cement, dry polymer admixture, and fillers specified for base coat.
 3. Factory-mixed non-cementitious formulation designed for adhesive attachment of insulation to substrates of type indicated, as recommended by EIFS manufacturer.
- D. Insulation Board: Rigid, closed-cell Extruded Polystyrene Insulation board (XPS): Comply with ASTM C 578, Type IV requirements; and with EIFS manufacturer's requirements for most stringent requirements for material performance and qualities of insulation, including dimensions and permissible variations, and the following:
1. Aging: Before cutting and shipping, age insulation in block form by air drying for not less than six weeks.
 2. Flame-Spread and Smoke-Developed Indexes: 25 and 450 or less, respectively, according to ASTM E 84.
 3. Dimensions: Provide insulation board to be 2-inch thick but not more than 4 inches thick or less than the thickness allowed by ASTM C 1397, of not more than 24 by 48 inches and in thickness indicated,
 4. Foam Build-Outs: **Provide with special shapes/profiles and dimensions indicated on Drawings.**
- E. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other EIFS materials, made from continuous multi-end strands with retained mesh tensile strength of not less than 120 lbf/in. according to ASTM E 2098 and the following:
1. Reinforcing Mesh for EIFS, General: Not less than weight required to meet impact-performance level specified in "Performance Requirements" Article.
- F. Base-Coat Materials: EIFS manufacturer's standard mixture complying with one of the following:
1. Job-mixed formulation of Portland cement complying with ASTM C 150/C 150M, Type I, white or natural color; and manufacturer's standard polymer-emulsion adhesive designed for use with Portland cement.
 2. Job-combined formulation of manufacturer's standard polymer-emulsion adhesive and manufacturer's standard dry mix containing Portland cement.
 3. Factory-blended dry formulation of Portland cement, dry polymer admixture, and inert fillers to which only water is added at Project site.
 4. Factory-mixed non-cementitious formulation of polymer-emulsion adhesive and inert fillers that is ready to use without adding other materials.
- G. Waterproof Adhesive/Base-Coat Materials: EIFS manufacturer's standard waterproof formulation and complying with one of the following:

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1. Job-mixed formulation of Portland cement complying with ASTM C 150/C 150M, Type I, white or natural color; and manufacturer's standard polymer-emulsion adhesive designed for use with Portland cement.
 2. Job-combined formulation of manufacturer's standard polymer-emulsion adhesive and manufacturer's standard dry mix containing Portland cement.
- H. Mechanical Fasteners: EIFS manufacturer's standard corrosion-resistant fasteners consisting of thermal cap, standard washer and shaft attachments, and fastener indicated below; designed to resist Project's design loads; capable of pulling fastener head below surface of insulation board; and complying with the following:
1. For attachment to steel studs from 0.033 to 0.112 inch in thickness, provide steel drill screws complying with ASTM C 954.
 2. For attachment to light-gage steel framing members not less than 0.0179 inch in thickness, provide steel drill screws complying with ASTM C 1002.
- I. Primer: EIFS manufacturer's standard factory-mixed, elastomeric-polymer primer for preparing base-coat surface for application of finish coat.
- J. Finish-Coat Materials: EIFS manufacturer's standard acrylic-based coating utilizing an elastomeric binder and complying with the following:
1. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, sound stone particles, and fillers.
 2. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, and fillers used with stone particles for embedding in finish coat to produce an applied-aggregate finish.
 - a. Aggregate: Marble chips of size and color as selected by Architect from manufacturer's full range of industry colors and color densities.
 3. Colors: As selected by Architect from manufacturer's full range.
 4. Textures: Smooth fine sand texture equal to Dryvit "Weatherlast" with Adobe finish.
- K. Sealer: Manufacturer's waterproof, clear acrylic-based sealer for protecting finish coat.
- L. Water: Clean and Potable.
- M. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with EIFS manufacturer's written instructions; manufactured from UV-stabilized PVC; and complying with ASTM D 1784 and ASTM C 1063.
1. Casing Bead: Prefabricated, one-piece type for attachment behind insulation, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
 2. Drip Screed/Track: Prefabricated, one-piece type for attachment behind insulation with face leg extended to form a drip, of depth required to suit

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thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.

3. Expansion Joint: Prefabricated, one-piece V profile; designed to relieve stress of movement.
4. Parapet Cap Flashing: Type for both flashing and covering parapet top with design complying with ASTM C 1397.

2.4 MIXING

- A. Comply with EIFS manufacturer's requirements for combining and mixing materials. Do not introduce admixtures, water, or other materials except as recommended by EIFS manufacturer. Mix materials in clean containers. Use materials within time period specified by EIFS manufacturer or discard.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roof edges, wall framing, flashings, openings, substrates, and junctures at other construction for suitable conditions where EIFS will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
 1. Begin coating application only after surfaces are dry.
 2. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Protect contiguous work from moisture deterioration and soiling caused by application of EIFS. Provide temporary covering and other protection needed to prevent spattering of exterior finish coats on other work.
- B. Protect EIFS, substrates, and wall construction behind them from inclement weather during installation. Prevent penetration of moisture behind EIFS and deterioration of substrates.
- C. Prepare and clean substrates to comply with EIFS manufacturer's written instructions to obtain optimum bond between substrate and adhesive for insulation.

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3.3 EIFS INSTALLATION, GENERAL

- A. Comply with ASTM C 1397, ASTM E 2511, and EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate.

3.4 SUBSTRATE PROTECTION APPLICATION

- A. Primer/Sealer: Apply over gypsum sheathing substrates and where required by EIFS manufacturer for improving adhesion of insulation to substrate.
- B. Flexible-Membrane Flashing: Apply and lap to shed water; seal at openings, penetrations, terminations, and where required by EIFS manufacturer. Prime substrates if required and install flashing to comply with EIFS manufacturer's written instructions and details.

3.5 TRIM INSTALLATION

- A. Trim: Apply trim accessories at perimeter of EIFS, at expansion joints and elsewhere as indicated. Coordinate with installation of insulation.
 - 1. Drip Screed/Track: Use at bottom edges of EIFS unless otherwise indicated.
 - 2. Expansion Joint: Use where indicated on Drawings.
 - 3. Casing Bead: Use at other locations.
 - 4. Parapet Cap Flashing: Use where indicated on Drawings.

3.6 INSULATION INSTALLATION

- A. Board Insulation: Adhesively and mechanically attach insulation to substrate in compliance with ASTM C 1397 and the following:
 - 1. Sheathing: Apply adhesive to insulation by notched-trowel method in a manner that results in coating the entire surface of sheathing with adhesive once insulation is adhered to substrate. Apply adhesive to a thickness of not less than 1/4 inch for factory mixed and not less than 3/8 inch for field mixed, measured from surface of insulation before placement.
 - 2. Concrete or Masonry: Apply adhesive by ribbon-and-dab method.
 - 3. Press and slide insulation into place. Apply pressure over the entire surface of insulation to accomplish uniform contact, high initial grab, and overall level surface.
 - 4. Allow adhered insulation to remain undisturbed for not less than 24 hours, before installing mechanical fasteners, beginning rasping and sanding insulation or before applying base coat and reinforcing mesh.
 - 5. Mechanically attach insulation to substrate. Install top surface of fastener heads flush with plane of insulation. Install fasteners into or through substrates with the following minimum penetration:

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- a. Steel Framing: 5/16 inch.
 - b. Concrete and Masonry: 1 inch.
6. Apply insulation over dry substrates in courses with long edges of boards oriented horizontally.
 7. Begin first course of insulation from a level base line and work upward.
 8. Begin first course of insulation from screed/track and work upward. Work from perimeter casing beads toward interior of panels if possible.
 9. Interlock ends at internal and external corners.
 10. Abut insulation tightly at joints within and between each course to produce flush, continuously even surfaces without gaps or raised edges between boards. If gaps greater than 1/16 inch occur, fill with insulation cut to fit gaps exactly; insert insulation without using adhesive or other material.
 11. Cut insulation to fit openings, corners, and projections precisely and to produce edges and shapes complying with details indicated.
 12. Rasp or sand flush entire surface of insulation to remove irregularities projecting more than 1/32 inch from surface of insulation and to remove yellowed areas due to sun exposure; do not create depressions deeper than 1/16 inch. Prevent airborne dispersal and immediately collect insulation raspings or sandings.
 13. Cut aesthetic reveals in outside face of insulation with high-speed router and bit configured to produce grooves, rabbets, and other features that comply with profiles and locations indicated. Do not reduce insulation thickness at aesthetic reveals to less than 3/4 inch.
 14. Install foam build-outs and attach to sheathing.
 15. Interrupt insulation for expansion joints where indicated.
 16. Form joints for sealant application by leaving gaps between adjoining insulation edges and between insulation edges and dissimilar adjoining surfaces. Make gaps wide enough to produce joint widths indicated after encapsulating joint substrates with base coat and reinforcing mesh.
 17. Form joints for sealant application with back-to-back casing beads for joints within EIFS and with perimeter casing beads at dissimilar adjoining surfaces. Make gaps between casing beads and between perimeter casing beads and adjoining surfaces of width indicated.
 18. Fully back-wrap board edges with strip reinforcing mesh.
 19. Treat exposed edges of insulation as follows:
 - a. Except for edges forming substrates of sealant joints, encapsulate with base coat, reinforcing mesh, and finish coat.
 - b. Encapsulate edges forming substrates of sealant joints within EIFS or between EIFS and other work with base coat and reinforcing mesh.
 - c. At edges trimmed by accessories, extend base coat, reinforcing mesh, and finish coat over face leg of accessories.
 20. Coordinate installation of flashing and insulation to produce wall assembly that does not allow water to penetrate behind flashing and EIFS lamina.

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- B. Expansion Joints: Install at locations indicated, where required by EIFS manufacturer, and as follows:
 - 1. At expansion joints in substrates behind EIFS.
 - 2. Where EIFS adjoin dissimilar substrates, materials, and construction, including other EIFS.
 - 3. Where wall height or building shape changes.
 - 4. Where EIFS manufacturer requires joints in long continuous elevations.

3.7 BASE-COAT INSTALLATION

- A. Waterproof Adhesive/Base Coat: To exposed surfaces of insulation, apply in minimum thickness recommended in writing by EIFS manufacturer.
- B. Base Coat: Apply to exposed surfaces of insulation and foam build-outs in minimum thickness recommended in writing by EIFS manufacturer, but not less than 1/16-inch dry-coat thickness.
- C. Reinforcing Mesh: Embed reinforcing mesh in wet base coat to produce wrinkle-free installation with mesh continuous at corners, overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C 1397 and EIFS manufacturer's written instructions. Do not lap reinforcing mesh within 8 inches of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are invisible.
- D. Foam Build-Outs: Fully embed reinforcing mesh in base coat.
- E. Double Base-Coat Application: Where indicated, apply second base coat in same manner and thickness as first application, except without reinforcing mesh. Do not apply until first base coat has cured.

3.8 FINISH-COAT INSTALLATION

- A. Primer: Apply over dry base coat according to EIFS manufacturer's written instructions.
- B. Finish Coat: Apply over dry primed base coat, maintaining a wet edge at all times for uniform appearance, in thickness required by EIFS manufacturer to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.
 - 1. Embed aggregate in finish coat according to EIFS manufacturer's written instructions to produce a uniform applied-aggregate finish of color and texture matching approved sample.
- C. Sealer Coat: Apply over dry finish coat, in number of coats and thickness required by EIFS manufacturer.

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3.9 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
 - 1. As stipulated in Ch. 17 of the IBC.
 - 2. According to ICC-ES AC2.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. EIFS Tests and Inspections: According to ASTM E 2568.
- D. EIFS will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.10 CLEANING AND PROTECTION

- A. Remove all excess materials from job site in accordance with contract provisions.
- B. Clean debris and foreign substances resulting from the contractor's work in surrounding areas.
- C. Remove temporary covering and protection of other work. Promptly remove coating materials from other surfaces outside areas indicated to receive EIFS coatings.
- D. Protect installed product until completion of project.
- E. Touch-up repair or replace damaged products before Substantial Completion.

END OF SECTION 072413

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SECTION 072726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

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. Vapor-retarding, fluid-applied air barriers, applied to CMU wall substrates at cavity walls.

- B. Related Requirements:

- 1. Section 061643 "Glass-Mat Faced Gypsum Sheathing" for wall sheathings and wall sheathing joint-and-penetration treatments.

1.3 DEFINITIONS

- A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.
- B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.
- C. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.4 PRE-INSTALLATION MEETINGS

- A. Pre-installation Conference: Conduct conference at Project site.

- 1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

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1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.
- C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.
- D. Field quality-control reports.

1.7 QUALITY ASSURANCE

- A. Mockups: Build mockups to set quality standards for materials and execution.
 - 1. Build integrated mockups of exterior wall assembly, 60 sq. ft. (5.5 sq. m), incorporating backup wall construction, external cladding, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
 - a. Coordinate construction of mockups to permit inspection and testing of air barrier before external insulation and cladding are installed.
 - b. Include junction with roofing membrane, building corner condition, and [foundation wall intersection.
 - c. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

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1.8 DELIVERY, STORAGE, AND HANDLING

- A. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- B. Protect stored materials from direct sunlight.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.
 - 1. Protect substrates from environmental conditions that affect air-barrier performance.
 - 2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Air-Barrier Assembly Air Leakage: Maximum 0.004 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. (0.02 L/s x sq. m of surface area at 75 Pa), when tested according to ASTM E2357.

2.3 HIGH-BUILD AIR BARRIERS, VAPOR RETARDING

- A. High-Build, Vapor-Retarding Air Barrier: Synthetic polymer membrane with an installed dry film thickness, according to manufacturer's written instructions, of 35 mils (0.9 mm) or thicker over smooth, void-free substrates.

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1. Physical and Performance Properties:
 - a. Air Permeance: Maximum 0.04 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. (0.2 L/s x sq. m of surface area at 75-Pa) pressure difference; ASTM E2178.
 - b. Vapor Permeance: Maximum 0.1 perm (5.8 ng/Pa x s x sq. m); ASTM E96/E96M, Desiccant Method.
 - c. Ultimate Elongation: Minimum 500 percent; ASTM D412, Die C.
 - d. Adhesion to Substrate: Minimum 30 lbf/sq. in. (207 kPa) when tested according to ASTM D454.
 - e. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
 - f. UV Resistance: Can be exposed to sunlight for 180 days according to manufacturer's written instructions.

2.4 MEDIUM- AND LOW-BUILD AIR BARRIERS, VAPOR RETARDING

- A. Medium-Build or Low-Build, Vapor-Retarding Air Barrier: Synthetic polymer material with an installed dry film thickness, according to manufacturer's written instructions, of 17 to 30 mils (0.4 to 0.8 mm) for medium-build, and 6 to 15 mils for low-build, over smooth, void-free substrates (***not allowed for CMU, but is allowed over exterior sheathing or other smooth substrates***).

1. Physical and Performance Properties:
 - a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. (0.02 L/s x sq. m of surface area at 75-Pa) pressure difference; ASTM E2178.
 - b. Vapor Permeance: Maximum 0.1 perm (5.8 ng/Pa x s x sq. m) [5.7 perms (327 ng/Pa x s x sq. m)]; ASTM E96/E96M, Desiccant Method.
 - c. Ultimate Elongation: Minimum 350 percent; ASTM D412, Die C.
 - d. Adhesion to Substrate: Minimum 30 lbf/sq. in. (207 kPa) when tested according to ASTM D4541.
 - e. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
 - f. UV Resistance: Can be exposed to sunlight for 180 days according to manufacturer's written instructions.

2.5 ACCESSORY MATERIALS

- A. Requirement: Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-

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barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

- B. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.
- C. Stainless-Steel Sheet: ASTM A240/A240M, Type 304, 0.0250 inch (0.64 mm) thick, and Series 300 stainless-steel fasteners.
- D. Preformed Silicone Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 - 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
 - 2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
 - 3. Verify that substrates are visibly dry and free of moisture.
 - 4. Verify that masonry joints are flush and completely filled with mortar.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching material.

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- E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.
- H. Bridge isolation joints, contraction and expansion joints, and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

3.3 ACCESSORIES INSTALLATION

- A. Install accessory materials according to air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.
 - 1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
 - 2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate.
 - 3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
 - 4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Re-prime areas exposed for more than 24 hours.
- B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- D. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip or pre-formed silicone extrusion so that a minimum of 3 inches (75 mm) of coverage is achieved over each

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substrate. Maintain 3 inches (75 mm) of full contact over firm bearing to perimeter frames, with not less than 1 inch (25 mm) of full contact.

1. Transition Strip: Roll firmly to enhance adhesion.
 2. Preformed Silicone Extrusion: Set in full bed of silicone sealant applied to walls, frame, and air-barrier material.
- F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.
- G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
- H. Seal top of through-wall flashings to air barrier with an additional 6-inch- (150-mm-) wide, transition strip.
- I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches (150 mm) beyond repaired areas in strip direction.

3.4 PRIMARY AIR-BARRIER MATERIAL INSTALLATION

- A. Apply air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.
1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
 2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
 3. Where multiple prime coats are needed to achieve required bond, allow adequate drying time between coats.
- B. High-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply air-barrier material in full contact around protrusions such as masonry ties.
1. Vapor-Retarding, High-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, but not less than 35 mils (0.9 mm), applied in one or more equal coats.

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- C. Medium-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply an increased thickness of air-barrier material in full contact around protrusions such as masonry ties.
 - 1. Vapor-Retarding, Medium-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, but not less than 17 mils (0.4 mm), applied in one or more equal coats. Apply additional material as needed to achieve void- and pinhole-free surface.
- D. Low-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply an increased thickness of air-barrier material in full contact around protrusions such as masonry ties.
 - 1. Vapor-Retarding, Low-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, but not less than 6 mils (1.5 mm), applied in one coat. Apply additional material as needed to achieve void- and pinhole-free surface.
- E. Do not cover air barrier until it has been tested and inspected by testing agency.
- F. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.5 FIELD QUALITY CONTROL

- A. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
 - 1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
 - 2. Air-barrier dry film thickness.
 - 3. Continuous structural support of air-barrier system has been provided.
 - 4. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
 - 5. Site conditions for application temperature and dryness of substrates have been maintained.
 - 6. Maximum exposure time of materials to UV deterioration has not been exceeded.
 - 7. Surfaces have been primed, if applicable.
 - 8. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
 - 9. Termination mastic has been applied on cut edges.
 - 10. Strips and transition strips have been firmly adhered to substrate.
 - 11. Compatible materials have been used.

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12. Transitions at changes in direction and structural support at gaps have been provided.
13. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
14. All penetrations have been sealed.

B. Air barriers will be considered defective if they do not pass inspections.

1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
2. Remove and replace deficient air-barrier components for retesting as specified above.

C. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

D. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials according to air-barrier manufacturer's written instructions.
2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

C. Remove masking materials after installation.

END OF SECTION 072726

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SECTION 074213 - METAL WALL AND SOFFIT 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 BASIC REQUIREMENT UNDER THIS CONTRACT

- A. It shall be a basic requirement under this contract to provide the wall panels sourced from, a single manufacturer for all exterior wall and eave areas under this contract.

1.3 SUMMARY

- A. Section Includes:

1. Concealed-Fastener, Vertical Lap-Seam Metal Wall Panels
- 2.
3. Metal Soffit Panels

- B. Related Sections:

1. Division 05 Section "Cold-Formed Metal Framing" for support framing, including girts, studs, and bracing.
2. Division 07 Section "Sheet Metal Flashing and Trim" for flashing and other sheet metal work that is not part of metal wall panel assemblies.
3. Section 084113, "Aluminum-Framed Storefronts, Windows and Entrances" for field-erected storefront system in which laminated/insulated composite wall panels shall be erected with glazing to form a weathertight enclosure.

1.4 DEFINITION

- A. Metal Wall Panel Assembly: Metal wall panels, attachment system components, miscellaneous metal framing, thermal insulation, and accessories necessary for a complete weathertight wall system.
- B. Laminated/insulated Composite Wall Panel Assembly: Metal-faced composite wall panels, metal framing, and accessories necessary for a complete weathertight wall system.

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1.5 PERFORMANCE REQUIREMENTS

- A. General Performance: Metal wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Delegated Design: Design metal wall panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) of wall area when tested according to ASTM E 283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa).
- D. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).
- E. Water Penetration under Dynamic Pressure: No evidence of water leakage when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lbf/sq. ft. (300 Pa) and not more than 12 lbf/sq. ft. (575 Pa).
 - 1. Water Leakage: As defined according to AAMA 501.1.
 - 2. Water Leakage: Uncontrolled water infiltrating the system or appearing on system's normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.
- F. Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592:
 - 1. Wind Loads: Determine loads based on the following minimum design wind pressures:
 - a. Uniform pressure of 20 lbf/sq. ft. (957 Pa) acting inward or outward.
 - b. Uniform pressure as indicated on Drawings.
 - 2. Deflection Limits: Metal wall panel assemblies shall withstand wind loads with horizontal deflections no greater than $[1/180]$ $[1/240]$ <Insert deflection> of the span.
- G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of

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components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.6 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of wall panel and accessory.
- B. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory-, shop- and field-assembled work.
 1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches (1:10):
 - a. Flashing and trim.
 - b. Anchorage systems.
- C. Samples for Initial Selection: For each type of metal wall panel indicated with factory-applied color finishes.
 1. Include similar Samples of trim and accessories involving color selection.
 2. Include manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each sealant exposed to view.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 1. Metal Wall and Soffit Panels: 12 inches (305 mm) long by actual panel width. Include fasteners, closures, and other metal wall panel accessories.
 2. Trim and Closures: 12 inches (305 mm) long. Include fasteners and other exposed accessories.
 3. Accessories: 12-inch- (305-mm-) long Samples for each type of accessory.
- E. Delegated-Design Submittal: For metal wall panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- F. Coordination Drawings: Exterior elevations drawn to scale and coordinating penetrations and wall-mounted items. Show the following:
 1. Wall panels and attachments.

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2. Girts.
3. Wall-mounted items including doors, windows, louvers, and lighting fixtures.
4. Penetrations of wall by pipes and utilities.

- G. Qualification Data: For Installer.
- H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.
- I. Field quality-control reports.
- J. Maintenance Data: For metal wall panels to include in maintenance manuals.
- K. Warranties: Sample of special warranties.

1.7 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Exterior elevations, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 1. Wall panels and attachments.
 2. Interface with aluminum storefront framing, including storefront gasketing system
- B. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.
- D. Warranties: Samples of special warranties.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- C. Source Limitations: Obtain each type of metal wall panel from single source from single manufacturer.

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- D. Fire-Resistance Ratings: Where indicated, provide metal wall panels identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
- E. Pre-installation Conference: Conduct conference at project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal wall panel Installer, metal wall panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal wall panels, including installers of doors, windows, and louvers.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review methods and procedures related to metal wall panel installation, including manufacturer's written instructions.
 - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 - 5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
 - 6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
 - 7. Review temporary protection requirements for metal wall panel assembly during and after installation.
 - 8. Review wall panel observation and repair procedures after metal wall panel installation.

1.9 DELIVERY, STORAGE, AND HANDLING

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

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- E. Protect foam-plastic 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-plastic insulation materials to Project site before installation time.
 - 3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.10 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal wall panels to be performed according to manufacturers' written instructions and warranty requirements.
- B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal wall panel fabrication, and indicate measurements on Shop Drawings.

1.11 COORDINATION

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

1.12 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - 2. Warranty Period: **Two** years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.

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- b. Chalking in excess of a No.8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: **Non-pro-rated 30** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANEL MATERIALS

- A. Metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 1. Aluminum-Zinc Alloy-Coated Steel Sheet: Prefinished metal shall be Aluminum-Zinc Alloy Coated (AZ-55 Galvalume) Steel Sheet, **22-Gauge (for walls), 24-Gauge (for soffits)**, ASTM A 792, Grade 40, yield strength 40 ksi min.
 2. Surface: Smooth, flat finish.
 3. Exposed Coil-Coated Finish:
 - a. 2-Coat Fluoropolymer: AAMA 621. Fluoropolymer **finish** containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - b. Color: As specified below for each panel system.
 4. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).
- B. Aluminum Sheet: Coil-coated sheet, ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
 1. Surface: Smooth, flat finish.
 2. Exposed Coil-Coated Finishes Exterior and Interior surfaces):
 - a. Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - b. Metallic Fluoropolymer: AAMA 620. 3-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

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3. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

C. Panel Sealants:

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal wall panels and remain weathertight; and as recommended in writing by metal wall panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.2 MISCELLANEOUS METAL FRAMING

- A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G40 (Z120) hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated.
- B. Zee Clips: 0.079-inch (2.01-mm) nominal thickness.
- C. Base or Sill Angles: 0.079-inch (2.01-mm) nominal thickness.
- D. Hat-Shaped, Rigid Furring Channels:
 1. Nominal Thickness: 0.040 inch (1.02 mm).
 2. Depth: 7/8-inch (22 mm).
- E. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

2.3 MISCELLANEOUS MATERIALS

- A. Panel Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

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2.4 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS

- A. General: Provide factory-formed metal wall panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.
- B. Ribbed-Profile, Exposed-Fastener Metal Wall Panels for use at **Primary Wall Areas**: ASTM E 1592, formed with raised panel edges, formed ribs at 12 inches on center, and flat pan between the ribs panel edges; with lapped joint between panels. Provide profile panels with overall depth not to exceed 1-1/2 inch nor less than 1- inch. Each panels shall provide for not less than 36 inches of wall coverage.
 - 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. Basis of Design: MBCI, "PBR" wall panel.
 - b. Varco-Pruden, "2057 Panel" (Rib Wall).
 - c. Butler Building Systems, "Butlerib II EX" wall system.
 - d. American/Nucor Metal Building Systems, "R-Panel."
 - e. Star Buildings, "PBR" wall panel.
 - f. Ceco Building Systems, "PBR" wall panel.
 - g. Vulcan Steel Structures, "PBR" wall panel.
 - 2. Material: Zinc-coated (galvanized) steel sheet, **22-gauge** nominal thickness.
 - a. Exterior Finish: 2-coat fluoropolymer.
 - b. Color: As selected by Architect from manufacturer's full range.
 - 3. Panel Coverage: 36 inches (915 mm) minimum.
 - 4. Panel Height: Continuous unbroken lengths, as indicated on the drawings.
 - 5. Panel Color: To match MBCI Signature 300, "Tundra" or manufacturer's standard color selected and approved by the Architect.

2.5 LAMINATED/INSULATED COMPOSITE WALL PANELS (CAP) – FOR USE AT STOREFRONTS

- A. General: Provide factory-formed and -assembled, laminated/insulated composite wall panels fabricated from two 0.060-inch thickness metal facings bonded to suitable substrate base sheet and polyisocyanurate core insulation; formed into flat sheet profile of overall 1-inch thickness for installation method into aluminum storefront indicated. Include accessories required for weathertight system.
 - 1. Fire-Retardant Core: Noncombustible, with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

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- a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
2. Products: Subject to compliance with requirements, provide one of the following:
- a. Thermolite by Omega Panel Products
 - b. High Standard Inc.
 - c. Wrisco Industries, Inc.
 - d. Mapes-R by Mapes Architectural Panels
- B. Laminated/insulated Composite Wall Panels Formed with 0.060-inch-thick, coil-coated aluminum sheet facings.
1. Overall Panel Thickness: 1 inch (25.6 mm).
 2. Core: Fire retardant insulation, polyisocyanurate, minimum R-value = 6.0
 3. Exterior Finish: 3-coat fluoropolymer.
 - a. Color on South Wall (both exterior and interior sides of panels): Color shall match Omega Panel Laminators "Sierra Tan," or shall be as selected and approved by Architect from manufacturer's full range standard colors to match existing flush metal panel color specified above as closely as possible.
 - b. Color on North Wall (both exterior and interior sides of panels, where infilling with fixed storefront at doors to be removed): Color shall match existing aluminum storefront color, Omega Panel Laminators "Forest Green," or shall be as selected and approved by Architect from manufacturer's full range standard colors to match existing flush metal panel color specified above as closely as possible.

2.6 SOFFIT PANELS

- A. General: Provide factory-formed metal soffit panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.
- B. Flush-Profile, Concealed-Fastener Metal Wall Panels: ASTM E 1592, unperforated (solid) metal, formed with vertical panel edges and flat pan between panel edges; with V-groove joint between panels. Provide thin profile panels of not less than 3/8-inch overall depth.
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 systems or equal approved by Architect:
 - a. Petersen Aluminum Company, PAC-850 Solid Soffit Panel System

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- b. Fabral "Posi-Lock" Soffit Panel System
 - c. Englert "E-375" Soffit Panel System
2. Material: Zinc-coated (galvanized) steel sheet, **24-gauge** nominal thickness.
- a. Exterior Finish: 2-coat fluoropolymer.
 - b. Color: As selected by Architect from manufacturer's full range.
3. Panel Coverage: 12 inches (305 mm) minimum.
4. Panel Height: Continuous unbroken lengths, as indicated on the drawings.
5. Panel Color: To match Petersen Aluminum Company "Bone White" or manufacturer's standard color selected and approved by the Architect.

2.7 ACCESSORIES

- A. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels, unless otherwise indicated.
1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal wall panels.
 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- B. Flashing and Trim: Formed from 0.018-inch (0.46-mm) minimum thickness, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.
- C. Panel Fasteners: Self-tapping stainless or zinc/aluminum-coated screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal roof panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers. **All screws used in conjunction with metal wall panels where exposed to view shall be factory pre-finished to match the wall panel color identically.**

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- D. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.8 FABRICATION

- A. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Fabricate laminated/insulated composite wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.
- E. Laminated/insulated Composite Wall Panels: Factory form panels in a continuous process. Trim and square edges of sheets with no displacement of face sheets or protrusion of core material.
 - 1. Form panel lines, breaks, and angles to be sharp and true, with surfaces free from warp and buckle.
 - 2. Fabricate panels with sharply cut edges, with no displacement of face sheets or protrusion of core material or insulation.
 - 3. Dimensional Tolerances:
 - a. Panel Bow: 0.8 percent maximum of panel length or width.
 - b. Squareness: 0.25 inch (5 mm) maximum.
- F. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

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4. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal wall panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.9 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of work.
 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
- B. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

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3.2 PREPARATION

- A. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorages according to ASTM C 754 and metal wall panel manufacturer's written recommendations.

3.3 METAL WALL PANEL INSTALLATION

- A. General: Install metal wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Shim or otherwise plumb substrates receiving metal wall panels.
 - 2. Flash and seal metal wall panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by metal wall panels are installed.
 - 3. Install screw fasteners in predrilled holes.
 - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 5. Install flashing and trim as metal wall panel work proceeds.
 - 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 - 7. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
 - 8. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 - 9. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.
- B. Fasteners:
 - 1. Steel Wall Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized steel fasteners for surfaces exposed to the interior.
 - 2. Aluminum Wall Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized steel fasteners for surfaces exposed to the interior.
- C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal wall panel manufacturer.
- D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types

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of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.

1. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

- E. Zee Clips: Provide Zee clips of size indicated or, if not indicated, as required to act as standoff from subgirts for thickness of insulation indicated. Attach to subgirts with fasteners.

3.4 LAMINATED/INSULATED COMPOSITE WALL PANEL INSTALLATION

- A. General: Install laminated/insulated composite wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Anchor panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Shim or otherwise plumb substrates receiving laminated/insulated composite wall panels.
 2. Install clips, shims, trim and accessories as laminated/insulated composite wall panel work proceeds.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by laminated/insulated composite wall panel manufacturer.

3.5 METAL SOFFIT PANEL INSTALLATION

- A. Install according to manufacturer's installation instructions. Align seams and V-grooves perpendicular to outside edge of building. Install continuous metal angle trim in matching color at perimeter of all soffits. Secure soffit panels to edge supports and intermediate supports using concealed fastening methods and corrosion-resistant fasteners. Install light fixtures in centers of soffits and coordinate layout of above-soffit supports so as not to conflict with light fixtures. Provide neat cut-outs and metal trim rings or beads for all light fixture penetrations. Install soffit panels level, true and flat, without bow or warp.

3.6 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

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1. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (605 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

3.7 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect and test completed metal wall panel installation, including accessories.
- B. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.
- C. Installation Tolerances: Shim and align laminated/insulated composite wall panel units within installed tolerance of 1/4-inch in 20 feet (6 mm in 6 m), non-accumulative, on level, plumb, and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.
- D. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.8 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.

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- B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213

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SECTION 075200 - 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 new roof system installation at the Secure Vestibule Addition. It shall also apply to roofing work at existing low-slope roofing where indicated on the Drawings. Patching and repairs are required in conjunction with removal of existing HVAC system components as well as placement of new HVAC system components, equipment, structural supports, curbs, utility distribution and related accessories. Existing low-slope roof at the school was very recently replaced 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 that the current 20-year warranty at low-slope areas where existing bituminous membrane was recently installed to remain in effect, unaffected by work on this project. Continuance of the existing warranty shall be certified by the existing roof system manufacturer (Soprema).**

This Section includes the following:

- 1. Roof membrane application:
 - a. 2-ply Modified Bitumen roof, cold adhesive applied for slope equal or greater 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 5 Section "Steel Deck" for acoustic roof deck insulation requirements.
 - 2. Division 6 Section "Rough Carpentry" for sheathing, composite insulated sheathing, wood nailers, curbs, and wood cants.
 - 3. Division 7 Section "Sheet Metal Flashing and Trim" for metal counter flashings, gravel stops and fascias. Materials specified in this section for roofing application shall form part of the Total System Warranty of the roof manufacturer/installer.

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.

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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. Deck: Metal
 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. Glass Mat Roof Board
c. CertainTeed Corp.: GlasRoc™ Roof Board
 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. Specified Guarantee: Twenty Year Roof Membrane flashings, gravel stop and fascia, "Full System Warranty" Guarantee with an insulation inclusion addendum. No exclusions for ponding water are allowed in the Guarantee in areas to receive the liquid-applied roofing (PMMA or alternate chemistry waterproofing) system.
 9. Approved Manufacturers: The following manufacturer is approved to bid based upon an existing 20 year warranty which expires in 2027:
 - a. Firestone Building Products – Certified Firestone Roof Contractor.

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.

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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

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- 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.

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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

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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. The existing roof warrantor, Tremco, Inc., will observe and approve all modified bituminous roof membrane and substrate work under this contract that comes into contact with previously-coated, low-slope MBR.

PART 2 - PRODUCTS

2.1 ROOFING SYSTEM ASSEMBLY

- A. Roofing Membrane Assembly: A roof membrane assembly consisting of two (2) plies of a prefabricated, fiberglass 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:
 - 1. Modified Bitumen Base Ply: ASTM D 6163, Grade S, Type II, SBS-modified asphalt sheet (reinforced with glass fibers); smooth surfaced; suitable for application method specified. Minimum 114 mils.
 - 2. Modified Bitumen Cap Sheet: ASTM D 6163, Grade G, Type I, SBS-modified asphalt sheet (reinforced with glass fibers); white ceramic-coated granular surfaced; suitable for application method specified. Minimum 130 mil
 - 3. Stripping Ply: (Same as roof system base ply unless noted).
 - 4. Flashing Membrane Assembly: ASTM D 6298, aluminum-foil surfaced SBS-modified asphalt sheet (reinforced with glass fibers); 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.

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- 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.

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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.”

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.

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- 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.

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- 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.

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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.

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- 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 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 continuance of the existing 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

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attended by the Owner, Architect-Engineer, and Contractor and the manufacturer's representative. A two-year inspection punchlist shall be compiled by the manufacturer and submitted to the Contractor for his completion. Upon completion, sign and mail the punchlist form to the manufacturer's headquarters, verifying that all items are in accordance with the manufacturer's recommendations.

END OF SECTION 075200

SECTION 076100 - SHEET METAL ROOFING

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 custom-fabricated standing-seam sheet metal roofing.
- B. Related Requirements:
 - 1. Section 061000 "Rough Carpentry" for wood nailers and blocking associated with seam sheet metal roofing.
 - 2. Section 074213 "Metal Wall and Soffit Panels" for manufactured metal panels used in exterior wall and soffit applications.
 - 3. Section 076200 "Sheet Metal Flashing and Trim" for gutters, downspouts, fasciae and flashings that are not part of sheet metal roofing.
 - 4. Section 077200 "Roof Accessories" for manufactured roof accessories.
 - 5. Section 079200 "Joint Sealants" for field-applied sealants adjoining sheet metal roofing and not otherwise specified in this Section.

1.3 COORDINATION

- A. Coordinate sheet metal roofing layout and seams with sizes and locations of roof curbs, equipment supports, equipment provided, and roof penetrations.
- B. Coordinate sheet metal roofing installation with rain drainage work, flashing, trim, and construction of roofing substrate, parapets, walls, and other adjoining work to provide leakproof, secure, and noncorrosive installation.

1.4 PRE-INSTALLATION MEETINGS

- A. Pre-installation Conference: Conduct conference at Project site.
 - 1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

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2. Review structural loading limitations of substrates during and after roofing installation.
3. Review insulation, air barrier, vapor retarder, and underlayment requirements.
4. Review flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affect sheet metal roofing.
5. Review requirements for insurance and certificates if applicable.
6. Review roof observation and repair procedures after sheet metal roofing installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each of the following:

1. Roofing sheet metal.
2. Underlayment materials.
3. Fasteners.
4. Sealant tape.
5. Elastomeric sealant.
6. Butyl sealant.

B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and panel installation layouts, expansion joint locations, points of fixity, and keyed details. Distinguish between shop- and field-assembled Work.
3. Include details for forming, including seams and dimensions.
4. Include details for joining and securing, including layout and spacing of fasteners, cleats, and other attachments. Include pattern of seams.
5. Include details of expansion joints, including showing direction of expansion and contraction from points of fixity.
6. Include details of roof penetrations.
7. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, corners, flashings, and counterflashings.
8. Include details of special conditions.
9. Include details of connections to adjoining work.
10. Detail the following accessory items, at scale of not less than 1-1/2 inches per 12 inches (1:10):
 - a. Flashing and trim.
 - b. Roof curbs.

C. Samples: For each exposed product and for each color and texture specified, 12 inches (300 mm) long by actual width.

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- D. Samples for Initial Selection: For each type of sheet metal with factory-applied finishes.
 - 1. Include Samples of trim and accessories involving finish or color selection.
- E. Samples for Verification: For each type of exposed finish.
 - 1. Sheet Metal Roofing: 6 inches (150 mm) long by 4 inches (100 mm).
 - 2. Trim and Metal Closures: 12 inches (300 mm) long and in required profile. Include fasteners and other exposed accessories.
 - 3. Other Accessories: 12-inch- (300-mm-) long Samples for each type of other accessory.

1.6 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Roof plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Sheet metal roofing, seam locations, and attachments.
 - 2. Details for penetrations, if any.
- B. Qualification Data: For Installer.
 - 1. Include listing of completed projects of comparable scale of this Project, including name, address, telephone, and contact person for Architect, and name, address, telephone number, and contact person for building Owner.
- C. Evaluation Reports: For self-adhering, high-temperature sheet underlayment, from ICC-ES.
- D. Sample Warranties: For special warranties.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing sheet metals and accessories to include in maintenance manuals.
- B. Special warranties.

1.8 QUALITY ASSURANCE

- A. Sheet Metal Roofing Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal roofing similar to that required for this Project and whose products have a record of successful in-service performance.

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- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Build mockup of typical roof area and eave as shown on Drawings, including underlayment, attachments, and accessories.
 - a. Size: Approximately 12 feet (3.5 m) long by 6 feet (1.75 m).
 - b. Include each type of exposed seam and seam termination with fascia.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal roofing materials in contact with other materials that might cause staining, denting, or other surface damage.
 - 1. Store sheet metal roofing materials away from uncured concrete and masonry.
 - 2. Protect stored sheet metal roofing materials from contact with water.
- B. Protect strippable protective covering on sheet metal roofing from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal roofing installation.

1.10 WARRANTY

- A. Special Warranty: Warranty form at end of this Section in which Installer agrees to repair or replace components of sheet metal roofing that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including, but not limited to, rupturing, cracking, or puncturing.
 - b. Wrinkling or buckling.
 - c. Loose parts.
 - d. Failure to remain weathertight, including uncontrolled water leakage.
 - e. Deterioration of metals, metal finishes, and other materials beyond normal weathering, including non-uniformity of color or finish.
 - f. Galvanic action between sheet metal roofing and dissimilar materials.

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2. Warranty Period: **Two years** from date of Substantial Completion.
- B. General Warranty by Metal Roofing System Manufacturer for Weathertightness and Resistance to Damage and Physical Deterioration
1. Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
 2. Warranty Period: **20 years** from date of Substantial Completion.
- C. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal roofing that shows evidence of deterioration of factory-applied finishes within specified warranty period.
1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E 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. Finish Warranty Period: **20 years** from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. General: Metal roofing system may be considered "architectural" grade or "structural" grade; however, the intent under this project is for a metal roof that is installed over a corrugated metal roof deck covered by a gypsum coverboard.
- B. Materials: Metal roofing system shall consist of factory- or site-formed roof-panels from pre-finished sheet metal coil stock as specified in greater detail herein. All ferrous materials, except for stainless steel, shall be galvanized prior to receiving PVDF-finish coatings.
- C. Roof Panels: Seams shall be 16 inches on center with standing seams approximately 2 inches high but not less than 1-1/2 inches in height. Panels shall be 24 gauge and formed with two stiffening ribs parallel to length of panel and standing seams. Ribs shall be centered at one-third points across width of panel.

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- D. Roof System: Roofing system shall be panelized and consist of sequentially-installed panels that interlock to one another at the vertical seams. Panels shall be held down to the roof deck substrate by pre-formed metal clips also installed at the vertical seams. **Seam battens, separate from the panels, are not permitted.** The clips shall be manufactured in such a way as to tolerate thermal movement of the roof due to expansion and contraction. The roof system shall be secured to the roof substrate by these clips and concealed screw fasteners.
- E. Acceptable Manufacturers and Systems: Provide a metal roofing system as follows by one of the following manufacturers, or an equal system if submitted to, and approved by, the Architect:
 - 1. MBCI, LokSeam® Metal Roofing System.
 - 2. PAC-Clad Roofing Systems, "Snap-Clad."
 - 3. Atas International, Inc., "Dutch Seam."
 - 4. McElroy Metal, "Medallion-Lok."
 - 5. Fabral, "Thin Seam"

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Sheet metal roofing system, including, but not limited to, metal roof panels, cleats, anchors and fasteners, seams, sheet metal flashing integral with sheet metal roofing, fascia panels, trim, underlayment, and accessories, shall comply with requirements without failure due to defective manufacture, fabrication, or installation, or due to other defects in construction. Sheet metal roofing shall remain watertight.
- B. Sheet Metal Roofing Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or indicated on Drawings.
- C. Energy Performance: Provide sheet metal roofing according to one of the following when tested according to CRRC-1:
 - 1. Three-year, aged, solar reflectance of not less than 0.55 and emissivity of not less than 0.75.
 - 2. Three-year, aged, Solar Reflectance Index of not less than 64 when calculated according to ASTM E1980.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

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2.3 ROOFING SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Metallic-Coated Steel Sheet: Provide aluminum-zinc alloy-coated steel sheet according to ASTM A792/A792M, Class AZ50 (Class AZM150) coating designation, Grade 40 (Grade 275); with smooth, flat surface; factory-painted by coil-coating process to comply with ASTM A755/A755M.
 - 1. Thickness: Nominal 0.022 (0.56) inch (mm) unless otherwise indicated.
 - 2. Exposed Coil-Coated Finish, one of the following:
 - a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.
 - b. FEVE Fluoropolymer: AAMA 621. Two-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether (FEVE) resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.
 - 3. Color: As selected by Architect from manufacturer's full range of standard colors to match the building's existing metal roofing.
 - 4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil (0.013 mm).

2.4 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet Underlayment: Minimum 30 mils (0.76 mm) thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.
 - 1. Thermal Stability: ASTM D1970/D1970M; stable after testing at 240 deg F (116 deg C) or higher.
 - 2. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F (29 deg C) or lower.
- B. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. (0.16 kg/sq. m) minimum.

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- C. Ventilation Mat: 0.40-inch (10.16-mm-thick), three-dimensional nylon mat.

2.5 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete roofing system and as recommended by primary sheet metal manufacturer unless otherwise indicated.

- B. Fasteners: Wood screws, annular-threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.

- 1. General:

- a. Exposed Fasteners: Heads matching color of sheet metal roofing, using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of roofing.
- b. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed; with hex-washer head.
- c. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.

- 2. Fasteners for Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

- C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.

- D. Elastomeric Sealant: ASTM C920, elastomeric polyurethane or polysulfide polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal roofing and remain watertight.

- E. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

- F. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D1187.

2.6 ACCESSORIES

- A. Sheet Metal Accessories: Provide components required for complete sheet metal roofing assembly, including trim, fasciae, corner units, clips, flashings, sealants, gaskets, fillers, metal closures, closure strips, and similar items. Match material and finish of sheet metal roofing unless otherwise indicated.

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1. Cleats: Intermittent and continuous attachment devices for mechanically seaming into joints and formed from the following materials and thicknesses unless otherwise indicated:
 - a. Metallic-Coated Steel Roofing: [0.0250- (0.64-) inch- (mm-) thick stainless steel.
 2. Expansion-Type Cleats: Cleats of a design that allows longitudinal movement of roof panels without stressing panel seams; of same material as other cleats.
 3. Backing Plates: Plates at roofing splices, fabricated from material recommended by SMACNA's "Architectural Sheet Metal Manual."
 4. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible-closure strips; cut or premolded to match sheet metal roofing profile. Provide closure strips where necessary to ensure weathertight construction.
 5. Flashing and Trim: Formed from same material and with same finish as sheet metal roofing, minimum 0.018 (0.46) inch (mm) thick.
- B. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.

2.7 FABRICATION

- A. Custom fabricate sheet metal roofing to comply with details shown and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions (panel width and seam height), geometry, metal thickness, and other characteristics of installation. Fabricate sheet metal roofing and accessories in shop to greatest extent possible.
 1. Standing-Seam Roofing: Form standing-seam panels with finished seam height of 1-1/2 inches (38 mm).
- B. Fabrication Tolerances: Fabricate sheet metal roofing that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.
- C. Fabrication Tolerances: Fabricate sheet metal roofing that is capable of installation to tolerances specified in MCA's "Metal Roof Installation Manual."
- D. Form exposed sheet metal work to fit substrates with little oil canning; free of buckling and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.

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1. Lay out sheet metal roofing, so transverse seams, if required, are made in direction of flow, with higher panels overlapping lower panels.
 2. Transverse seams shall not be permitted; form all roof panels from continuous lengths of sheet metal, from ridge to eave.
 3. Fold and cleat eaves and transverse seams in shop.
 4. Form and fabricate sheets, seams, strips, cleats, valleys, ridges, edge treatments, integral flashings, and other components of metal roofing to profiles, patterns, and drainage arrangements indicated on Drawings and as required for leakproof construction.
- E. Expansion Provisions: Fabricate sheet metal roofing to allow for expansion in running work sufficient to prevent leakage, damage, and deterioration of the Work.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
- F. Sealant Joints: Where movable, non-expansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to SMACNA's "Architectural Sheet Metal Manual."
- G. Sheet Metal Accessories: Custom fabricate flashings and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item required. Obtain field measurements for accurate fit before shop fabrication.
1. Form exposed sheet metal accessories without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 2. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 3. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
 4. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate elastomeric sealant.
 5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces of accessories exposed to view.
 6. Fabricate cleats and attachment devices of sizes recommended by SMACNA's "Architectural Sheet Metal Manual" for application, but not less than thickness of metal being secured.
- H. Do not use graphite pencils to mark metal surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
 - 1. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking, that tops of fasteners are flush with surface, and that installation is within flatness tolerances required for finished roofing installation.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored, and that provision has been made for drainage, flashings, and penetrations through sheet metal roofing.
 - 3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating sheet metal roofing to verify actual locations of penetrations relative to seam locations of sheet metal roofing before installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Lay out panel arrangement before installation of sheet metal roofing.
 - 1. Space fasteners not more than 18 (460) inches (mm) o.c.

3.3 UNDERLAYMENT INSTALLATION

- A. Self-Adhering High-Temperature Sheet Underlayment:
 - 1. Install self-adhering high-temperature sheet underlayment, wrinkle free.
 - 2. Prime substrate if recommended by underlayment manufacturer.
 - 3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
 - 4. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses.
 - 5. Overlap side edges not less than 3-1/2 inches (90 mm).
 - 6. Roll laps and edges with roller.

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7. Cover underlayment within 14 days of installation.
 8. Install self-adhering high-temperature underlayment over the entire pitched roof area.
- B. Install slip sheet, wrinkle free, over underlayment before installing sheet metal roofing and related flashing.
1. Install in shingle fashion to shed water, with lapped joints of not less than 4 inches (100 mm).
- C. Install ventilation mat over underlayment before installing sheet metal roofing and related flashing.
- D. Install flashings to cover underlayment, slip sheet and ventilation mat according to requirements in Section 076200 "Sheet Metal Flashing and Trim," or as otherwise shown on the Drawings.

3.4 INSTALLATION, GENERAL

- A. Install sheet metal roofing to comply with details shown and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to installation characteristics required unless otherwise indicated on Drawings.
1. Install fasteners, protective coatings, separators, sealants, and other miscellaneous items as required for complete roofing system.
 2. Install sheet metal roofing true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of sealant.
 3. Anchor sheet metal roofing and other components of the Work securely in place, with provisions for thermal and structural movement.
 4. Do not field cut sheet metal roofing by torch.
 5. Provide metal closures at peaks, eaves each side of ridge and hip caps.
 6. Flash and seal sheet metal roofing with closure strips at eaves, rakes, and perimeter of all openings. Fasten with self-tapping screws.
 7. Locate and space fastenings in uniform vertical and horizontal alignment. Predrill panels for fasteners.
 8. Install ridge and hip caps as sheet metal roofing work proceeds.
 9. Lap metal flashing over sheet metal roofing to direct moisture to run over and off roofing.
 10. Do not use graphite pencils to mark metal surfaces.
- B. Thermal Movement: Rigidly fasten metal roof panels to structure at only one location for each panel.
1. Allow remainder of panel to move freely for thermal expansion and contraction.
 2. Point of Fixity: Fasten each panel along a single common line of fixing located at eaves.

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3. Avoid attaching accessories through roof panels in manner that inhibits thermal movement.
 - C. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.
 - D. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating, by applying self-adhering sheet underlayment to each contact surface, or by other permanent separation as recommended in SMACNA's "Architectural Sheet Metal Manual."
 1. Coat concealed side of uncoated-aluminum and stainless steel sheet metal roofing with bituminous coating where roofing contacts wood, ferrous metal, or cementitious construction.
 - E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
 - F. Fasciae:
 1. Align bottom of sheet metal roofing and fasten with blind rivets, bolts, or self-tapping screws.
 2. Flash and seal sheet metal roofing with closure strips where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.
- 3.5 CUSTOM-FABRICATED SHEET METAL ROOFING INSTALLATION
- A. Install sheet metal roofing system with lines and corners of exposed units true and accurate.
 1. Form exposed faces flat and free of buckles, excessive waves, and avoidable tool marks, considering metal temper and reflectivity.
 2. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 3. Fold back sheet metal to form hem on concealed side of exposed edges unless otherwise indicated.
 - B. Install cleats to hold sheet metal roofing panels in position.
 1. Attach each cleat with at least two fasteners to prevent rotation.
 2. Space cleats not more than 12 (300) inches (mm) o.c.
 3. Bend tabs over fastener head.

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4. Provide expansion-type cleats for roof panels that exceed 30 feet (9.1 m) in length.
- C. Seal joints as required for watertight construction. For roofing with 3:12 slopes or less, use cleats at transverse seams.
1. Use sealant-filled joints unless otherwise indicated.
 - a. Embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant.
 - b. Form joints to completely conceal sealant.
 - c. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way.
 - d. Adjust setting proportionately for installation at higher ambient temperatures.
 - e. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."
- D. Standing-Seam Roofing:
1. Attach standing-seam metal panels to substrate with double-fastened cleats spaced at 12 (300) inches (mm) o.c.
 2. Install panels reaching from eave to ridge before moving to adjacent panels.
 - a. Where transverse joints are required, stagger joints in adjacent panels not less than 48 inches (1200 mm).
 3. Before panels are interlocked, apply continuous bead of sealant to top of flange of lower panel.
 4. Lock standing seams by folding over twice, so cleat and panel edges are completely engaged.
 5. Loose-lock panels at eave edges to continuous cleats and flanges at roof edge at gutters.
 6. Loose-lock panels at eave edges to continuous edge flashing exposed 24 inches (600 mm) from roof edge.
 - a. Attach edge flashing to face of roof edge with continuous cleat fastened to roof substrate at 12- (305) inch (mm) o.c. spacing.
 - b. Lock panels to edge flashing.
 7. Leave seams upright after locking at ridges and hips.

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3.6 ACCESSORY INSTALLATION

- A. Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion.
 - 1. Coordinate installation with flashings and other components.
 - 2. Install components required for complete sheet metal roofing assembly, including trim, seam covers, flashings, sealants, gaskets, fillers, metal closures, closure strips, and similar items.
 - 3. Install accessories integral to sheet metal roofing that are specified in Section 076200 "Sheet Metal Flashing and Trim" to comply with that Section's requirements.

- B. Flashing and Trim: Comply with performance requirements and SMACNA's "Architectural Sheet Metal Manual."
 - 1. Provide concealed fasteners where possible, and install units true to line, levels, and slopes.
 - 2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
 - 3. Install flashing and trim as required to seal against weather and to provide finished appearance, including, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
 - 4. Install continuous strip of self-adhering underlayment at edge of continuous flashing overlapping self-adhering underlayment, where "continuous seal strip" is indicated in SMACNA's "Architectural Sheet Metal Manual" and on Drawings.
 - 5. Install exposed flashing and trim without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 - 6. Install sheet metal flashing and trim to fit substrates, and to result in waterproof and weather-resistant performance.
 - 7. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.
 - a. Space expansion joints at maximum of 10 feet (3 m) with no joints within 24 inches (600 mm) of corner or intersection.
 - b. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, and filled with butyl sealant concealed within joints.
 - c. Use lapped expansion joints only where indicated on Drawings.

- C. Pipe Flashing: Form flashing around pipe penetration and sheet metal roofing. Fasten and seal to sheet metal roofing as recommended in SMACNA's "Architectural Sheet Metal Manual."

- D. Roof Curbs: Install flashing around bases where curbs meet sheet metal roofing.

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3.7 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal roofing within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.
- B. Installation Tolerances: Shim and align sheet metal roofing within installed tolerances specified in MCA's "Metal Roof Installation Manual."

3.8 CLEANING

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. On completion of sheet metal roofing installation, clean finished surfaces as recommended by sheet metal roofing manufacturer.
- C. Clean and neutralize flux materials. Clean off excess solder.
- D. Clean off excess sealants.

3.9 PROTECTION

- A. Remove temporary protective coverings and strippable films as sheet metal roofing is installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Prohibit traffic of any kind on installed sheet metal roofing.
- C. Maintain sheet metal roofing in clean condition during construction.
- D. Replace sheet metal roofing components that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

3.10 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS **<Insert name>** of **<Insert address>**, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
 - 1. Owner: **<Insert name>**.
 - 2. Owner's Address: **<Insert address>**.
 - 3. Building Name/Type: **<Insert information>**.
 - 4. Building's Address: **<Insert address>**.
 - 5. Area of Work: **<Insert information>**.

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6. Acceptance Date: **<Insert date>**.
 7. Warranty Period: **<Insert time>**.
 8. Expiration Date: **<Insert date>**.
- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period Roofing Installer will, at Roofing Installer's own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - a. Lightning;
 - b. Peak gust wind speed exceeding **<Insert mph (m/s)>**;
 - c. Fire;
 - d. Failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. Faulty construction of parapet walls, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - f. Vapor condensation on bottom of roofing; and
 - g. Activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
 2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
 4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or

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deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.

5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this **<Insert day>** day of **<Insert month>**, **<Insert year>**.

1. Authorized Signature: **<Insert signature>**.
2. Name: **<Insert name>**.
3. Title: **<Insert title>**.

END OF SECTION 076100

SECTION 076200 - SHEET METAL FLASHING AND TRIM

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. Formed Products:

- a. Formed metal downspout boots.
 - b. Miscellaneous closures and trim.
 - c. Coping, other than pre-fabricated/manufactured coping systems.
 - d. Metal flashings.
 - e. Metal roof edge and fascia, gutters and downspouts.

- B. Related Sections:

- 1. Division 07 Section 075419 "Polyvinyl Chloride (PVC) Roofing" for installing sheet metal flashing and trim integral with PVC single-ply membrane roofing.
 - 2. Division 07 Section 076100 "Sheet Metal Roofing" for preformed standing seam metal roof panels.
 - 3. Division 07 Section 074213 "Metal Wall and Soffit Panels" for exterior metal wall and soffit panels.
 - 4. Division 07 Section 077200 "Roof Accessories" for equipment supports, roof vents, pre-manufactured metal copings, and other manufactured roof accessory items.
 - 5. Division 08 Section 084113 "Aluminum-Framed Storefronts and Entrances" for flashing requirements at aluminum-framed windows and doors.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

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B. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:

1. Identification of material, thickness, weight, and finish for each item and location in Project.
2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
4. Details of termination points and assemblies, including fixed points.
5. Details of edge conditions, including eaves and counter flashings as applicable.
6. Details of special conditions.
7. Details of connections to adjoining work.
8. Detail formed flashing and trim at a scale of not less than 3 inches per 12 inches.

C. Samples for Initial Selection: For each type of sheet metal flashing, trim, and accessory indicated with factory-applied color finishes involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
 - a. Trim, metal closures, furring/edge trims, edge fascia, compression band trim and miscellaneous fabrications.
 - b. Flat Metal Panel and associated "J" and corner trims.

E. Qualification Data: For qualified fabricator.

F. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.

G. Warranty: Sample of special warranty.

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1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
- B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.
- C. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockup of typical roof edge fascia and metal eave cladding; flat metal panel and associated "J" and corner trim; compression band trim and pipe cover.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

1.7 WARRANTY

- A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

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PART 2 - PRODUCTS

2.1 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B 209 , alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.
 - 1. Surface: Smooth, flat.
 - 2. As-Milled Finish: Standard two-side bright finish.
 - 3. Exposed Coil-Coated Finishes:
 - a. Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - b. Metallic Fluoropolymer: AAMA 620. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - c. Color: As selected by Architect from manufacturer's full range including metallic.
 - d. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.
- C. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - 1. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275); structural quality.
 - 2. Surface: Smooth, flat.
 - 3. Exposed Coil-Coated Finish:
 - a. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - b. Metallic Fluoropolymer: AAMA 621. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

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4. Color: As selected by Architect from manufacturer's full range.
 5. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).
- D. Schedule of Sheet Metal Thicknesses: See Schedule on the drawings.

2.2 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.
1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
- C. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
- D. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
- F. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.3 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.

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1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 2. Obtain field measurements for accurate fit before shop fabrication.
 3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- C. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant.
- D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" for application, but not less than thickness of metal being secured.
- G. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.
1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams.
 2. All exposed corners and termination flanges are to be fully welded.
- H. Do not use graphite pencils to mark metal surfaces.

2.4 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Roof-Edge Fascia: Fabricate in minimum 96-inch- long, but not exceeding 10-foot-long, sections. Furnish with 6-inch- wide, joint cover plates.
1. Joint Style: Butt, with 12-inch- wide, concealed backup plate.
 2. Fabricate from the following materials:
 - a. Fabricate from the following materials: As shown on the Metal Flashing Schedule on the Construction Drawings.

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- B. Roof Expansion Joint Covers, Saddles and Terminations: Fabricate to tie into expansion joint to remain. Fabricate joint plates of same thickness as covers. Furnish with continuous saddles to support edge and cover. Miter corners, weld watertight.
 - 1. Roof Expansion Joint Profile: See drawings.
 - 2. Joint Style: Standing seams per standard SMACNA detail.
 - 3. Fabricate from the following materials:
 - a. As shown on the Metal Flashing Schedule on the Construction Drawings.
- C. Counterflashing: Fabricate from the following materials:
 - a. Aluminum: As shown on the Metal Flashing Schedule on the Construction Drawings.
- D. Flat Metal Panel: Fabricate from the following materials:
 - 1. Steel: As shown on the Metal Flashing Schedule on the Construction Drawings.
- E. "L," "J," and Corner Trim:
 - 1. Steel: As shown on the Metal Flashing Schedule on the Construction Drawings.
- F. Copings: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 12-foot- (3.6-m-) long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and interior leg. Miter corners, solder or weld watertight. Shop fabricate interior and exterior corners.
 - 1. Coping Profile: as shown
 - 2. Joint Style: Butted with expansion space and 6-inch- (150-mm-) wide, concealed backup plate.
 - 3. Fabricate from the Following Materials:
 - a. Aluminum: 0.050 inch (1.27 mm) thick.

2.5 FORMED ROOF DRAINAGE SHEET METAL FABRICATIONS

- A. Gutter: Fabricate from the following materials:
 - 1. Aluminum: As shown on the Metal Flashing Schedule on the Construction Drawings. Weld all end caps, inside and outside corner segments; and powder-coat to match straight sections of gutters.
 - 2. Gutters and gutter supports shall be in color to match metal **roofing**.
 - 3. Gutter Expansion Joints: Gutters shall be fabricated in lengths that do not exceed 50 feet (or other spacing as shown on the Drawings) without expansion joints. Provide expansion joints no further than 30 feet from inside or outside corners of building. Gutter expansion joints shall be fabricated in strict accordance with SMACNA Standard Plate #8 for end butt-type expansion joints.
- B. Gutter Supports:
 - 1. Aluminum: As shown on the Metal Flashing Schedule on the Construction Drawings. Powder-coat any aluminum bar or other components to match gutters that cannot be fabricated from factory-coated sheet metal.

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- C. Downspouts and Downspout Straps:
 - 1. Aluminum: As shown on the Metal Flashing Schedule on the Construction Drawings.
 - 2. Downspouts, downspout straps and downspout boots shall be in color to match metal **siding**.

- D. Downspout Boots:
 - 1. Form downspout boots from 1/8-inch (0.125") aluminum sheet. Overall boot height shall be not less than 2'-8". Boots shall be formed into a box cross section identical in dimensions to downspout, with spot-welded vertical seam hidden at rear of boot. Top of boot shall include a minimum 2-inch net wide aluminum flange welded all around the top formed as a receiver for the downspout from above. Weld two integral 1/8-inch thick by 2-inch high straps across rear of boot, one at top, and one near bottom, for attachment to exterior walls.
 - 2. Weld angled discharge to bottom of boot at a 45-degree angle. Discharge shall be identical in cross section to upper boot.
 - 3. Grind all welds and powder-coat the downspout boots to match color of downspouts.
 - 4. Secure downspout boots to existing exterior walls with stainless steel expansion bolts and washers located at masonry joints and stainless steel sheet metal screws and washers at metal siding.
 - 5. Provide one boot at each downspout discharge point near grade, typically, throughout the project.
 - 6. Provide a new precast concrete splashblock at grade for each discharge points **except** where downspout discharges into a new underground collection pipe.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.
 - 1. Verify compliance with requirements for installation tolerances of substrates.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

- B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners,

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solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 3. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
 4. Install sealant tape where indicated.
 5. Torch cutting of sheet metal flashing and trim is not permitted.
 6. Do not use graphite pencils to mark metal surfaces.
- B. 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 SMACNA.
1. Coat back side of uncoated aluminum sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
- D. Fastener Sizes: Use fasteners of sizes that will penetrate wood sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
- E. Seal joints as shown and as required for watertight construction.
1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
 2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."
- F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches, except reduce pre-tinning where pre-tinned surface would show in completed Work.
1. Do not solder metallic-coated steel and aluminum sheet.

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2. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3.3 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
- B. Roof Edge Fascia: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.

3.4 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.5 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.
- E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200

SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 1. Prefabricated Roof Equipment Curbs
 2. Prefabricated Pipe Supports
 3. Utility/Roof Penetration Housing
 4. Roof Expansion Joint Cover
 5. Miscellaneous Materials
 6. Roofing Sealants
- B. Related Sections include the following:
 1. Division 07 Section 076100 "Sheet Metal Roofing" for roofing system required under this project and associated requirements with which to coordinate for roof accessories.
 2. Division 07 Section "Sheet Metal Flashing and Trim" for shop- and field-fabricated metal flashing and counterflashing, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.

1.3 SUBMITTALS

- A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation details for roof accessories. Show layouts of roof accessories including plans and elevations. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each type of exposed factory-applied finish required and for each type of roof accessory indicated, prepared on Samples of size to adequately show color.

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1.4 QUALITY ASSURANCE

- A. Sheet Metal Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify required openings for each type of roof accessory by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
 - 1. With Architect's approval, adjust location of roof accessories that would interrupt roof drainage routes.

PART 2 - PRODUCTS

2.1 METAL MATERIALS

- A. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coated.
- B. Aluminum Extrusions and Tubes: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for type of use, mill finished.
- C. Stainless-Steel Shapes or Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304 or Type 316, No. 2D finish.
- D. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized to comply with ASTM A 123/A 123M, unless otherwise indicated.
- E. Galvanized Steel Tube: ASTM A 500, round tube, hot-dip galvanized to comply with ASTM A 123/A 123M.
- F. Galvanized Steel Pipe: ASTM A 53/A 53M.

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2.2 MISCELLANEOUS MATERIALS

- A. 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.
- B. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.
- C. 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.
- D. 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.

2.3 PREFABRICATED ROOF EQUIPMENT CURBS

- A. Roof 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.

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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.
7. **Sloping Roofs:** Fabricate curb units with water diverter or cricket and with height tapered to match slope to level tops of units. Fabricate curb to suit applications for existing roof slope of up to 4:12. Contractor shall verify actual roof slope at all applicable locations for each prefabricated roof curb to ensure level installation of the supported equipment.

2.4 PREFABRICATED PIPE SUPPORTS

- A. 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.

2.5 UTILITY / ROOF PENETRATION HOUSING

- A. Prefabricated Utility Chase Housings
 1. 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:

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- a. "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.

2.6 ROOF EXPANSION JOINT COVER

A. Bellows-Type Flexible Weatherproof Expansion Joint Cover

1. General: Where indicated on the drawings, provide a continuous, pre-manufactured expansion joint cover consisting of a linear, heavy-duty EPDM flexible bellows securely clad by continuous, flat, metal flanges along length of each side.
2. Configuration: Provide custom configurations in curb-to-wall and wall-to-wall with transitions as indicated on the drawings. Also, provide 90-degree inside corner wall-to-curb transition where indicated on the drawings. Where flanges fit over curbs, provide continuous, pre-formed drip edge in the metal. Provide continuous lengths of material in unbroken, longest practical lengths. Where pre-formed lengths are required in lieu of continuous coil product, provide covers in lengths of not less than 10 feet. Provide splice sections and special transition pieces as needed.
3. Materials: Provide bellows of EPDM, 60-mil minimum. Provide galvanized steel flanges of not less than 26-gauge thickness. Provide an integral foam backer material behind the EPDM bellows to prevent bellows from sagging.
4. Joint Width: Provide flexible bellows of sufficient size in 180-degree configuration (half-round) and 90-degree configuration (quarter-round) to span a net clear joint width of 1-inch, plus tolerance for movement of up to one inch. Provide a wider net clear joint in the wall or curb construction where the manufacturer recommends additional joint clearance.
5. Acceptable Manufacturers and Products: Provide products from one of the following manufacturers as listed below, or submit alternate, equal products from other manufacturers to the Architect for approval in accordance with Specification Section 012500 "Substitution Procedures:"
 - a. Johns Manville "Expand-O-Flash Expansion Joint Cover.
 - b. Watson Bowman Acme "Wabo Flash" Expansion Joint Cover.
 - c. Balco/CSW Industries Co. "BRB – Traditional" Expansion Joint Cover.

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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.
 - 1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored and is ready to receive roof accessories.
 - 2. Verify dimensions of roof openings for roof accessories.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- 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.

3.3 EXPANSION JOINT COVERS

- A. General: Install covers in strict accordance with manufacturer's instructions. Secure flanges to substrate curbs with grommets screws or nails of stainless or galvanized steel at not less than 8-inch centers and not more than 1-inch from ends.

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3.4 TOUCH UP

- A. Touch up factory-primed surfaces with compatible primer ready for field painting in accordance with Division 09 painting Sections.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.5 CLEANING

- A. Clean exposed surfaces according to manufacturer's written instructions.

3.6 SPARE ROOF ACCESSORY MATERIALS

- A. At the conclusion of construction, provide and turn over to the Owner spare roof accessory mounting clips with integral screws matching those provided for this project in quantities as required under Specification Section 012100 "Allowances." Bundle and wrap spare clips in protective covering. Store in a protected area in the nearby attic where directed by the Owner's representative.

END OF SECTION 077200

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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.

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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.

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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.

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- 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

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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.

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- 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

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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-

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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. Polyurethane joint sealants.
2. Polysulfide joint sealants.
3. Silicone joint sealants.
4. Butyl joint sealants.

- B. Related Sections:

1. Division 03 Section 033000, "Cast-in-Place Concrete" for sealing joints in pavements, walkways, and curbing.
2. Division 04 Section 042000, "Unit Masonry" for masonry control and expansion joint fillers and gaskets.
3. Division 08 Section 084113, "Aluminum-Framed Storefronts, Windows and Entrances" for additional instructions for sealing exterior and interior sides of aluminum framing members to adjacent construction.
4. Division 08 Section 088000, "Glazing" for glazing sealants.
5. Division 09 Section 092900, "Gypsum Board" for sealing perimeter joints.
6. Division 09 Section 093000, "Tiling" for sealing tile joints.
7. Division 09 Section 095113, "Acoustical Panel Ceilings" for sealing edge moldings at perimeters with acoustical sealant.

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.

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- E. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
- G. 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:

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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.
 2. Provide polysulfide sealants at all roofing applications where sealed joints, if any, may be subject to brief periods of immersion.
- 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.
- F. Product Use: Use sealant products generally in conformance to the following uses and locations listed below. Sealant applicator may substitute one type of sealant for another designated use subject to submitting intended alternate product and intended use for approval by the Architect:
 1. Polyurethane Joint Sealant:

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- a. Masonry-to-masonry joints.
 - b. Concrete-to-concrete or masonry-to concrete joints.
 - c. Masonry to metal joints at window and door frames.
 - d. Gypsum wallboard-to-masonry joints at building interior.
 - e. Metal-to-metal joints, except at roofing.
 - f. Ceramic and porcelain tile applications.
2. Polysulfide Joint Sealants:
- a. All roofing applications in low-movement joint conditions.
3. Silicone Joint Sealants:
- a. All window glazing applications where glass is sealed to metal.
 - b. All roofing applications in high-movement joint conditions.
4. Butyl Joint Sealants:
- a. Interior use only at narrow joints anticipating no movement, used as filler only, and intended to be painted over. Not for use at control joints, expansion joints or joints exceeding 1/8-inch in width.
 - b. Any location where applying sealant against a rubber, EPDM or neoprene surface.
 - c. Acoustical applications at walls such as beneath metal stud runner channels and inside corners of gypsum wallboard applications without movement.

2.2 POLYURETHANE JOINT SEALANTS

- A. Single-Component, Nonsag, Polyurethane 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 POLYSULFIDE JOINT SEALANTS

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- A. Multicomponent, Nonsag, Traffic-Grade, Polysulfide Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T.
 - 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. BASF Building Systems; Sonolastic Polysulfide Sealant.
 - b. Pecora Corporation; Synthacalk GC-2+.

2.4 SILICONE JOINT SEALANTS

- A. Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, 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 1 Silicone Sealant.
 - b. Sika Corporation, Sikasil WS-290 Silicone Sealant.

2.5 BUTYL JOINT SEALANTS

- A. Butyl-Rubber-Based Joint Sealants: ASTM C 1311.
 - 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 General Purpose Butyl Sealant.
 - b. Sika Corporation, Sikalastomer 511 Butyl Sealant.

2.6 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.

2.7 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

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- 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.
 - d. Architectural wall panels.
 - 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:

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- 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 as 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 in order to 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

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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 architectural wall panels.
 - c. Joints between different materials listed above.
 - d. Perimeter joints between materials listed above and frames of doors windows and louvers.

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2. Urethane Joint Sealant: Single component, nonsag, Class 100/50.
 3. Joint-Sealant Color: As selected by Architect 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. Polysulfide Joint Sealant: Multicomponent, nonsag, traffic grade.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints of exterior openings where indicated.
 - c. Vertical joints on exposed surfaces of interior unit masonry walls and partitions.
 2. Perimeter joints between interior wall surfaces and frames of interior doors and windows. Urethane Joint Sealant: Single component, nonsag, Class 50.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 07920

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SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Standard, Heavy-duty hollow metal doors and frames, including sidelites, transoms, windows and storefronts, for interior and exterior applications.

- B. Related Sections:

- 1. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
 - 2. Division 08 Section "Flush Wood Doors" for interior wood doors to be installed in hollow metal door frames.
 - 3. Division 08 Section "Door Hardware" for door hardware for hollow metal doors.
 - 4. Division 08 Section "Glazing" for glass inserts at doors and borrowed lites.
 - 5. Division 08 Section "Fire-Rated Glazing" for fire-rated glass inserts at fire-rated doors, windows and borrowed lites.
 - 6. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.
- B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, and finishes.

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B. Shop Drawings: Include the following:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

C. Other Action Submittals:

1. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.

1. Provide additional protection to prevent damage to finish of factory-finished units.

- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch-high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

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1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.8 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, [provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Amweld Building Products, LLC.
 - 2. Benchmark; a Division of Therma-Tru Corporation.
 - 3. Curries Company; an Assa Abloy Group company.
 - 4. Steelcraft; an Ingersoll-Rand company.
 - 5. Windsor Republic Doors.
 - 6. Ray-Bar Engineering Corp., for fire-rated window frames.
- B. Source Limitations: Obtain hollow-metal work from single source manufacturer.

2.2 REGULATORY REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - 1. Smoke and Draft Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

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- B. Fire-Rated Windows, Doors, Door Frames, Borrowed-Lite Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.3 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.
- D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.
- G. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.
- H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- I. Glazing: Comply with requirements in Division 08 Sections for "Glazing" and Fire-Rated Glazing."
- J. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.4 STANDARD HOLLOW METAL DOORS

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- A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
 - 1. Design: Flush panel.
 - 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.
 - a. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 6.0 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.
 - 1) Locations: Exterior doors.
 - 3. Vertical Edges for Single-Acting Doors: Square edge.
 - 4. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- thick, end closures or channels of same material as face sheets.
 - 5. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- B. Interior Doors: Provide the following types of interior doors and hollow metal steel frames where scheduled on the drawings:
 - 1. Standard Duty (SD): SDI A250.8, Level 1; SDI A250.4, Level C, Model 2 (Seamless). Frames shall be uncoated steel sheet, minimum thickness of 0.042 inch (1.0 mm).
 - 2. Heavy-Duty (HD): SDI A250.8, Level 2; SDI A250.4, Level B, Model 2 (Seamless). Frames shall be uncoated steel sheet, minimum thickness of 0.053 inch (1.3 mm).
 - 3. Extra Heavy-Duty (XHD): SDI A250.8, Level 3; SDI A250.4, Level A, Model 2 (Seamless). Frames shall be uncoated steel sheet, minimum thickness of 0.067 inch (1.7 mm).
 - 4. All door thicknesses shall be nominal 1-3/4 inches.
- C. Exterior Doors: Insulated, SDI A250.8, Level 3; SDI A250.4, Level A. Model 1 (Full Flush), 1-3/4 inch thickness. Frames shall be uncoated steel sheet, minimum thickness of 0.067 inch (1.7 mm).
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.5 STANDARD HOLLOW METAL FRAMES

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- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Exterior Frames: Fabricated from metallic-coated steel sheet.
 - 1. Fabricate frames with mitered or coped corners.
 - 2. Fabricate frames as full profile welded unless otherwise indicated.
 - 3. Frame(s) for Level 3 Steel Doors: 0.067 inch-thick steel sheet.
 - 4. Frame(s) for Level 2 Steel Doors: 0.053 inch-thick steel sheet.
 - 5. Exterior frames shall be ZF180 electrogalvanized.
 - 6. Provide welded frame assemblies for all doors; **knock-down frames are not permitted.**
 - 7. Make provision for retrofit of frames into new or existing openings where indicated. Provide retrofit jamb anchors and means of securing frames to anchors in such a way that any holes for screw attachment of frame-to-anchor are sealed with caps or plugs that cannot be easily removed or removed without special tool.
- C. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.6 BORROWED LITES AND HM-FRAMED WINDOWS

- A. Fabricate of uncoated steel sheet, minimum thickness of 0.053 inch (1.3 mm).
- B. Construction: Full profile welded.
- C. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.
- D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
- E. Comply with all requirements for NFPA 80 and U.L 10 standards for fire-rated frames. Refer to Section 088813 Fire-Rated Glazing for additional requirements.

2.7 FRAME ANCHORS

- A. Base Anchors: Provide fixed base anchor, typically for all vertical jambs at doors and sidelights.
- B. Jamb Anchors:
 - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches.

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2. Retrofit Jamb Anchors: Provide existing opening anchors for retrofit of door frames into new wall openings, unless new frames may be installed in such a way that masonry or metal stud walls may be easily constructed inside the throat of the frame jambs.

2.8 ACCESSORIES

- A. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

2.9 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/NAAMM-HMMA 861.
- C. Hollow Metal Doors:
 1. Fire Door Cores: As required to provide fire-protection and temperature-rise ratings indicated
 2. Vertical Edges for Single-Acting Doors: Provide beveled or square edges at manufacturer's discretion.
 3. Top Edge Closures: Close top edges of doors with inverted closures of same material as face sheets.
 4. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 2. Sidelite and Interior Window Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding.
 3. Provide countersunk, flat or oval head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.

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5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
6. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.
- F. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
 1. Provide stops and moldings flush with face of door, and with square stops unless otherwise indicated.
 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
 4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
 5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.
- G. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
 1. Locate hardware as indicated, or if not indicated, according to ANSI/NAAMM-HMMA 861.
 2. Reinforce doors and frames to receive non-templated, mortised and surface-mounted door hardware.

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3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.

2.10 STEEL FINISHES

- A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pre-treating.
 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
 1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.

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4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive non-templated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with HMMA 840.
1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-protection-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable glazing stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Field apply bituminous coating to backs of frames that are filled with grout containing anti-freezing agents.
 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
 - a. Floor anchors may be set with powder-actuated fasteners instead of post-installed expansion anchors if so indicated and approved on Shop Drawings.
 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 4. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.

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- b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
- 1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
- D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow metal manufacturer's written instructions.
- 1. Secure stops with countersunk flat or oval head machine screws spaced uniformly not more than 9 inches on center and not more than 2 inches on center from each corner.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

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SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Solid-core doors with wood-veneer faces.
 - 2. Factory finishing flush wood doors.
- B. Related Sections:
 - 1. Division 08 Section 081113, "Hollow Metal Doors and Frames" for steel door frames into which wood doors shall be installed.
 - 2. Division 08 Section 088000, "Glazing" for glass view panels in flush wood doors.
 - 3. Division 08 Section 088813, "Fire-Rated Glazing" for glass view panels in fire-rated flush wood doors.

1.3 SUBMITTALS

- A. Product Data: For each type of door indicated. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
 - 1. Indicate dimensions and locations of mortises and holes for hardware.
 - 2. Indicate dimensions and locations of cutouts.
 - 3. Indicate requirements for veneer matching.
 - 4. Indicate doors to be factory finished and finish requirements.
 - 5. Indicate fire-protection ratings for fire-rated doors.
- C. Samples for Initial Selection: For factory-finished doors.
- D. Samples for Verification:

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1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish.
2. Corner sections of doors, approximately 8 by 10 inches (200 by 250 mm), with door faces and edges representing actual materials to be used.
 - a. Provide samples for each species of veneer and solid lumber required.
 - b. Provide samples for each color, texture, and pattern of plastic laminate required.
 - c. Finish veneer-faced door samples with same materials proposed for factory-finished doors.
3. Frames for light openings, 6 inches (150 mm) long, for each material, type, and finish required.

E. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- B. Source Limitations: Obtain flush wood doors from single manufacturer.
- C. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated."
 1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.
 2. Provide WI-Certified Compliance Certificate indicating that doors comply with requirements of grades specified.
 3. Provide WI-Certified Compliance Certificate for installation.
- D. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure as close to neutral pressure as possible according to NFPA 252 or UL 10B.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.
- C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

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1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
 - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) span.
 - 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 - 3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Masonite Architectural, Aspiro Series.
 - 2. Eggers Industries.
 - 3. Graham; an Assa Abloy Group company.
 - 4. Haley Brothers, Inc.
 - 5. VT Industries Inc.

2.2 DOOR CONSTRUCTION, GENERAL

- A. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.
- B. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

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- C. Structural-Composite-Lumber-Core Doors:
 - 1. Structural Composite Lumber: WDMA I.S.10.
 - a. Screw Withdrawal, Face: 700 lbf (3100 N).
- D. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
 - 1. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
 - 2. Pairs: Provide formed-steel edges and astragals with intumescent seals.
 - a. Finish steel edges and astragals to match door hardware (locksets or exit devices).
- E. Mineral-Core Doors:
 - 1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
 - 2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as follows:
 - a. 5-inch (125-mm) top-rail blocking.
 - b. 5-inch (125-mm) bottom-rail blocking, in doors indicated to have protection plates.
 - c. 5-inch (125-mm) midrail blocking, in doors indicated to have exit devices.
 - 3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Solid-Core Doors:
 - 1. Grade: Custom (Grade A faces).
 - 2. Species: Select Red Oak.
 - 3. Cut: Plain sliced (flat sliced); minimum leaf width = 4 to 5 inches.
 - 4. Match between Veneer Leaves: Pair match.
 - 5. Assembly of Veneer Leaves on Door Faces: Center-balance match.
 - 6. Pair and Set Match: Provide for doors hung in same opening.

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7. Room Match: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 10 feet (3 m) or more.
8. Exposed Vertical and Top Edges: Same species as faces or a compatible species.
9. Core: Either glued wood stave or structural composite lumber.
10. Construction: Five plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press.
11. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

2.4 LOUVERS AND LIGHT FRAMES

- A. Wood Frames for Light Openings in Fire-Rated Doors, 20 minute Fire-Rated: Provide manufacturer's wood-trimmed frame opening with hardwood edges and glass stops of species and color/finish that matches veneer of the wood doors, of fire-protection rating up to 20 minutes. Conceal any metal edge bead or components, and provide for hidden or concealed fastening of all wood members. Neatly and tightly miter at 45-degrees all wood beads at inside corners.
- B. Metal Frames for Light Openings in Fire-Rated Doors, 45 minutes and Above: Provide manufacturer's standard frame formed of 0.048-inch- (1.2-mm-) thick, cold-rolled steel sheet; with baked-enamel- or powder-coated finish; and approved for use in doors of fire-protection rating indicated, 45 minutes and above.

2.5 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 1. Comply with requirements in NFPA 80 for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
 2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- C. Openings: Cut and trim openings through doors in factory.

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1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 08 Section "Glazing."
3. Louvers: Factory install louvers in prepared openings.

2.6 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
- B. Transparent Finish and Color:
 1. Grade: Custom.
 2. Stain: Door manufacturer's proprietary standard stain method.
 3. Finish: AWI conversion varnish or catalyzed polyurethane system.
 4. Effect: Semi-filled finish, produced by applying an additional finish coat to partially fill the wood pores.
 5. Sheen: Semigloss.
 6. Color (**match required**): All doors: VT Industries "Heritage" Series, Plainsliced Birch with stained #CL-18 "Natural" finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.
 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Division 08 Section "Door Hardware."

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- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
 - 1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
 - 1. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.
 - a. Comply with NFPA 80 for fire-rated doors.
 - 2. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
 - 3. Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock edge; trim stiles and rails only to extent permitted by labeling agency.
- D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

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SECTION 083326 – OVERHEAD COILING GRILLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Manual-operated overhead rolling grilles.
- B. Related Sections:
 - 1. 05 50 00 Metal Fabrications. Door opening jamb and head members.
 - 2. 06 10 00 Rough Carpentry. Door opening jamb and head members.
 - 3. 08 31 00 Access Doors and Panels. Access doors.
 - 4. 08 70 00 Hardware.
- C. Products That May Be Supplied, But Are Not Installed Under This Section:
 - 1. Control Station

1.2 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. Cycle Life:
 - a. Design grilles of standard construction for normal use of up to 5 cycles per day maximum, and an overall maximum of 50,000 operating cycles for the life of the grille.
 - 2. Safety:
 - a. Chain operated doors shall be designed so that the door immediately stops upward or downward travel and is maintained in a stationary position when the hand chain is released by user.
 - 3. Headroom:
 - a. Fully coiled curtain with bracket not to exceed 11.75" in diameter

1.3 SUBMITTALS

- A. Reference Section 01 33 00 Submittal Procedures; submit the following items:
 - 1. Product Data
 - 2. Shop Drawings
 - 3. Quality Assurance/Control Submittals:
 - a. Provide proof of manufacturer ISO 9001:2015 registration.
 - b. Provide proof of manufacturer and installer qualifications - see 1.4 below.
 - c. Provide manufacturer's installation instructions.

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- d. Provide manufacturer's Health Product Declaration (HPD) for each product.
- 4. Closeout Submittals:
 - a. Operation and Maintenance Manual.
 - b. Certificate stating that installed materials comply with this specification.

1.4 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer Qualifications: ISO 9001:2015 registered and a minimum of five year experience in producing grilles of the type specified.
 - 2. Installer Qualifications: Manufacturer's approval.

1.5 DELIVERY STORAGE AND HANDLING

- A. Reference Section 016600 Product Storage and Handling Requirements.
- B. Follow manufacturer's instructions.

1.6 WARRANTY

- A. Standard Warranty: Two years from date of shipment against defects in material and workmanship, on mechanical components, operator and control panel
- B. Maintenance: Submit for owner's consideration and acceptance of a required preventative maintenance schedule and service agreement for installed products.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Acceptable Manufacturers:
 - 1. Cornell Ironworks, 24 Elmwood Ave. Mountain Top, PA 18707. Telephone: (800) 233-8366. Website: <https://www.cornelliron.com/product/rolling-grilles>.
 - 2. Overhead Door Corporation, 2501 S. State Hwy. 121, Suite 200, Lewisville, TX 75067. ASD. Tel. Toll Free: (800) 275-3290. Phone: (469) 549-7100. Website: www.overheaddoor.com. E-mail: info@overheaddoor.com.
 - 3. McKeon Door Company, 44 Sawgrass Drive, Bellport, New York 11713. Telephone: (800) 266-9392. Website: <https://www.mckeondoors.com/>.
 - 4. Clopay Corporation, 8585 Duke Blvd., Mason, OH 45040 (800) 225-6729. Website: <https://www.clopaydoor.com/commercial-door-products/commercial-grilles>

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- B. Basis of Design Model: Cornell Ironworks ESG12C (Brick Pattern grille)

2.2 MATERIALS

- A. Curtain: Configuration - Brick Pattern (Model ESG12C)
- a. Horizontal Rods: Minimum solid 5/16 inch (8 mm) diameter, 5056 H32 aluminum alloy sleeved with horizontal aluminum or stainless steel tube spacers to separate vertical links on every rod with continuous end tube spacers.
 - b. Vertical Spacing: 2.5" to 3.7" on center
 - c. Vertical Chains: Solid 1/8" minimum stainless steel links, 1/4 inch (6 mm) wide, positioned by aluminum tube spacers on 9 inch (228.6 mm) staggered centers. Provide nylon insert nuts threaded on to the end of each rod to secure the chains.
2. Finish:
- a. Aluminum: Dark bronze duranodic.
- B. Bottom Bar:
1. Fabrication:
 - a. Extruded Aluminum Tubular Section: Minimum 1.5x1.5x.18 inch (38.1x38.1x4.572 mm)
 2. Finish:
 - a. Extruded Aluminum: Match grille curtain color, may be powder-coated finish.
- C. Guides: Wall Mounted: Heavy duty (minimum .109 inch thick) extruded aluminum sections with snap-on cover to conceal fasteners and Santoprene runners on both sides of curtain. Provide steel mounting angle as required for face of wall installation. Also is 12 gauge bent stainless steel with UHMW overlaid on EPDM wear strips.
- D. Guides, Tube Mounted (OPTIONAL): Heavy duty extruded aluminum sections with snap-on cover to conceal fasteners and polypropylene pile runners on both sides of curtain. Provide [steel] [aluminum] tubes, floor saddles and hardware as recommended by manufacturer to support grille.
1. Fabrication:
 - a. Aluminum Guide:
 - 1) Finish: Clear anodized.
 - b. Steel Mounting [Mounting Angles] [Tubes], Finish:

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- 1) Standard (Stock Colors): Phosphate treatment followed by a white baked-on polyester powder coat; minimum 2.5 mils (0.065 mm) cured film thickness.
- E. Counterbalance Shaft Assembly:
1. Barrel: Minimum 6" steel pipe with a 1-1/2 Inch inner shaft capable of supporting curtain load with maximum deflection of 0.5125 inches per foot of width.
 2. Spring Balance: Oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of grille to ensure that maximum effort to operate will not exceed 25 lbs (110 N). Provide wheel for applying and adjusting spring torque.
- F. Brackets: Fabricate from minimum 1/4 inch (6.35 mm) steel plate with permanently lubricated ball or roller bearings at rotating support points to support counterbalance shaft assembly and form end closures.
1. Finish:
 - a. Powder Coat (Stock Colors): Phosphate treatment followed by a white baked-on polyester powder coat; minimum 2.5 mils (0.065 mm) cured film thickness

2.3 OPERATION

- A. Manual ControlGard Chain Hoist: Provide chain hoist operator with endless steel chain, chain pocket wheel and guard, geared reduction unit, and chain keeper secured to guide. Chain hoist to include integral brake mechanism that will immediately stop upward or downward travel and maintain the door in a stationary position when the hand chain is released by the user.

2.4 ACCESSORIES

- A. Locking:
1. Keyed cylinder locking into both jambs operable from both sides of curtain.
- B. Hood and Fascia: 0.040 inch (1.016 mm) aluminum with reinforced top and bottom edges. Provide minimum 1/4 inch (6.35 mm) steel intermediate support brackets.
1. Finish:
 - a. GalvaNex™ Coating System (Stock Colors):

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- 1) ASTM A 653 galvanized base coating treated with dual process rinsing agents in preparation for chemical bonding baked-on base coat and white baked-on polyester finish coat.
- C. Operator and Bracket Mechanism Cover: 0.040 inch (1.016 mm) aluminum sheet metal cover to enclose exposed moving operating components at coil area of unit. Finish to match door hood.
- D. Trim Package: Minimum 16 gauge powder coated steel to match guides. Custom-made to hide visible bolts, fasteners and other exposed hardware.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates upon which work will be installed and verify conditions are in accordance with approved shop drawings
- B. Coordinate with responsible entity to perform corrective work on unsatisfactory substrates.
- C. Commencement of work by installer is acceptance of substrate

3.2.1 INSTALLATION

- A. General: Install grille and operating equipment with necessary hardware, anchors, inserts, hangers and supports
- B. Follow manufacturer's installation instructions

3.2.2 ADJUSTING

- A. Following completion of installation, including related work by others, lubricate, test, and adjust grilles for ease of operation, free from warp, twist, or distortion

3.2.3 CLEANING

- A. Clean surfaces soiled by work as recommended by manufacturer
- B. Remove surplus materials and debris from the site

3.2.4 DEMONSTRATION

- A. Demonstrate proper operation to Owner's Representative

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- B. Instruct Owner's Representative in maintenance procedures

END OF SECTION 083326

SECTION 084113 - ALUMINUM-FRAMED STOREFRONTS, WINDOWS AND ENTRANCES

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. Exterior storefront windows and entrance doors.
- 2. Storefront framing for punched opening, fixed-glass exterior windows.

- B. Related Sections:

- 1. Division 07 Section 074213, "Metal Wall and Soffit Panels" for laminated/insulated metal panels used in conjunction with exterior storefront windows.
- 2. Division 07 Section 079200, "Joint Sealants."
- 3. Division 08 Section 088000, "Glazing."

1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:
 - 1. Dimensional tolerances of building frame and other adjacent construction.
 - 2. Failure includes the following:
 - a. Deflection exceeding specified limits.
 - b. Thermal stresses transferring to building structure.
 - c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
 - d. Glazing-to-glazing contact.
 - e. Noise or vibration created by wind and by thermal and structural movements.
 - f. Loosening or weakening of fasteners, attachments, and other components.
 - g. Sealant failure.

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- B. Delegated Design: Design aluminum-framed systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. Structural Loads:
 - 1. Wind Loads:
 - 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. Seismic Loads: $S_s=1.5g$; $S_1=.05g$; Soil Site Class D; an Occupancy Category II.
- D. Deflection of Framing Members:
 - 1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed $L/175$ of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.
 - 2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components directly below them to less than 1/8 inch (3.2 mm) and clearance between members and operable units directly below them to less than 1/16 inch (1.5 mm).
- E. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:
 - 1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
 - 2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
 - 3. Test Durations: As required by design wind velocity, but not fewer than 10 seconds.
- F. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. (0.03 L/s per sq. m) of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft. (300 Pa).
- G. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20

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percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).

- H. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
 - 2. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
 - a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F (82 deg C).
 - b. Low Exterior Ambient-Air Temperature: 0 deg F (minus 18 deg C).
 - 3. Interior Ambient-Air Temperature: 75 deg F (24 deg C).
- I. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 45 when tested according to AAMA 1503.
- J. Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having an average U-factor of not more than 0.69 Btu/sq. ft. x h x deg F (3.92 W/sq. m x K) when tested according to AAMA 1503.
- K. Sound Transmission: Provide aluminum-framed systems with fixed glazing and framing areas having the following sound-transmission characteristics:
 - 1. Sound Transmission Class (STC): Minimum 38 STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413.
 - 2. Outdoor-Indoor Transmission Class (OITC): Minimum 38 OITC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 1332.

1.4 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.

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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.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- E. Fabrication Sample: Of each vertical-to-horizontal intersection of aluminum-framed systems, made from 12-inch (300-mm) lengths of full-size components and showing details of the following:
1. Joinery, including concealed welds.
 2. Anchorage.
 3. Expansion provisions.
 4. Glazing.
 5. Flashing and drainage.
- F. Delegated-Design Submittal: For aluminum-framed systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Detail fabrication and assembly of aluminum-framed systems.
 2. Include design calculations.
- G. Qualification Data: For qualified Installer.
- H. Seismic Qualification Certificates: For aluminum-framed systems, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
- I. Welding certificates.
- J. Preconstruction Test Reports: For sealant.
- K. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems, indicating compliance with performance requirements.
- L. Source quality-control reports.
- M. Quality-Control Program for Structural-Sealant-Glazed System: Include reports.
- N. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

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- O. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
- C. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.
- D. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
 - 1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.
- E. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.
- F. Welding Qualifications: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."

1.6 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.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:

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- a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration caused by thermal movements.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - d. Adhesive or cohesive sealant failures.
 - e. Water leakage through fixed glazing and framing areas.
 - f. Failure of operating components.
2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.
1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. Kawneer North America; an Alcoa company.
 2. EFCO.
 3. Tubelite.
 4. YKK AP America.

2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
 3. Structural Profiles: ASTM B 308/B 308M.
 4. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

2.3 FRAMING SYSTEMS

- A. Exterior Window and Storefront Framing Members: Manufacturer's standard single-thermal-break, insulating glass-glazed, extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads. **Basis of design detailed on the drawings is Kawneer VersaGlaze 451T.** Allowable alternative

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products include Tubelite T14000 Single-Cavity Pour & Debridge Thermal Storefront, EFCO 433 Series, and YKK AP America YES 45 TU.

1. Construction: (Standard) Single-thermally broken.
 2. Glazing System: Outside-glazed, retained mechanically with gaskets on four sides.
 3. Basic member nominal size: 4-1/2 inch deep by 2-inch sightline (width).
 4. Glazing Plane: Center-set.
- B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with non-staining, nonferrous shims for aligning system components.
- C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, 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.
- D. 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.
- E. Concealed Flashing: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding flashing compatible with adjacent materials.
- F. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.

2.4 ENTRANCE DOORS

- A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing.
- B. Door Construction: 1-3/4-inch (44.5-mm) overall thickness, with minimum 0.125-inch- (3.2-mm-) 2-inch (50.8-mm) overall thickness, with minimum 0.188-inch- (4.8-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
- C. Door Design: Wide stile; 5-inch (127-mm) nominal width.
- D. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
- E. Provide non-removable glazing stops on outside of door.
- F. Hardware: As specified under Section 087100, "Door Hardware." Also:

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1. Provide for factory-integrated weatherstripping at door frames and sweeps at door bottoms.
2. Provide reinforcement at tubular storefront and curtainwall members where hardware is attached to the framing system, including, but not limited to:
 - a. Hinges
 - b. Overhead door closers
 - c. Strikes
 - d. Exit (panic) devices

2.5 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.

2.6 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.

2.7 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
 1. Profiles that are sharp, straight, and free of defects or deformations.
 2. Accurately fitted joints with ends coped or mitered.
 3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.

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4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing from exterior.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Storefront Framing: Fabricate components for assembly using shear-block system.

F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. At interior and exterior doors, provide compression weather stripping at fixed stops.

G. Entrance Doors: Entrance doors shall be factory-welded with tight-fitting seams. Reinforce doors as required for installing entrance door hardware.

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

H. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

I. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

A. Exterior Windows, Storefronts and Doors: Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm thickness. Color: Dark bronze.

B. Interior Windows and Storefronts: Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm thickness. Color: Dark bronze.

2.9 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform field water testing of windows.

B. Prepare test and inspection reports.

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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 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.

H. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

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1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

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.

3.5 ADJUSTING

- A. Adjust all windows and doors to assure proper fit of glazing, glazing stops, gasketing, doors and door hardware. Replace any components that do not fit properly. Doors shall open smoothly with specified opening force and close smoothly at specified closer speed or as otherwise required for safe, efficient operation. Ensure that doors latch, lock and unlock properly. Correct any deficiencies prior to acceptance.

END OF SECTION 084113

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SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY:

A. Section Includes: Finish Hardware for swinging doors.

1. Provide all components including fasteners, brackets and accessories required for complete, properly functioning and operable openings.
2. **Keying: The Owner shall be responsible for providing permanent keying. Owner will be responsible keying for providing permanent keys. Contractor shall be responsible for securing the facility until permanent locks are installed.**

B. Related Sections

1. Division 08 Section 081113, "Hollow Metal Doors and Frames."
2. Division 08 section 081416, "Flush Wood Doors."
3. Division 08 Section 084113, "Aluminum-Framed Storefronts, Windows and Entrances."
4. Division 26 Sections (shown on the Electrical Drawings) pertaining to electrical work related to electric locks, including, but not limited to, electrical conduit, boxes, wiring devices, low-voltage transformers and conductors.

C. References

National Fire Protection Association

NFPA 80 Standard for Fire Doors and Other Opening Protectives

Builders Hardware Manufacturers Association

- ANSI/BHMA A156.1 Butts & Hinges
- ANSI/BHMA A156.2 Bored and Preassembled Locks and Latches
- ANSI/BHMA A156.3 Exit Devices
- ANSI/BHMA A156.4 Door Controls – Closers
- ANSI/BHMA A156.5 Cylinder & Input Devices
- ANSI/BHMA A156.6 Architectural Door Trim
- ANSI/BHMA A156.7 Template Hinge Dimensions
- ANSI/BHMA A156.8 Door Controls – Overhead Stops & Holders
- ANSI/BHMA A156.9 Cabinet Hardware
- ANSI/BHMA A156.13 Mortise Locks
- ANSI/BHMA A156.15 Release Devices
- ANSI/BHMA A156.18 Materials and Finishes
- ANSI/BHMA A156.21 Thresholds
- ANSI/BHMA A156.22 Gaskets
- ANSI/BHMA A156.26 Continuous Hinges
- ANSI/BHMA A156.31 Electric Strikes and Frame Mounted Actuators
- ANSI/BHMA A156.37 Multipoint Locks

ADA Standards for Accessible Design

Door and Hardware Institute (DHI)

Keying Systems and Nomenclature

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Sequence and Format

Recommended Locations for Architectural Hardware for Standard
Steel Doors and Frames.

Recommended Locations for Architectural Hardware for Flush Wood
Doors.

1.2 SUBSTITUTIONS:

- A. Comply with Division 1. Refer to Part 2 paragraph "Manufacturers" herein for Owner's proprietary requirements and limitations on substitute or alternate products by other manufacturers. For items listed as "No Substitutions, provide products from manufacturers exactly as specified.

1.3 SUBMITTALS:

- A. Comply with Division 1 Section 013300, "Submittals."
- B. Product Data: Submit PDF-formatted copies which include technical data indicating design, grade, function and relevant accessories of each hardware item indicated in the hardware sets. Highlight in some manner only information relative to the scheduled products. Provide wiring riser and point to point diagrams for all openings scheduled with electrified hardware. Indicate all electrical requirements including amps and voltages for each electrified item.
- C. Shop Drawings: Submit PDF-formatted copies of a detailed Hardware Schedule in a vertical format as outlined in the DHI publication "Sequence and Format." Include the following:
 - 1. Door numbers corresponding to Architects door numbers as indicated on the architectural drawings.
 - 2. Manufacturers List of each hardware product group scheduled
 - 3. Abbreviations List
- D. Templates: Submit templates and "reviewed Hardware Schedule" to door and frame supplier and others as applicable to enable timely door and frame preps.
- E. Samples: Furnish as requested by the Architect.
- F. Contract Closeout Submittals: Comply with Division 1 including specific requirements indicated.
 - 1. Operating and maintenance manuals: Submit the following in a three ring binder:
 - a. "As Built" Hardware Schedule.
 - b. Catalog Cuts.
 - c. Installation instructions for each hardware item.
 - d. Warranties.
 - f. Point to point and Riser diagrams for each opening scheduled with electrified hardware.

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1.4 QUALITY ASSURANCE

G. Comply with Division 1.

1. Statement of qualification for distributor and installers.
2. Statement of compliance with regulatory requirements and single source responsibility.
3. Distributor's Qualifications: Firm with 3 years' experience in the distribution of commercial hardware.
 - a. Distributor to employ a full time Architectural Hardware Consultant for the purpose of scheduling and coordinating hardware, establishing a keying schedule and be available for consultation at reasonable times throughout the project until final completion..
4. Installer's Qualifications: Firm with 3 years experienced in installation of similar hardware to that required for this Project, including specific requirements indicated.
5. Regulatory Label Requirements: Provide testing agency label or stamp on hardware for labeled openings.
 - a. Provide UL listed hardware for labeled and 20 minute openings in conformance with requirements for class of opening scheduled.
 - b. Underwriters Laboratories requirements have precedence over this specification where conflict exists.
 - c. Provide and install hardware for fire rated openings in conformance with NFPA 80.
6. Single Source Responsibility: Except where specified in hardware schedule, furnish products of only one manufacturer for each type of hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Comply with Division 1.

1. Deliver products in original unopened packaging with legible manufacturer's identification.
2. Package hardware to prevent damage during transit and storage.
3. Mark hardware to correspond with "reviewed hardware schedule".

B. Storage and Protection: Store hardware in a clean, dry, secure area.

1.6 PROJECT CONDITIONS:

- A. Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for the proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents.

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- B. Review Shop Drawings for doors and entrances to confirm that adequate provisions will be made for the proper installation of hardware.

1.7 WARRANTY:

- A. Refer to Conditions of the Contract
- B. Manufacturer's Warranty:
 1. Closers: Thirty (30) years
 2. Exit Devices: Three (3) Years
 3. Electric Strike: Five (5) years
 4. Locksets: 10-year mechanical warranty; three (3) year finish warranty

1.8 OWNER'S INSTRUCTION:

- A. Instruct Owner's personnel in operation and maintenance of hardware units.

1.9 MAINTENANCE:

- A. Extra Materials: Provide owner with any manufacture's product installation tools and remaining fasteners at project completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Manufacturers and manufacturer's product model numbers indicated in the Hardware Sets are listed below. Acceptable alternate manufacturers are also listed except where Owner requires no substitution due to compatibility with existing hardware.

Item:	Manufacturer:	Acceptable:
Hinges	Stanley	Hager, Ives
Continuous Hinges	Pemko	Stanley
Exit Devices	Von Duprin	None (Von Duprin only)
Locksets / Latchsets	Sargent	None (Sargent only)
Indicating Deadbolt	Sargent	Schlage, Falcon, Yale
Deadlatch/Deadlocks	Adams-Rite	None (Adams Rite only)
Electric Strike	HES	None (HES only)
Closers	LCN	None (LCN only)
Push / Pulls	Rockwood	Trimco, Hager, Ives
Flush Bolts	Ives	Baldwin
Overhead Door Holders	Hager	Glynn Johnson
Protective Plates	Rockwood	Trimco, Hager
Stops	Rockwood	Trimco, Hager
Door Stops	Rockwood	Trimco, Hager
Automatic Flush Bolts	Rockwood	Ives
Flush Bolts	Rockwood	Trimco, Hager
Weatherstripping	National Guard	Pemko, Reese

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Thresholds	National Guard	Pemko, Reese
Smoke/Sound Seal	National Guard	Pemko, Reese
Automatic Door Bottoms	National Guard	Pemko, Reese
Roller Latches	Rockwell Security	Trimco

2.2 ENTRANCE DOOR HARDWARE

- A. General: Provide entrance door hardware and entrance door hardware sets indicated in "Entrance Door Hardware Sets" Article for each entrance door to comply with requirements in this Section.
 - 1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products complying with BHMA standard referenced.
 - 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
 - 3. Opening-Force Requirements:
 - a. Egress Doors: Not more than 15 lbf (67 N) to release the latch and not more than 30 lbf (133 N) to set the door in motion and not more than 15 lbf (67 N) to open the door to its minimum required width.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:
 - 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in "Entrance Door Hardware Sets" Article.
 - 2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.

2.3 MATERIALS:

- A. Hinges:
 - 1. Certified to ANSI/BHMA A156.1.
 - 2. Provide hinges for fire rated doors conforming to NFPA 80.
 - 3. Furnish heavy weight hinges at high frequency or high abuse locations and as indicated in the hardware sets.
 - 4. Provide hinge types as listed in schedule.
 - 5. Furnish 3 hinges per leaf to 7 foot 6 inch height. Add one for each additional 30 inches in height or fraction thereof.
 - 6. Furnish NRP (Non Removable Pin) on hinges at all reverse bevel exterior doors and as indicated in the hardware sets.
- B. Continuous Hinges: BHMA A156.26, Grade 1; minimum 0.120-inch- (3.0-mm-) thick, hinge leaves with minimum overall width of 4 inches (102 mm); fabricated to full

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height of door and frame and to template screw locations; with components finished after milling and drilling are complete. Provide for safety lip/edge guard.

1. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.
2. Manufacturer/Model: Provide PEMKO Model FM/Heavy Duty (full mortise) or equal approved by the Architect.

C. Mortise Locksets:

1. Mortise Locks: BHMA A156.13; Operational Grade 1, Security Grade 1, stamped steel case with steel or brass parts; Series 1000. Provide for interchangeable lock cylinder and/or cylinder core.
2. Sargent 7900 Series, Type "BL" handle lever trim.
3. Provide strike box at each lock location.

D. Cylindrical (Bored) Locks and Latches:

1. Exterior Door Locksets: Sargent 11 Series, Type "L" lever trim. Certified to ANSI/BHMA A156.2 Series 4000, Operational Grade 1, Extra-Heavy Duty, Security Grade 2, UL10C-1998 listed.
 - a. Entry Lock: Sargent Model 11G05, single-cylinder. Provide at Door 201.
2. Interior Door Locksets: Sargent 10X Series, Type "L" lever trim. Certified to ANSI/BHMA A156.2 Series 4000, Operational Grade 1, Extra-Heavy Duty, Security Grade 2, UL10C-1998 listed.
 - a. Exit/Entry Locks: Sargent Model 10XG16 with indicating rose at interior side, double-cylinder. Provide at Door 104A.
 - b. Communicating Lock: Sargent Model 10XG30, double-cylinder. Provide at Door 104B.
 - c. Office/Entry Lock: Sargent Model 10XG24, single-cylinder. Provide at Doors 102, 103, 106, 110 and 111.
 - d. Provide latchset without cylinders at Bathroom Door 105 (equipped with separate indicating deadbolt).
3. Functions and design as indicated in the hardware groups.
4. Provide standard 2-3/4 inch backset.
5. Provide strike box at each lock location.
6. Provide lever trim with roses, including at matching dummy lever trim.
7. Provide strike of sufficient lip length to clear wall and frame trim.
8. Deadbolt: Where new deadbolt(s) are specified, provide Grade 1, single cylinder units with one exterior keyhole with removable core and interior thumbturn.

E. Indicating-Type Deadbolts (for use at single-water closet restrooms):

1. BHMA/ANSI A156.36, satin chromium plated, 1-inch throw on bolt. Provide thumbturn at interior side. Where scheduled, provide ADA-compliant "indicating" deadbolts at single-occupant restroom doors that display whether room is unoccupied ("VACANT"/Green) or if door is locked ("IN USE"/Red) on outside of door. Provide emergency means of releasing door from outer,

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secure side. Provide Sargent Model 460 indicating deadbolts or equal approved by the Architect.

- F. Deadlocks, Deadlatches and Auxiliary Items: BHMA A156.3, A156.13 and A156.36
 - 1. Manufacturers: Subject to compliance with requirements, provide products by ASSA Abloy/Adams Rite Series (no substitutions allowed). Products must suit installation in wide stile/glazed aluminum storefront doors.
 - 2. Function, Trim and lock(s): Shall be as scheduled at the end of this section and as described herein.

- G. Exit Devices and Auxiliary Items: BHMA A156.3, Rim-type.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allegion/Von Duprin, 99 Series (no substitutions).
 - 2. Function, Trim and lock(s): Latch shall be lockable by key and released from exterior side by access-controlled electric strike. When unlocked, trim at entrance doors shall be by lever-handled operator exterior trim and escutcheon. Provide two dogging keys to retain actuating bars. Provide auxiliary, keyed lock cylinder that can retract latchbolt from exterior side. Trim at exterior side of door shall be by lever handle equal to Von Duprin "Rhodes" with angled return.
 - 3. For concealed vertical rod exit devices, provide strike receptors at head and floor, including recessed, dust-proof pocket for floor. Mount top of floor receptor flush with floor or threshold surface.

- H. Cylinders:
 - 1. Mortise-type. Provide Grade 1 with conventional (non-interchangeable) cores. Provide Sargent-compatible keyways, 6-pin, as specified below under Paragraph titled "Keying," unless otherwise directed.

- I. Electric Strikes: ANSI/BHMA 156.31-compliant. Electric strikes shall be manufactured by HES, Model 9600, with low voltage transformer kit and wiring harness and connectors for use with the building's existing electronic access control system. Contractor to provide rough-in for device at frame(s) where scheduled or indicated. Provide only at single-leaf door applications. Coordinate installation with Owner's security system installer, Mid-Atlantic Technology Services.

- J. Flush Bolts: Mortise-type, equal to Ives No. 265B with 1-inch minimum bolt throw. Provide with 630 finish at exterior doors and 626 finish at interior doors. Provide in pair, one for top and bottom of door. Provide recessed, fitted keepers to set into head of door frame and into floor. Install at inactive leaf of a pair of doors.

- K. Door Closers:

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1. Certified to ANSI/BHMA A156.4 Grade 1, modern-type with cover.
 2. Conform to ADAAG for opening and closing requirements.
 3. Separate adjusting valves for closing and latching speed, and backcheck.
 4. Provide adapter plates, shim spacers and blade stop spacers as required by frame and door conditions.
 5. Furnish with adjustable spring power.
 6. Mount closers on non-public side of door, unless otherwise noted in Hardware Schedule.
 7. Closers shall be non-handed, non-sized and multi-sized 1 through 6.
 8. Closers shall limit door opening to 100 degrees
 9. Acceptable Products:
 - a. **"Grade 1 Heavy-Duty"** Closers (1HD): LCN Model No. 4040XP parallel arm for push-side mounting (C02021).
 - b. **"Grade 1"** Closers (1): LCN Model No. 4010 for pull-side mounting (C02011) and Model No. 4110 for parallel-arm, push-side mounting (C02021).
- L. Overhead Door Holders: ANSI/BHMA A156.8, Grade 1, from stainless steel or stain anodized aluminum.
- M. Push/Protection Plates: Stainless steel, not less than 0.062 inch thick. Furnish with four beveled edges. Push plates shall be 8 inches wide by 16 inches high, mounted at push-side of door. Kickplates shall be by door width less 2 (two) inches on single doors and 1 inch less door width on pairs of doors, unless indicated otherwise in hardware sets. Furnish oval-head countersunk screws to match finish. Kickplates to be 10 (ten) inches in height. Provide kickplates on respective side(s) of door leaf as indicated in the Door Schedule and Schedule Notes.
- N. Push / Pull Bars: ANSI 156.6, J505; provide in satin stainless steel. Provide Rockwood Model No. BF157A47HD Series 47 Offset single bar set with T4 concealed mounting or equal approved by Architect. Bar shall be 1-inch diameter; pull shall be 9 inches high. Pull projection shall be 3-1/2 inches; bar projection shall be 2-3/4 inches. Provide for heavy-duty fastening through the door.
- O. Thresholds: Aluminum, mill finish, type required for outswing pair of doors. Provide with thermal barrier and neoprene gasket applied to raised stop. Provide similar and/or equal to Pemko No. 278 x 224 FGT. Furnish with stainless steel machine screws and expansion shields. All door thresholds shall be handicapped-accessible and result in net height, after installation of not more than 1/2-inch.
- P. Weatherstripping: at head and jambs. Provide aluminum storefront entrance manufacturer's standard, stop-mounted head and jamb weatherstripping, and door bottom sweeps as specified under Section 084113, "Aluminum Storefronts, Windows and Entrances."
- Q. Rain Drips: At exterior, outswinging doors, provide door bottom rain drip the full width of each leaf fabricated from satin anodized aluminum or stainless steel with an integral rubber bottom sweep equal to Pemko 345-V. Provide a continuous overhead rain drip fabricated from satin anodized aluminum or stainless steel

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mounted to head of door frame equal to Pemko 346, length equal to the full width of door frame. Secure drips with stainless steel or aluminum screws.

- R. Soundproofing: Soundproofing shall consist of two elements: door gasketing or stripping at all edges of the door where it meets the frame, and automatic door bottoms, for sealing the gap between sill of the door and floor. Provide at doors where specifically identified in the Hardware Schedule, as follows:
1. Soundstripping: Provide neoprene, bulb-type sound gasketing set into continuous aluminum extrusions for application to stops at heads and jambs of door frames. Provide Pemko 315_R or equal/similar product in bronze anodized aluminum finish.
 2. Automatic Door Bottoms: ANSI S12.60, surface-applied, with automatically-dropping EPDM gasket in adjustable extruded aluminum bar assembly, equal to Pemko Model PDB411-E in bronze anodized aluminum finish. Provide full width across door bottom. Provide mortised metal strike plate for actuator pin at wood door frame.
- S. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.
- T. Floor Stops: Furnish at all doors where wall stops or closer stop arms are not feasible. Provide Rockwood #441H or equal approved by Architect.
- U. Wall Stops: Gray rubber convex bumper in wrought satin aluminum rose trim. Provide concealed fasteners applicable for wall types and conditions. Provide Rockwood #406 or equal approved by Architect. Where indicated to provide wall stops with keeper hook, provide Rockwood #476 or equal approved by Architect. Anchor to CMU wall with stainless steel anchor screws in expansion shields at approximately 8 inches above the floor.
- V. Roller Catches: Provide adjustable, heavy-duty roller catches with steel or brass forged construction, and spring-actuated, nylon roller latch. Provide matching steel or brass receptor for mortise installation in the door frame. Locate at head of doors where indicated, at meeting stile side; install one per door leaf. Roller projection shall be adjustable and not exceed 3/8-inch. Provide Model No. 23380004 or Trimco Model No. 1559.
- W. Keying: The Contractor shall be responsible to provide locksets and locks that accept the Owner's required keying procedure. The Contractor shall provide all locks and lock cylinders for the Owner's locksmith to key, according to the following procedure: The GC will order "uncombined" (zero-bitted) cores integral with the locks and cylinders. The locks and cylinders will be pinned/keyed by Newport News Public Schools. The Owner shall be turn all locks and cylinders over the Contractor for installing. Provide **Sargent Type LG keyways**, unless otherwise directed. Provide 150 key blanks and ship to Newport News Public Schools, Plant Services, who shall cut all keys for permanent locks. Point-of-contact for all keying information at Newport News Public Schools is Kenny Hipps, e-mail: kenny.hipps@nn.k12.va.us. The

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Contractor shall be responsible for maintaining temporary construction measures for exterior doors in order to secure the building prior to installation of permanent locks.

2.4 FINISHES:

- A. Provide finishes as scheduled. Use manufacturer's standard finishes conforming to ANSI/BHMA A156.18 including coordination with traditional U.S. finishes shown by certain manufacturers for their products. Match finishes as closely as possible between products. General Finishes scheduled: 626 Satin Chromium, 630 Satin Stainless Steel, 689 Sprayed Aluminum Closers, 628 Aluminum or Mill finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of conditions: Examine doors, frames, related items and conditions under which Work is to be performed and identify conditions detrimental to proper and or timely completion. Do not proceed until unsatisfactory conditions are corrected.

3.2 HARDWARE LOCATIONS:

- A. Mount hardware units at heights indicated in the following publications except as specifically indicated or required to comply with the governing regulations.
 - 1. Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames
 - 2. Lock Backset: 2-3/4 inches, typical.

3.3 INSTALLATION:

- A. Install each hardware item per manufacturer's instructions and recommendations. Do not install surface mounted items until finishes have been completed on the substrate. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- B. Install conforming to ADAAG for mounting heights, operational closer requirements, and other ADA requirements.
- C. Installed hardware using the manufacturers fasteners provided. Drill and tap all screw holes located in metallic materials.

3.4 FIELD QUALITY CONTROL AND FINAL ADJUSTMENT

- A. After installation is complete, inspect completed door openings on site to verify installation of hardware is complete and properly adjusted, in accordance with both the Contract Documents and final shop drawings. Report findings, in writing, to the Architect that all hardware is installed properly and is operating properly. Indicate corrective actions and recommendations if necessary for compliance.

3.5 DESCRIPTION OF SECURITY AND ACCESS CONTROL FUNCTIONS

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- A. The following doors include hardware and functionality to achieve access control and security, described as follows:
1. Pair Doors 100A: These doors furnish ingress and egress, and are typically used only during student arrival and departure while the Vestibule is under direct surveillance by security attendants. These doors are a required exit. These doors are also to be equipped with contact switches.
 2. Single-leaf Door 100B: This door furnishes ingress and egress, and is used during student arrival and departure. It, too, is a required exit. Ingress by this door is controlled by a card reader that releases an electric strike. This door is to be equipped with a contact switch.
 3. Pair Doors 100C: These doors furnish ingress and egress, and are typically used only during student arrival and departure. These doors are a required exit.
 4. Single-leaf Door 100D: This door furnishes ingress and egress, and is used during student arrival and departure. It, too, is a required exit. Ingress by this door is controlled by a card reader that releases an electric strike. This door is to be equipped with a contact switch.
 5. Single-leaf Door 104A: This door provides access to the Reception Area from the Vestibule. This door is a required exit, but has no access control features. This door may be mechanically locked to secure the Reception area for both routine security and during emergency lockdown.
 6. Single-leaf Door 104B: This door provides access to the school's interior from the Reception Area. This door is not a required exit. It controls access to the school's interior from the Reception area by an electric strike-equipped lock that can be remotely released at the secretarial station. This door also provides uncontrolled access by staff and students into the Reception area from the school's interior. An auxiliary, manual deadbolt operated by key (on both sides) allowing the Reception area to be secured during emergency lockdown. This door is to be equipped with a contact switch.
 7. Single-leaf Door 102: This door provides access from the Reception area to the secure Administrative Suite area. It is a required exit. Ingress by this door is controlled by a card reader that releases an electric strike. This door is to be equipped with a contact switch.

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3.6 SCHEDULE OF FINISH HARDWARE:

HW-1 Exterior Entrance/Exit Alum. Storefront Doors, Pair, Non-Access-Controlled (100A):

2	Ea.	Hinges	Continuous Vertical Geared Hinge, as specified.
1	Ea.	Exit Device	Type 8 x F04 x Grade 1 x 626 or 630 (Active leaf)
1	Ea.	Exit Device	Type 8 x F01 x Grade 1 x 626 or 630 (Inactive leaf, no ext. trim)
2	Ea.	Lock cylinders	As specified, for exit devices
1	Ea.	Exterior Pull	Offset tubular as specified x 630 (active leaf only)
2	Ea.	O/H Closers	C02021 Heavy-Duty x PT6 x Grade 1 x 689 (push-side) with adjustable holding arms
1	Ea.	Threshold	As specified
1	Set	Weatherstripping	As specified, including door bottom sweep

HW-2 Exterior Entrance/Exit Alum. Storefront Door, Access-Controlled, Single-Leaf (Door No. 101B):

1	Ea.	Cont. Hinge	Continuous Vertical Geared Hinges, as specified
1	Ea.	Exit Device	Type 1 x F08 X GR1 x 626 or 630
1	Ea.	Door Trim	Lever-handle operator as specified.
1	Ea.	Lock Cylinder	As specified, for exit device Exterior Door Trim
1	Ea.	Electric Strike	As specified, surface/stop-mounted for rim latch
1	Ea.	O/H Closer	C02021 Heavy-Duty x PT6 x Grade 1 x 689 (push-side) with adjustable holding arm
1	Ea.	Cont. Threshold	As specified x full opening width
1	Set	Weatherstripping	As specified, including door bottom sweep
1	Ea.	Contact Switch	Magnetic, fully mortised (prep frame and door to receive; switch to be installed by MASEC)

NOTE: Card reading device to operate electric strike shall be provided by the security systems subcontractor.

HW-3 Interior Entrance/Exit Alum. Storefront Door, Pair, Non-Access-Controlled (100C):

2	Ea.	Hinges	Continuous Vertical Geared Hinge, as specified.
1	Ea.	Exit Device	Type 8 x F04 x Grade 1 x 626 or 630 (Active leaf)
1	Ea.	Exit Device	Type 8 x F01 x Grade 1 x 626 or 630 (Inactive leaf, no ext. trim)
2	Ea.	Lock cylinders	As specified, for exit devices
1	Ea.	Exterior Pull	Offset tubular as specified x 630 (active leaf only)
2	Ea.	O/H Closers	C02021 Heavy-Duty x PT6 x Grade 1 x 689 (push-side) with adjustable holding arm
1	Set	Weatherstripping	As specified (omit door bottom sweep)

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HW-4 Interior Entrance/Exit Alum., Single-Leaf Storefront Door, Access-Controlled (Door No. 100D):

1	Ea.	Cont. Hinge	Continuous Vertical Geared Hinges, as specified
1	Ea.	Exit Device	Type 1 x F08 X GR1 x 626 or 630
1	Ea.	Door Trim	Lever-handle operator as specified.
1	Ea.	Lock Cylinder	As specified, for exit device Exterior Door Trim
1	Ea.	Electric Strike	As specified, surface/stop-mounted for rim latch
1	Ea.	O/H Closer	C02021 Heavy-Duty x PT6 x Grade 1 x 689 (push-side) with adjustable holding arms
1	Set	Weatherstripping	As specified (omit door bottom sweep)
1	Ea.	Contact switch	Magnetic, fully mortised (prep frame and door to receive; switches to be installed by MASEC)

NOTE: Card reading device to operate electric strike shall be provided by the security systems subcontractor.

HW-5 Exterior Entrance/Exit Alum. Storefront Door, Non-Access-Controlled, Single-Leaf (Door No. 121):

1	Ea.	Cont. Hinge	Continuous Vertical Geared Hinges, as specified
1	Ea.	Exit Device	Type 1 x F04 X GR1 x 626
1	Ea.	Exterior Pull	Offset tubular as specified x 630
1	Ea.	Lock Cylinder	As specified, for exit device Exterior Door Trim
1	Ea.	O/H Closer	C02021 Heavy-Duty x PT6 x Grade 1 x 689 (push-side)
1	Ea.	Cont. Threshold	As specified x full opening width
1	Ea.	O/H Rain Drip	As specified
1	Ea.	Door Bottom Rain Drip	As specified
1	Set	Weatherstripping	As specified, including door bottom sweep

HW-6 Interior Pair Dual-Egress Fire Doors (4'-0"W Leaves) on Hold-Open Devices, Fire-Rated (Doors 122 & 123)

4	Pr.	Hinges	A8111 x Grade 1 x 626 (two pair per leaf)
2	Ea.	Exit Device	Type 8 x F08 x Grade 1 x 630
2	Ea.	Exterior Trim	Latching/Lever Handle trim, as specified, one per leaf
2	Ea.	O/H Closers	C02011 x Grade 1 x 689 (Pull side)
2	Ea.	Door Stops	Wall type, as specified
4	Ea.	Kickplate	As specified, both sides of doors
2	Ea.	Lock cylinders	As specified, for exit devices (integral in lever handles)
2	Ea.	Door Holders	Electromagnetic door hold-open devices, as specified

Note: Provide for connection of door hold-open devices to fire alarm system in order to enable release upon the building's fire alarm system.

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HW-7 Office Entrance/Exit Door from Vestibule, Single Leaf, Fire-Rated (Door No. 104A):

1-1/2	Pr.	Hinges	A5111 x Grade 2 x 630
1	Ea.	Bored Lockset	4000 x F88 x GR1 x 626 (Exit/entry lock)
1	Ea.	O/H Closer	C02011 Heavy-Duty x Grade 1 x 689 (mount at pull-side)
1	Ea.	Door Stop	As scheduled (floor type)
2	Ea.	Kickplates	630, door width minus 2 inches X 10 inches H

HW-8 Office Entrance/Exit Door to Lobby, Single Leaf, Access-Controlled, Fire-Rated (Door No. 104B):

1-1/2	Pr.	Hinges	A5111 x Grade 1 x 630
1	Ea.	Electric Strike	As specified; coordinate with access controls and remote release
1	Ea.	Contact switch	Magnetic, fully mortised (prep frame and door to receive; switch to be installed by MASEC)
1	Ea.	Bored Lockset	4000 x F80 x GR1 x 626 (Communicating lock)
1	Ea.	O/H Closer	C02011 Heavy-Duty x Grade 1 x 689 (pull-side)
2	Ea.	Kickplates	As specified, each side of door
1	Ea.	Wall Stop	As specified, Wall-type

NOTE: Card reading device to operate electric strike shall be provided by the security systems subcontractor.

Note regarding Lockset function and arrangement at Door No. 104B:

The interior of the school (Lobby) side of the door shall be considered the (inside) secure area, and the Reception Area shall be considered the non-secure (outside) area. The intent is to install a latchable, lockable lever handle set at Office/Reception-room side of door, and to allow handle to turn, permitting ingress to the Office from the Lobby side except when door is made secure by from Office side. Electric strike is released from the secretarial station at the Office/Reception side of door. Configure bolt to secure latch of door in the electric strike on the Reception area side of door. Lever handle shall retract latch bolt on either side, except when locked by key on the respective side. Not an required exit.

HW-9 Office Entrance/Exit Door, Non-Fire-Rated (Door No. 102, 103, 106 and 110):

1-1/2	Pr.	Hinges	A8111 x Grade 1 x 626
1	Ea.	Bored Lockset	4000 X F82A x GR1 x 626 (Office/entry lock)
1	Ea.	Door Stop	As specified; Floor-type at 103 and Wall-type at 109
2	Ea.	Kickplates	As specified; each side of door
1	Set	Soundproofing	As specified (Omit at Door #102)

HW-10 Restroom Door (Single Toilet), Single Leaf (Door No. 105)

1-1/2	Pr.	Hinges	A8111 x Grade 1 x 626
1	Ea.	Bored Latchset	4000 x F75 x GR1 x 626
1	Ea.	Bored Deadbolt	E0121 x Grade 1 x 626, Indicating Type
1	Ea.	Door Stop	Wall type, as specified
2	Ea.	Kickplates	As specified, both sides of doors

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HW-11 Office Entrance/Exit Door, Fire-Rated, Single Leaf (Door No. 111):

1-1/2	Pr.	Hinges	A5111 x Grade 1 x 630
1	Ea.	Bored Lockset	4000 X F82A x GR1 x 630 (Office entry lock)
1	Ea.	O/H Closer	C02011 x Grade 1 x 689 (pull-side)
1	Ea.	Door Stop	As specified; omit at #110
2	Ea.	Kickplates	As specified; each side of door

HW-12 Closet Door, Pair (Door No. 112):

3	Pr.	Hinges	A8112 x Grade 2 x 626
2	Ea.	Dummy Trim	Each leaf
2	Ea.	Roller Latches	As specified, mortised in frame at head of doors
2	Ea.	Kickplate	As specified, office side of door

HW-13 Single Leaf Exterior Door at Mechanical Mezzanine, Non-Fire-Rated (Door No. 201)

1	Pr.	Hinges	A5112 x Grade 2 x 630
1	Ea.	Bored Lockset	4000 x F86 x GR1 x 630 (Entry lock)
1	Ea.	O/H Holder	C02511 x Grade 1 x 630
1	Ea.	Threshold	As specified
1	Ea.	O/H Rain Drip	As specified
1	Ea.	Door Bottom Rain Drip	As specified
1	Set	Weatherstripping	As specified

HW-14 Single Leaf Interior Doors to Mechanical Closets at Cafeteria (Doors No. 119A, 119B, 120 A & 120B); Salvage & reinstall all existing door hardware for each leaf, including:

1-1/2	Pr.	Hinges	Mortise-type (Existing)
1	Ea.	Bored Lockset	w/Knob (Existing); reuse existing strike plate
1	Ea.	Armor Plate	Wrap-Around-type, at lockset (Existing)

END OF SECTION 087100

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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. Fixed aluminum storefront-framed exterior windows.
 - 2. Exterior aluminum entrances, sidelights and transoms.
 - 3. Interior non-fire-rated metal storefront windows and sidelights.
 - 4. Non-fire-rated swinging door lites.
- B. Related Sections:
 - 1. Division 08 Section 081113, "Hollow Metal Doors and Frames," or glazing at non-fire-rated hollow-metal frames for windows, storefronts, sidelites and transoms, as well as inserted lites in metal doors.
 - 2. Division 08 Section 081416, "Flush Wood Doors," for glazing at inserted lites in non-fire-rated wood doors.
 - 3. Division 08 Section 084113, "Aluminum Framed Storefronts, Windows and Entrances." Refer to this section for coordination with aluminum-framed storefront and glazed entry door requirements.
 - 4. Division 08 Section 088813, "Fire-Rated Glazing" for glass and glazing requirements at interior fire-rated opening, door and window assemblies.

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.

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- 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 2018 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. Non-insulating glass (interior use).

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2. Insulating glass (exterior use).
 3. One-way vision 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.

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- 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.
- C. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than 1/4-inch or the thickness otherwise indicated or required for strength. Where "insulating glass" is indicated, it shall mean not less than 1-inch overall thickness, consisting of an inner lite of 1/4-inch thickness, a 1/2-inch wide dessicant-treated air space, and an outer lite of 1/4-inch thickness. Where insulating glass includes an outboard lite of 5/16-inch thick laminated glass, overall insulating unit thickness shall be 1-1/6 inch thick.
- E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

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2.2 GLASS PRODUCTS

- A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
- B. 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).
- C. Reflective-Coated Vision Glass: ASTM C1376, Kind CV, over ASTM C1048 heat treated FT (fully-tempered) glass.
- D. Laminated Safety Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
 - 1. Construction: Laminate glass with polyvinyl butyral interlayer or ionomeric polymer interlayer to comply with interlayer manufacturer's written instructions.
 - 2. Interlayer Thickness: Provide thickness not less than 0.060-inch thick and as needed to comply with requirements.
 - 3. Interlayer Color: Clear unless otherwise indicated.
 - 4. Nominal glass thickness: 5/16-inch (two 1/8-inch glass layers plus 1/16-inch interlayer).

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 Paragraph titled "Glass Types" below.

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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.

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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.
- D. Cut round hole speaker openings in 1/4-inch thickness interior glass prior to heat-strengthening. Locate holes where indicated on the drawings. Coordinate with speak hole products as specified under Section 0841 13 Aluminum-Framed Storefronts and Entrances."

2.7 GLASS TYPES

- A. Glass Type GL-1: Heat-Strengthened, insulating glass, for use aluminum-framed windows at exterior walls 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.
- B. Glass Type GL-2: Tempered, non-insulating glass, for use in exterior aluminum doors, at interior HM storefront Door #103C sidelight, at Conference Room #109 HM storefront framing, as lites in exterior and interior hollow metal doors, and at sliding pass windows:
 - 1. Overall Unit Thickness: 1/4-inch (6 mm).
 - 2. Indoor Lite: Clear float glass, fully-tempered.
 - 3. Low-E Coating: N/A.
- C. Glass Type GL-3: Hybrid Laminated and heat-strengthened, insulating glass, for use at interior HM-framed windows in the following locations: Chief Mechanic Office #117 and Shop Foreman Office #118, as follows:
 - 1. Overall Unit Thickness: 1-1/16 inch (27 mm).
 - 2. Outdoor Lite (facing Maintenance Bays: Clear laminated glass, 5/16-inch thickness.
 - 3. Interspace Content: Argon-filled, 1/2-width.

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4. Indoor Lite: Clear heat-Strengthened float glass, 1/4-inch thickness.
5. Low-E Coating: N/A.

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, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

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- 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 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 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.
 - 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

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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.

END OF SECTION 088000

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SECTION 088723 – SAFETY AND SECURITY WINDOW LAMINATES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Smash resistant laminate film.
- B. Forced entry resistant laminate film.
- C. Small arms bullet fragmentation-resistant laminate film.

1.2 RELATED SECTIONS

- A. Section 084113, "Aluminum-Framed Storefronts, Windows and Entrances."
- B. Section 088000, "Glazing."

1.3 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 2. ASTM E 1886 - Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.
 - 3. ASTM F 3561 - Standard Test Method For Forced-Entry-Resistance Of Fenestration Systems After Simulated Active Shooter Attack (2022).
- B. American National Standards Institute (ANSI):
 - 1. ANSI Z97.1 - For Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
- C. Consumer Product Safety Commission (CPSC):
 - 1. CPSC 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.
- D. U.S. Department of Justice, National Institute of Justice (NIJ):
 - 1. NIJ 0108.01 - Technology Assessment Program Ballistic Resistant Protective Materials.
- E. Underwriters Laboratories (UL):
 - 1. UL 972 – Forced Entry Burglary Resisting Glazing Material.

1.4 SUBMITTALS

- A. Submit under provisions of Section 013300, "Submittals."
- B. Product Data:
 - 1. Manufacturer's data sheets on each film product to be used.
 - 2. Preparation instructions and recommendations.

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3. Storage and handling requirements and recommendations.
 4. Typical installation methods, including retention system at perimeter window frames.
- C. Verification Samples: Two representative units of each type, size, pattern, and color.
- D. Shop Drawings: Include details of materials, construction, and finish. Include relationship with adjacent construction.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with a minimum five years documented experience.
- B. Installer Qualifications: Company specializing in performing Work of this section with minimum two years documented experience with projects of similar scope and complexity.
- C. Source Limitations: Provide each type of product from a single manufacturing source to ensure uniformity.
- D. Mock-Up: Construct a mock-up with actual materials in sufficient time for Architect's review and to not delay construction progress. Locate mock-up as acceptable to Architect and provide temporary foundations and support.
1. Intent of mock-up is to demonstrate quality of workmanship and visual appearance.
 2. If mock-up is not acceptable, rebuild mock-up until satisfactory results are achieved.
 3. Retain mock-up during construction as a standard for comparison with completed work.
 4. Do not alter or remove mock-up until work is completed or removal is authorized.

1.6 PRE-INSTALLATION CONFERENCE

- A. Convene a conference approximately two weeks before scheduled commencement of the Work. Attendees shall include Architect, Contractor and trades involved. Agenda shall include schedule, responsibilities, critical path items and approvals.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store and handle in strict compliance with manufacturer's written instructions and recommendations.
- B. Protect from damage due to weather, excessive temperature, and construction operations.

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1.8 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.9 WARRANTY

- A. Manufacturer's standard limited warranty unless indicated otherwise.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers/Products:
 - 1. ArmouredOne, Window Security Film 23-Mil (Basis of Design). **Note that this product is the standard adopted for installation at other schools by Newport News Public Schools.**
 - 2. Safe Haven Defense, SW600FE Film.
- B. Products of other manufacturers that are deemed equal may be submitted to the Architect for consideration as substitutes. Requests for substitutions will be considered in accordance with provisions of Section 012500, "Substitutions."

2.2 SECURITY GLAZING LAMINATES

- A. Product and System Description: Work under this Section includes provision of a laminated, clear plastic window film applied and adhered to the inner surface of exterior vision glass that is inherently secured to the perimeter metal window frame that retains the glass in the frame in the event of an attack by armed intruder. The applied film and method of continuous attachment at the perimeter frame shall have been successfully tested and passed ASTM F 3561.
- B. Glazing Force Entry Resistant Laminate:
 - 1. Standards Compliance:
 - a. Building Glaze Materials: Per ANSI Z97.1.
 - b. CPSC 16 CFR 1201: Impact Test.
 - c. ASTM E1886: Hurricane Wind.
 - d. GSA Explosive Test: GSA TS01-2003.
 - e. BMAG: Level 1- Blast Mitigation.
 - f. UL972 / ULC 332: Forced Entry Burglary Protection.
 - g. ASTM F 3561: Forced Entry after Shooter Attack.
 - 2. Performance Requirements:
 - a. Thickness (1 layer): 22 mil (0.56 mm), minimum.
 - b. Break Strength: 660 psi (4550 kPa).
 - c. Tensile Strength: 34,000 psi (234,420 kPa).

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- d. Peel Strength: 6 psi (41.4 kPa).
 - e. Total Solar Energy Rejection: 20 percent.
 - f. IR Rejection: 59 percent.
 - g. UV Rejection: 99 percent.
3. Optical Qualities:
- a. Haze: ASTM D 1003, Haze Gard Plus; <4%, Film Only
 - b. Color B: ASTM D 2244, MiniScan, XE Plus; 4.2, CIE-LAB D65/10 (Film Only)
 - c. Visible Light Transmitted: 87% (Performance Data On 1/8-inch Clear Glass)
 - d. Visible Light Reflected (Interior): 12%
 - e. Visible Light Reflected (Exterior): 12%
 - f. UV Block: >99%
 - g. Total Solar Energy Reflected: 11%
 - h. Total Solar Energy Transmitted : 77%
 - i. Total Solar Energy Absorbed: 12%
 - j. Shading Coefficient: 0.93
 - k. Total Solar Energy Rejected: 19%
 - l. Solar Heat Gain Coefficient: 0.81
 - m. U-Value Winter: 1.03
 - n. K-Value Winter: 5.85
 - o. Glare Reduction: 3%
- C. Retention System Attachment to Frame:
- 1. Film shall be fully adhered to the surrounding window frames on all sides using the film manufacturer's proprietary adhesive and sealant.
 - 2. If required to pass the ASTM F 3561 test, provide manufacturer's proprietary metal retention strips and fasteners to aluminum window frames.
 - 3. Include details for the retention system

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly constructed and prepared.
 - 1. Existing window must be inspected to be structurally sound.
- B. If substrate preparation is the responsibility of another installer, notify Architect in writing of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
 - 1. Window must be free from debris and thoroughly cleaned prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for

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achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install at inner surface of all **new exterior glass, including doors and fixed windows, of the Security Vestibule and Lobby** in accordance with manufacturer's instructions, approved submittals, and in proper relationship with adjacent construction.

3.4 FIELD QUALITY CONTROL

- A. Field Inspection: Coordinate field inspection in accordance with appropriate sections in Division 01.
- B. Manufacturer's Services: Coordinate manufacturer's services in accordance with appropriate sections in Division 01.

3.5 CLEANING AND PROTECTION

- A. Clean products in accordance with the manufacturer's recommendations.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 088723

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SECTION 088813 - FIRE-RATED GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fire-rated glazing materials installed as vision lights in fire-rated doors.
 - 1 Fire-rated glazing materials installed as transoms, borrowed lites AND windows in fire-rated frames.
- B. Related Sections include the following:
 - 1. Section 081100 "Metal Doors and Frames" for vision panels in interior doors and interior vision panel (borrowed lites) frames.
 - 2. Section 081416 "Flush Wood Doors" for vision panels in interior doors.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM E2010-01: Standard Test Method for Positive Pressure Fire Tests of Window Assemblies.
- B. American National Standards Institute (ANSI):
 - 1. ANSI Z97.1: Standard for Safety Glazing Materials Used in Buildings
- C. Consumer Product Safety Commission (CPSC):
 - 1. CPSC 16 CFR 1201: Safety Standard for Architectural Glazing Materials
- D. Glass Association of North America (GANA):
 - 1. GANA – Glazing Manual.
 - 2. FGMA – Sealant Manual.
- E. National Fire Protection Association (NFPA):
 - 1. NFPA 80: Fire Doors and Windows.
 - 2. NFPA 252 – Fire Tests of Door Assemblies.
 - 3. NFPA 257 – Fire Tests of Window Assemblies.
- F. Underwriters Laboratories, Inc. (UL):
 - 1. UL 9 – Fire Tests of Window Assemblies.
 - 2. UL 10B – Fire Tests of Door Assemblies.
 - 3. UL 10C – Positive Pressure Fire Tests of Door Assemblies.
- G. Virginia Construction Code (VCC), 2018 Edition>

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1.3 DEFINITIONS

- A. Manufacturer: A firm that produces primary glass, fabricated glass or framing as defined in referenced glazing publications.

1.4 SUBMITTALS

- A. Comply with requirements of Section 013300, Submittals.
- B. Product data: Submit manufacturer's technical data for each glazing material required, including installation and maintenance instructions.
- C. Certificates of compliance from glass and glazing materials manufacturers attesting that glass and glazing materials furnished for project comply with requirements. Separate certification will not be required for glazing materials bearing manufacturer's permanent label designating type and thickness of glass, provided labels represent a quality control program involving a recognized certification agency or independent testing laboratory acceptable to authority having jurisdiction.
- D. Product Test Listings: From UL indicating fire-rated glass complies with requirements, based on comprehensive testing of current product.
- E. Samples: Submit, for verification purposes, approx. 8-inch by 10-inch sample for each type of glass indicated

1.5 QUALITY ASSURANCE

- A. Glazing Standards: FGMA Glazing Manual and Sealant Manual.
- B. Fire Protective Rated Glass: Each lite shall bear permanent, non-removable label of UL certifying it for use in tested and rated fire protective assemblies.
- C. Fire Protective Glazing Products for Door Assemblies: Products identical to those tested per ASTM E 152, classified and labeled by UL or other certification agency acceptable to authorities having jurisdiction.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials under provisions of Section 016000, Product Requirements.
- B. Deliver materials to specified destination in manufacturer's or distributor's packaging, undamaged, complete with installation instructions.

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- C. Store off ground, under cover, protected from weather and construction activities.

1.7 WARRANTY

- A. Provide manufacturer's limited warranty under provision of Section 017400, Warranties and Bonds.
- B. Warranty Period: Warrant glass against defects, deterioration and other failures unrelated to impact breakage for a period of not less than **three (3) years** from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS- (ACCEPTABLE MANUFACTURER/PRODUCTS)

- A. Manufacturer: FireLite®NT as manufactured by Nippon Electric Glass Company, Ltd., and distributed by Technical Glass Products, 8107 Bracken Place SE, Snoqualmie, WA 98065 phone (800.426.0279) fax (425.396.8300) e-mail sales@fireglass.com, web site <http://www.fireglass.com>

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-rated glass ceramic clear and wireless glazing material with surface-applied film listed for use in impact safety-rated locations such as doors, transoms and borrowed lites with fire rating requirements ranging from 20 minutes to 3 hours with required hose stream test.
- B. Passes positive pressure test standards UL 10C.

2.3 MATERIALS-GLASS

- A. Properties:
 1. Thickness: 3/16-inch (5 mm) FireLite®.
 2. Film: Fire-rated surface film as approved by manufacturer.
 3. Weight: 2.56 lbs/ft² or 12.5 kg/m²
 4. Approximate Visible Transmission: 88 percent.
 5. Approximate Visible Reflection: 9 percent.
 6. Hardness (Vicker's Scale): 700.
 7. Fire-rating: 20 minutes to 3 hours for doors; 20 minutes to 90 minutes for other applications.
 8. Impact Safety Resistance: ANSI Z97.1 and CPSC 16CFR1201 (Cat. I and II).
 9. Positive Pressure Test: UL 10C; passes.
 10. Surface Finish:

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- a. Standard Grade is polished for a surface quality that is comparable to alternative fire-rated ceramics marketed as having a premium finish.
- B. Maximum sheet sizes based on surface finish:
 - 1. Premium: 48 inches by 96 inches.
 - 2. Standard: 48 inches by 96 inches.
 - 3. Obscure: 36 inches by 96 inches.
- C. Labeling: Permanently label each piece of FireLite® NT with the FireLite® NT logo, UL logo and fire rating in sizes up to 3,325 sq. in., and with the FireLite® NT label only for sizes that exceed the listing (as approved by the local authority having jurisdiction).
- D. Fire Rating: Fire rating classified and labeled by UL for fire rating scheduled at opening locations on drawings, when tested in accordance with ASTM E2010-01, NFPA 252 and NFPA 257, or UL 9, UL 10B and UL 10C.
- E. Substitutions: Substitutions shall be permitted subject to complying with all requirements of this Section, and submission to, review and approval by the Architect in accordance with Section 012500, Substitution Procedures.

2.4 GLAZING COMPOUND FOR FIRE-RATED GLAZING MATERIALS

- A. Glazing Tape: Closed cell polyvinyl chloride (PVC) foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent. Glass panels that exceed 1,393 sq. inches for 90-minute ratings must be glazed with fire-rated glazing tape supplied by manufacturer.
- B. Glazing Compound: DAP 33 putty.
- C. Setting Blocks: Neoprene, EPDM; tested for compatibility with glazing compound; of 70 to 90 Shore A hardness.
- D. Cleaners, Primers, and Sealers: Type recommended by manufacturer of glass and gaskets.

2.5 FABRICATION

- A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.

PART 3 - EXECUTION

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3.1 EXAMINATION

- A. Examine glass framing, with glazier present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, offsets at corners.
 - 2. Minimum required face or edge clearances.
 - 3. Observable edge damage or face imperfections.
- B. Do not proceed with glazing until unsatisfactory conditions have been corrected.
- C. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings that are not firmly bonded to substrates.

3.2 INSTALLATION (GLAZING)

- A. Comply with referenced FGMA standards and instructions of manufacturers of glass, glazing sealants, and glazing compounds.
- B. Protect glass from edge damage during handling and installation. Inspect glass during installation and discard pieces with edge damage that could affect glass performance.
- C. Set units of glass in each series with uniformity of pattern, draw, bow, and similar characteristics.
- D. Cut glazing tape to length and set against permanent stops, flush with sight lines to fit openings exactly, with stretch allowance during installation.
- E. Place setting blocks located at quarter points of glass with edge block no more than 6 inches from corners.
- F. Glaze vertically into labeled fire-rated metal frames or partition walls with same fire rating as glass and push against tape for full contact at perimeter of pane or unit.
- G. Place glazing tape on free perimeter of glazing in same manner described above.
- H. Install removable stop and secure without displacement of tape.
- I. [Use specified glazing compound, without adulteration; bed glazing material in glazing compound; entirely fill all recess and spaces. Provide visible glazing compound with smooth and straight edges.]
- J. Install in vision panels in fire-rated doors to requirements of NFPA 80.
- K. Install so that appropriate UL or FireLite® NT markings remain permanently visible.

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3.3 PROTECTION AND CLEANING

- A. Protect glass from contact with contaminating substances resulting from construction operations. Remove any such substances by method approved by glass manufacturer.
- B. Wash glass on both faces not more than four days prior to date scheduled for inspections intended to establish date of substantial completion. Wash glass by method recommended by glass manufacturer.

3.4 GLAZING SCHEDULE

Rating	Assembly	Max. Exposed Area (Sq. In.)	Max. Width Of Exposed Glazing (In.)	OR	Max. Height Of Exposed Glazing (In.)	Stop Height
20 min.	Doors					
	HMS or wood*	3,204	36		89	5/8"
	Fireframes® D.S.	3,204	36		89	3/4"
	Other than doors					
45 min.	HMS or wood	3,325	95		95	5/8"
	Fireframes D.S.	3,325	95		95	3/4"
	Doors					
	HMS or wood	3,204	36		89	5/8"
60 min.	Fireframes D.S.	3,204	36		89	3/4"
	Other than doors					
	HMS or wood	3,325	95		95	5/8"
	Fireframes D.S.	3,325	95		95	3/4"
	Doors (non-temp rise)					
	HMS or wood	3,204	36		89	5/8"
	Fireframes D.S.	100	12		33	5/8"
	Doors (temp rise)					
Other than doors						
HMS or wood	3,325	95		95	5/8"	
Fireframes D.S.	3,325	95		95	3/4"	

* HMS indicates hollow metal steel framing. Fireframes® D.S. indicates Designer Series narrow profile framing. For wood frames, check with manufacturer for maximum tested glass sizes.

END OF SECTION

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.).
- B. Related Sections include the following:
 - 1. Division 05 Section "Cold-Formed Metal Framing" for all structural-related metal stud and joist steel framing systems.
 - 2. Division 09 Section "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.

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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 and Angles: ASTM C 645.
 - 1. Minimum Base Metal Thickness: **0.0312 inch (0.79 mm)**
 - 2. **7/8 inch (22.2 mm)**.
 - 3. Angles as sized on the Construction Drawings.

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.

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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.
 - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - 2. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

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- a. Fire-stop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
- 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.
 - 2. Interior tile backer board.
- B. Related Sections include the following:
 - 1. Division 06 Section 061643, "Glass-Mat Faced Gypsum Sheathing" for gypsum board products used as exterior board sheathing.
 - 2. Division 07 Section 072100, "Thermal Insulation" for insulation and vapor retarders installed in assemblies that incorporate gypsum board.
 - 3. Division 09 Section 092216, "Non-Structural Metal Framing" for non-load-bearing framing members.
 - 4. 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.

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- 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., M-BLOC® Abuse Resistant Type X Gypsum Board
 - b. Georgia-Pacific Building Products, ToughRock® Fireguard X® Mold-Guard™ Abuse-Resistant Gypsum Board
 - c. National Gypsum Company, Gold Bond® Hi-Abuse® XP® Gypsum Board
 - d. USG Corporation, Sheetrock® Brand Mold Tough® AR Firecode® X Panels
- B. Type X, Abuse- and Mold-Resistant: Fire Code, **for use at all partition assemblies regardless of fire-rating**, with manufacturer's proprietary mold-inhibiting treatment or formulation.
 - 1. Comply with ASTM C 1396 and ASTM C 1629.
 - 2. Non-combustible; comply with ASTM E 136.
 - 3. When tested in accordance with ASTM D 3273, achieve score of 10 for mold resistance.
 - 4. Paper-faced from recycled paper products.
 - 5. Thickness: 5/8-inch.
 - 6. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

2.3 TILE BACKER BOARD

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- A. Glass-Mat, Water-Resistant Backing Board: ASTM C1178/C1178M, with manufacturer's standard edges.
 - 1. Core: **5/8 inch (15.9 mm)**, Type X.
 - 2. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

- B. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.
 - 1. Thickness: **1/2 inch (12.7 mm)**.
 - 2. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.4 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. Expansion (control) joint.

2.5 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.

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2.6 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.
 - 2. Screws for use at cementitious backer board shall be corrosion-resistant coated.

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 and soffit 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.

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- 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.

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.

- 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 APPLYING TILE BACKING PANELS

- A. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and install at stud-framed wall locations indicated to receive tile. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.

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- B. Cementitious Backer Units: ANSI A108.11, at bathroom locations with water closets and other plumbing, indicated to receive tile.
- C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 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 [at locations indicated on Drawings] [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

3.6 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. Level 4: Unless otherwise noted, at all locations exposed to view below ceilings.
 - 2. Level 2 is permissible at locations above suspended ceilings and where otherwise concealed from view.
 - 3. Level 2 is permissible throughout the mechanical and electrical areas of the upper Mezzanine.

3.7 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

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- 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

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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 Wall Tile.
- 2. Porcelain tile (Floor Base).
- 3. Marble thresholds.

- B. Related Sections:

- 1. Section 079200, "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
- 2. Section 092900, "Gypsum Board" for cementitious backer board used as wall substrates over metal stud assemblies for installation of wall tile.

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 PERFORMANCE REQUIREMENTS

- A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
 - 1. Level Surfaces: Minimum >0.60 wet and >0.65 dry.

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1.5 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.

1.6 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.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
 - 2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.8 QUALITY ASSURANCE

- A. Source Limitations for Tile: Obtain tile of each color or finish from one source or producer.

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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.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and Cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.
- 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.

1.10 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.

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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 Wall Tile:
 - a. **Basis of Design:** Dal-Tile; Division of Dal-Tile International Inc., "Color Wheel Classic" Series.
 - b. American Marazzi Tile, Inc.
 - c. American Olean; Division of Dal-Tile International Inc.
 - d. Crossville, Inc.
 - e. Florida Tile Industries, Inc.
2. Module Size: Provide wall tiles in sizes as indicated on the Drawings and as follows:
 - a. Patching: 4-1/4 by 4-1/4 inches (108 by 108 mm) for all patching of existing wall tile.
 - b. New Large Surface Areas: Where new wall tile is to be installed over large areas and where existing wall tile was demolished, provide tile measuring 4 by 4 inches (102 by 102 mm).
3. Face Size Variation: Rectified.
4. Thickness: 5/16 inch (8 mm).
5. Face: Plain with modified square edges or cushion edges.
6. Finish: Bright, opaque glaze.
7. Tile Color and Pattern: Pattern as shown on the Construction Drawings. Tile color will have Glossy finish and be as indicated on the Drawings.
8. Grout Color: Standard light gray; specific color as selected by Architect from manufacturer's full range of submitted samples.
9. Mounting: Factory, back mounted.
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:

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- a. Base for Thinset Mortar Installations: Straight, module size 4-1/4 by 4-1/4 inches (108 by 108 mm), or 4 by 4 inches (102 mm by 102 mm), as applicable.
 - b. Wainscot Cap for Thinset Mortar Installations: Surface bullnose, module size 4-1/4 by 4-1/4 inches (108 by 108 mm), or 4 by 4 inches (102 mm by 102 mm), as applicable.
 - c. External Corners for Thinset Mortar Installations: Surface bullnose, same size as adjoining flat tile.
 - d. Internal Corners: Field-buttet square corners. For coved base and cap use angle pieces designed to fit with stretcher shapes.
- B. Floor Tile Type: Unglazed Porcelain Tile, used as Wall Base.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. **Basis of Design:** Dal-Tile; Division of Dal-Tile International Inc., "Pure" 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: Porcelain, through-body color.
 3. Face Size: 3 inches high by 12 inches or 24 inches long, nominal.
 4. Thickness: 5/16-inch
 5. Grout Joint Width: 1/4-inch.
 6. Face: Plain with square or cushion edges, with formed bullnose across top edge.
 7. Finish: Semi-mat, unpolished, clear glaze.
 8. Tile Color and Pattern: Pattern as shown on the Construction Drawings. Tile color will be as indicated on the Drawings.
 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 flat tile.
 - b. Internal Corners: Square.

2.3 THRESHOLDS

- A. General: Fabricate sills to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

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1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch (1.5 mm) above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch (12.7 mm) or less above adjacent floor surface.
- B. Marble Thresholds: ASTM C 503/C 503M, with a minimum abrasion resistance of 10 according to ASTM C 1353 or ASTM C 241/C 241M and with honed finish.
 1. Description: Uniform, fine- to medium-grained white stone with gray veining.
 2. Description: Match Architect's sample.
 3. Locate at sills of new bathroom/restroom doors.

2.4 SETTING MATERIALS

- A. Dry-Set Portland cement Mortar (Thin Set): ANSI A118.1.
 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.
 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.

2.5 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.

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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.

2.6 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.

2.7 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.

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- B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless-steel, ASTM A 666, 300 Series exposed-edge material.
- C. 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.
- D. 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.

2.8 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.

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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.

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- 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.
- G. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- H. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.

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.

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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 Floor Base Installation, Concrete Masonry Wall Substrate:
 1. Ceramic/Porcelain Wall Tile Installation: TCNA W202; thinset mortar.
 - a. Ceramic Tile Type: Ceramic Wall Tile and Porcelain Ceramic Wall Base.
 - b. Thinset Mortar: Improved (latex-) modified dry-set mortar.
 - c. Grout: Standard unsanded cement grout.
 2. Ceramic Tile Installation: TCNA W244C or TCNA W244F; thinset mortar on cementitious backer units or fiber-cement backer board.
 - a. Ceramic Tile Type: Ceramic Wall Tile and Porcelain Ceramic Wall Base.
 - b. Thinset Mortar: Improved (latex-) modified dry-set mortar.
 - c. Grout: Standard unsanded cement grout.

END OF SECTION 093000

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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 06 Section "Rough Carpentry" for wood 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 specifications on the Electrical Drawings 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

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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

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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 – 5/8-inch thickness, square-edged; water-felted, with white painted finish and perforated and fissured Pattern, ASTM E 84, Class A fire-resistance. Provide one of the following products or equal submitted to and approved by the Architect:
 - a. "Cortega 770," Armstrong World Industries, Inc.
 - b. "School Board," Certainteed/St. Gobain.
 - c. "Radar Education Panels," USG Interiors, Inc.
- 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

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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 MINERAL-BASE ACOUSTICAL PANELS - NODULAR, CAST, OR MOLDED APC (APC-1)

- A. Type, Form, and Finish: Provide Type III, Form 1 units per ASTM E 1264 with painted finish that comply with pattern and other requirements indicated.
- B. Fissured Pattern: Units fitting ASTM E 1264 pattern designation D, with other characteristics as follows:
 - 1. Color/Light Reflectance Coefficient: White/LR 0.75.
 - 2. Noise Reduction Coefficient: NRC 0.55.
 - 3. Ceiling Sound Transmission Class: CSTC 33.
 - 4. Edge Detail: Square.
 - 5. Edge Detail at Conference Rooms: Tegral (reveal) edges.
 - 6. Size: As shown on the drawings; 24" by 24" with square edges.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

- A. Standard for Metal Suspension Systems: Provide manufacturer's standard 15/16-inch white metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C 635 requirements.
- B. Finishes and Colors: Provide manufacturer's standard factory-applied finish for type of system indicated.
 - 1. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.
- C. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper.
 - 1. Gage: Provide wire sized so that stress at 3 times hanger design load (ASTM C 635, Table 1, Direct-Hung), will be less than yield stress of wire, but provide not less than 0.106-inch diameter (12 gage).
- D. Edge Moldings and Trim: Metal or extruded aluminum of types and profiles

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indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit type of edge detail and suspension system indicated.

1. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
3. For acoustical tile adhered to substrate, provide edge moldings at ceiling perimeters and where indicated.

2.5 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.

2.6 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-

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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

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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

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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.
 - 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.

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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: 4 inches.
- E. Lengths: Cut lengths 48 inches long or coils in manufacturer's standard length.
- F. Outside Corners: Job formed or preformed.

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- G. Inside Corners: Job formed or preformed.
- H. Finish: As selected by Architect from manufacturer's full range.
- I. Colors and Patterns: As indicated in the Interior Color Schedule shown on the Drawings; to be selected by Architect from full range of industry colors.

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.

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- 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.

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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.

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- 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

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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.

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- F. Colors and Patterns: As indicated on the Drawings.

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.

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- 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. Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.
- D. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound 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.**
- E. 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.
- F. 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.

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- 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

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SECTION 096623 - RESINOUS MATRIX TERRAZZO FLOORING

PART 1 – GENERAL

1.01 - SUMMARY

A. Section Includes:

1. Poured in place resinous matrix epoxy terrazzo flooring.
2. Joint, edge, and termination strips.
3. Prior to installation of structural floor slab, advise [General Contractor] [Construction Manager], in writing, of all requirements of concrete substrate regarding finish, level tolerance, curing and below substrate vapor barrier; see INSPECTION in Part 3.
4. Accessories necessary for complete installation.
5. Backing for Epoxy Terrazzo base must be a cement board or ¾" exterior grade plywood, concrete block, concrete or cement plaster.
6. Sufficient water, temporary heat and light, and adequate electric power with suitable outlets connected and distributed for use within 100 feet of any working space.
9. Temperature shall be maintained as per manufacturer's recommendations, minimum 55 degrees Fahrenheit, before, during and after installation.

B. Related Sections:

1. Cast-in-Place Concrete: Section 033000.
 - a) Concrete sub-floor to be level (maximum variation not to exceed ¼ inch in 10 feet) and to have a light broom brushed finished surface. No curing agents or other additives which could prevent bonding should be used.
 - b) The slab is required to have an effective moisture barrier placed directly under the concrete slab when placed directly on grade. Saw cutting of control joints must be done between 12-24 hours after placement of the structural concrete.
2. Sealants: Section 079200.
3. Gypsum Drywall: Section 092900.
4. Adjacent floor finishes: Division 9.

1.02 – QUALITY ASSURANCE

A. Acceptable Supplier:

1. Manufacturer shall provide materials in accordance with NTMA standards.
2. Materials used in the Terrazzo floor system should be the products of a single source manufacturer–Manufacturer – Contact a representative at info@terrazzco.com

B. Acceptable Installers:

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1. Acceptable installer shall be a contractor member of the NTMA and perform all work in accordance with NTMA standards.
2. If contractor is not a member of the NTMA, the contractor shall submit a list of 5 completed projects of similar magnitude and complexity. Installation shall be performed by an installer with minimum of five (5) years' experience in work of similar nature and scope.
3. Installer to verify locations of all joints required by the provisions of this Section.
 - a) Joint locations may or may not be shown in drawings.
 - b) Refer to drawings required under SUBMITTALS above.
4. Mock-up: Prior to starting application of flooring, provide full scale portable mock-up or mock-up to establish acceptable quality, durability, and appearance. Mock-up size must not be less than 4 square feet
 - a) Acceptable mock-up to be standard of quality for installed work. May be poured onsite and will become integral part of the floor.
 - b) Unacceptable installed work to be removed and replaced or refinished until acceptable

1.03 – SUBMITTALS

A. Samples:

1. Submit maximum of three samples, 6 inches by 6 inches for each color and type of terrazzo as specified.
2. Submit two 6-inch lengths of each type and kind of divider strips as specified.
3. Manufacturer's Application Instructions: Submit descriptive data and include any specific recommendations for mixing, application, curing and precautions of special handling instructions required to comply with the Occupational Safety and Health Act.
4. Shop Drawings: Shop Drawings shall be furnished showing installation of terrazzo termination details and precast details when applicable.

B. Maintenance Literature:

1. Submit two copies of NTMA maintenance recommendations.

C. Certification:

1. Manufacturer shall furnish properly labeled material and Safety Data Sheets which comply to current state and federal requirements.

1.04 – DELIVERY, STORAGE & HANDLING

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- A. All materials shall be delivered to project site in Manufacturer's or original manufacturer's sealed containers including type of material, batch numbers, date of manufacture, and pertinent labels intact and legible.
- B. Store materials in dry protected area at a temperature between 55 degrees to 90 degrees Fahrenheit. Contact manufacturer if there is a deviation from parameters listed.
- C. Follow all Manufacturer's specific instructions and prudent safety practices for storage and handling.

1.05 - GUARANTEE

- A. One year from the date of manufacturing of the product.

1.06 – PROJECT CONDITIONS

- A. Maintain the room and floor temperature at 55 degrees Fahrenheit, or above for a period extending from 72 hours before, during and after floor installation. Concrete to receive surfacing shall have cured for at least 28 days and be free of all curing compounds.
- B. Pre-job meeting between General Contractor, Architect, and installer shall be held to discuss concrete substrate, location of joints and/or saw cuts to minimize subfloor cracking and locations of control joints and strips in terrazzo surface.
- C. Acceptable Substrates
 - 1. Level tolerance: Concrete subfloor shall be level with a maximum variation from level of 1/4" in 10 feet noncumulative. Any irregularity of the surface requiring patching and/or leveling shall be done using material approved by Manufacturer.
 - 2. Concrete floor shall receive a light broom brush finish.
 - 3. No curing agents are to be used in areas to receive terrazzo.
 - 4. Concrete slab shall have an efficient puncture-resistant, reinforced moisture vapor barrier 10 mils thick minimum placed directly under the concrete slab (for slab on grade). Do not use vapor barrier manufactured with recycled material. Testing must be done to verify that the moisture vapor emission rate of the slab does not exceed that as recommended by Manufacturer at time of installation of the flooring or at any future date. Moisture vapor emission and moisture content testing must conform with the requirements of ASTM F-2170 (Relative Humidity Probe Test). If test results show excessive levels of moisture above 75% relative humidity content, apply Concord Terrazzo's recommended moisture vapor emission control material (MMS 950) based upon the highest test reading. If moisture levels are above 95% of relative humidity, please contact Concord Terrazzo.
 - 5. Saw cutting of control joints must be done between 12 and 24 hours after placement of the concrete slab.

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PART 2 – PRODUCTS

2.01 - MANUFACTURER

- A. Specifications are based on Concord Terrazzo Co, Self-Priming TERRAZZCO® Groutless EZPour 158 Thin Set Epoxy Terrazzo Flooring System 1. TERRAZZCO® Brand Products is considered the approved quality standard for this job.
- B. Substitutions: Products of other manufacturers deemed equal by the Architect may be permitted subject to complying with all requirements herein and submit for review in accordance with Section 12500, "Substitution Procedures."

2.02 – MATERIALS

- A. Epoxy resin binder: "EZPour Epoxy 158" mixed according to Manufacturer's recommendation and tested without aggregate added. Meets all of the following conditions: All specimens cured for 7 days at 75 degrees plus or minus 2 degrees Fahrenheit and 50% plus or minus 2% R.H. The product shall meet the following requirements:

Property	Test Method	NTMA Requirements
Hardness	ASTM D-2240 using Shore D Durometer	60-85
Tensile Strength	ASTM D-412 Specimen made using "C" die	3,000 psi Minimum
Compressive Strength	ASTM D-695 Specimen "B" cylinder	10,000 psi Minimum
Chemical Resistance	ASTM D-1308 seven days at room temperature by immersion method	No deleterious effects: Distilled Water Mineral Oil Isopropanol Ethanol 0.025 Detergent Solution 1% Soap Solution 10% Sodium Hydroxide 10% Hydrochloric Acid 30% Sulfuric Acid

- 1. Epoxy Resin mixed according to Manufacturer's recommendations and blended with 3 volumes of Georgia White marble blended 60% #1 chip and 40% #0 chip, ground and grouted with epoxy resin according to 3.02 C-2. All specimens cured 7 days at 75 degrees plus or minus 2 degrees Fahrenheit and 50% plus or minus R.H. The finished epoxy terrazzo shall meet the following requirements:

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Property	Test Method	NTMA Requirements
Flammability	ASTM D-635	Self-extinguishing, extent of burning .025 inches maximum.
Thermal Coefficient of Linear Expansion	ASTM-D-696	25 x 10 ⁻⁶ inches per inch per degree to 140 degrees Fahrenheit
Bond Strength (See Note below)	ACI Committee No. 403/503 Bulletin Title No.59-43 (Pages 1139-1141)	100% concrete failure minimum, with 300 PSI minimum tensile strength.

Note: This test is intended to evaluate the bond to the concrete subfloor and is to be tested at the discretion of the Architect. A 100% concrete failure indicates a good bond.

B. Floor Aid Flexible Membrane 528

1. Prevention of substrate cracks transfer to the finish floor system.

C. Moisture Mitigation System 950

1. Retarder against moisture vapor transmission for concrete slabs having a relative humidity 75%-95%.

D. Aggregate (Marble, Glass, Shells, Metal or Plastic)

1. Size: To conform with NTMA gradation standards.
2. Hardness according to ASTM C-241 Ha-10 minimum
3. 24 hours absorption rate not to exceed 0.75 percent.
4. Chips shall contain no deleterious or foreign matter.
5. Dust content less than 1% by weight.

E. Strips

1. Stop, pour and divider "L" type to accommodate design parameters: 16 gauge. Strips to be of a white zinc alloy, or 100% aluminum. Provide double "L strips at expansion joints filled with sealant as specified under Section 079200, Sealants.

2.03 – MIXES

- A. Terrazzo matrix color selection shall be made by Architect from one of the manufacturer's standard color offerings.

PART 3 – EXECUTION

3.01 – INSPECTION

- A. Examine areas to receive terrazzo for:

RESINOUS MATRIX TERRAZZO FLOORING

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1. Defects in existing substrate that affect proper performance of terrazzo system.
Note: Untreated cracks in substrate will usually be transmitted through topping to surface. TERRAZZCO Flexible Membrane #528 over cracks shall be used to minimize chance of subfloor cracks transferring to the terrazzo surface. In areas with cracks, use fiber glass.
2. Deviations beyond allowable tolerances for the concrete slab work. Subfloor shall not vary more than 1/4-inch from true plane in 10 feet. Epoxy thin-set terrazzo, as specified, is not intended to level substrate and will only follow the contour of the concrete slab. Any work required to eliminate nonconformity of subsurface specifications is the responsibility of others. Any materials used to correct nonconformity must be compatible with terrazzo system selected and be approved by Manufacturer.

B. Proceed with installation only when all defects have been corrected.

3.02 – INSTALLATION

A. Subfloor

1. Prepare substrate to receive epoxy terrazzo by shotblast or rough grind area to receive Terrazzo, according to Manufacturer's recommendations (CSP 3-5).
2. Substrate Crack Repair: Hairline cracks less than 1/16" width may be filled with neat epoxy resin, EZpour #158. Treat cracks if wider than 1/16" width as recommended in NTMA Technical Bulletin #111 "Crack Detailing and Joint Treatments for Thin Set Terrazzo", Detail #6. Route out all cracks larger than 1/16" width and fill with rigid epoxy. Apply TERRAZZCO Flexible Epoxy #528 across the crack a minimum width of 24 inches at a spread rate of 35-45 square feet per gallon to achieve 40 mils dry film thickness over the crack and allow to cure. Optional reinforcement: Imbed fiberglass scrim cloth into wet primer and saturate with additional TERRAZZCO Flexible Membrane #528. Alternatively, scrim cloth may be gently placed onto surface of tacky TERRAZZCO Flexible Membrane #528 without pressing down into resin. Allow to cure.
 - a) Alternate to Step #2: If cracks are too numerous to treat individually, apply TERRAZZCO Flexible Membrane #528 over entire floor surface as a crack isolation membrane following procedure outlined in step #2. Refer also to NTMA Technical Bulletin #111 "Crack Detailing and Joint Treatments for Thin Set Terrazzo", Detail #5.
3. Install divider strips over all concrete joints as recommended in NTMA Technical Bulletin #111 "Crack Detailing and Joint Treatments for Thin Set Terrazzo", Details #1-#7. Divider strips must be bonded to joint edges for contraction joints (aka control joints/sawcuts) and isolation joints (aka expansion joints) in subfloor. For contraction joints, refer to Details #1-#3. For Isolation joints, refer to Detail #4. For Construction joints (aka cold joints), refer to Detail #7. For exposed contraction joints, fill with TERRAZZCO Flex-a-fill Joint Filler #1200. Fill isolation joints with urethane sealant formulated for use in floor expansion joints supplied by others. Do not use prefabricated double divider strips filled with neoprene.

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4. Install divider strips as shown on drawings.

B. Pouring Terrazzo

1. If required, install moisture vapor control material before other terrazzo system materials.
2. Place terrazzo mixture and trowel to a dense flat surface to the top of divider strips

C. Finishing

1. Rough Grinding:

- a) Grind with 24 or finer grit stones or with comparable diamond segments.
- b) Follow initial grind with 80 or finer grit stones or with comparable diamond plates.

2. Grouting:

- a) Cleanse floor with clean water and rinse.
- b) Remove excess rinse water, dry, and apply epoxy grout, supplied by Manufacturer, to fill voids.

3. Cure Grout:

Note: Grout may be left on terrazzo until all heavy and messy work in project is completed.

4. Fine Grinding

- a) Grind with 80 or finer grit stones or with comparable diamond segments until all grout is removed from surface. Continue polishing to specified grit level to match the approved sample(s).

D. Cleaning

1. pH factor between 7 and 10 where applicable.
2. Biodegradable and phosphate free.
3. Wash all surfaces with a neutral cleaner.
4. Rinse with clean water and allow surface to dry.

- E. Sealer:** TERRAZZCO Brand Epoxy floors should be sealed with a terrazzo sealer. Caution: Some finish systems require unsealed terrazzo for proper installation, to function as designed and to achieve the desired aesthetic effect, consult with Manufacturer of the finish system for requirements. Any sealer or finish system not supplied by Concord Terrazzo should be properly tested with a mock-up before use.

1. pH factor between 7 and 10, where applicable.

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2. Shall not discolor or amber.
3. Flash Point: ASTM D-56, 80 degrees Fahrenheit minimum, where applicable. DCOF testing was performed under ANSI A137.1-2012 parameters.
4. Special stain and/or chemical resistant sealers are needed for certain areas such as resistance to iodine or

F. Protection

1. Upon completion, the work shall be ready for final inspection and acceptance by the owner or its agent.
2. The installation of the terrazzo floor protection must be acceptable to the terrazzo installer and maintaining of such protection responsibility of others.

3.03 – MISCELLANEOUS

A. TERRAZZCO Flexa-Flex Joint Filler 1200

1. Absorbs the impact and shock of heavy loads while sealing joints. If required is considered out of scope of standard epoxy terrazzo system.

B. TERRAZZCO EZpour Leveling Fill Epoxy 162

1. Recommend for concrete surface where a uniformly even substrate is desired. If required is considered out of scope of standard epoxy terrazzo system.

C. TERRAZZCO Bonding Agent 159

1. Designed to promote adhesion between concrete slab and the terrazzo mix. If required is considered out of scope of standard epoxy terrazzo system.

END OF SECTION 096623

SECTION 096723 - RESINOUS EPOXY 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. Industrial resinous flooring systems.

- B. Related Sections:

- 1. Section 079200 "Joint Sealants" for sealants installed at joints in resinous flooring systems.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.
- B. Samples for Verification: For each resinous flooring system required, 6 inches square, applied to a rigid backing by Installer for this Project.
- C. Product should match existing quality, surface texture and visual appearance of existing work

1.4 INFORMATIONAL SUBMITTALS

- A. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.
- B. Material Certificates: For each resinous flooring component, from manufacturer.

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- C. Material Test Reports: For each resinous flooring system.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For resinous flooring to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of flooring systems required for this Project.

- 1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.

- B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.

- C. Preinstallation Conference: Conduct conference at Project site.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.

- B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

- C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

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2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide SoySTEP by Soy Resin Systems or pre-approved comparable product.
- B. Products of other manufacturers deemed equal by the Architect may be permitted subject to complying with all requirements herein and submit for review in accordance with Section 12500, "Substitution Procedures."

2.2 MATERIALS

- A. Epoxy should be approved under MIL-Spec MIL-D-24613 Type III and be 100% solids, non-toxic containing no solvents or thinners. ROCK to RESIN RATIO MUST BE LESS THAN 3LBS of AGGREGATE PER POUND OF EPOXY RESIN (EXCLUDING TOP COAT).
- B. Select the desired color patterns consisting of marble, silica sand and quartz.

2.3 INDUSTRIAL RESINOUS FLOORING

- A. Resinous Flooring: Abrasion-, impact- and chemical-resistant, industrial-aggregate-filled, resin-based, monolithic floor surfacing designed to produce a seamless floor and integral cove base.
- B. System Characteristics:
 - 1. Color and Pattern: SoySTEP by Soy Resin Systems
 - 2. Wearing Surface: **Orange-peel**
 - 3. Overall System Thickness: **1/8 inch**
- C. Body Coats:
 - 1. Resin: **SoyPoxy**.
 - 2. Formulation Description: 100 percent solids.
 - 3. Application Method: **Troweled**.
 - a. Thickness of Coats: **1/8 inch**.
 - b. Number of Coats: **One**.
 - 4. Aggregates: Marble, Silica Sand and Quartz
- D. Topcoat: Sealing or finish coats.

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1. Resin: **Urethane.**
2. Formulation Description: **Water based.**
3. Type: **Clear.**
4. Finish: **Epoxy.**
5. Number of Coats: **One.**

E. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:

1. Compressive Strength: 17,800 psi after 7 days per ASTM C 579.
2. Adhesion Strength: ASTM-D-4541 >500 psi with 100% concrete failure.
3. Tensile Strength: 7,100 psi after 7 days per ASTM C 307.
4. Flexural Modulus of Elasticity: 10,000 psi after 7 days per ASTM C 580.
5. Coefficient of Linear Expansion: 2.5×10^{-5} per ASTM D-696.
6. Linear Shrinkage: ASTM C-531 <.02% Specifications for SoySTEP Flooring System
7. Water Absorption: <.2% per ASTM D-570.
8. Indentation: Shall not exceed 1 percent maximum per ASTM D-2794.
9. Impact Resistance: No chipping, cracking, or delamination per MIL-D-24613 ASTM D- 2794>24,00 psi..
10. Abrasion Resistance: MIL-D-24613, MIL-STD-1623 42 mg ASTM C-501 18 mg.
11. Temperature Resistance ASTM D-2794 150-200 F No visible softening, cracking or delaminating.
12. Flame Spread MIL-D-24613, MIL-STD-1623 PASSED ASTM E-84 <3 Class A Flammability ASTM D-570 Self Extinguishing Critical Rad Flux E-648 >1.07w/cm 13. Smoke Developed MIL-D-24613, MIL-STD-1623 PASSED Smoke Density ASTM E-662 <3.
13. Critical Radiant Flux: E-648 >1.07w/cm².
14. Odor ASTM D-2794 Free from objectionable odors.
15. Weight ASTM D-2794 1.2 lbs/ft² @ 1/8" thickness.
16. Hardness: At 14 days Shore D 80 per ASTM D 2240.

F. Chemical Resistance

Chemical Resistance @ 25°C (77°F) after curing 7 days

<u>Duration in weeks</u>	<u>1</u>	<u>2</u>	<u>4</u>	<u>8</u>
Distilled water	+	+	+	+
Sea water	+	+	+	+
Sulfuric acid, 30%	+	+	+	+
Sulfuric acid, 70%	+	+	+	+
Hydrochloric acid, 10%	+	+	+	+
Hydrochloric acid, 20%	+	+	+	+

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Acetic acid, 5%	+	+	+	+
Ammonia, 10%	+	+	+	+
Toluene	a	a	a	a
MIBK	a	a	a	a
Ethanol, 50%	a	d	d	d
Gasoline, high test	+	+	+	+
Pine oil	+	+	+	+

+ = Resistant Film thickness 12 – 16 mils

a = Affected Cure Schedule 7 days at 21°C

d = Destroyed Substrate, Sandblasted steel

- G. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

PART 3 - EXECUTION

3.1 PREPARATION

- A. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry substrate for resinous flooring application.
- B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
1. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.
 2. Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
- C. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.
- D. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
- E. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.

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3.2 APPLICATION

- A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
 - 1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
 - 2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
 - 3. At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.
- B. Vertical Application:
- C. Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.
 - 1. Integral Cove Base: **6 inches** high.
- D. Apply troweled body coats at 1/8" for flooring system. Hand or power trowel to fill voids. When cured, remove trowel marks and roughness using method recommended by manufacturer.
- E. Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer.

3.3 PROTECTION

- A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION 096710

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.
- 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. Shop Drawings: Show the following:
 - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
 - 2. Carpet tile type, color, and dye lot.
 - 3. Type of subfloor.
 - 4. Type of installation.
 - 5. Pattern of installation.
 - 6. Pattern type, location, and direction.
 - 7. Pile direction.
 - 8. Type, color, and location of insets and borders.
 - 9. Type, color, and location of edge, transition, and other accessory strips.
 - 10. Transition details to other flooring materials.
- C. 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.

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1. Carpet Tile: Full-size Sample.
2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- (300-mm-) long Samples.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.
- C. Sample Warranty: For special warranty.

1.5 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.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. 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).

1.7 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.

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1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI's "CRI Carpet Installation Standard."

1.9 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.

1.10 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 Commercial, Mannington All Star Collection, "Halftime" (Style), Color: "Cobb" (Basis of Design).
 - 2. Interface
 - 3. Mohawk Industries

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- B. Color: As indicated in the Color Schedule on the Drawings, selected by Architect from manufacturer's full range.
- C. Fiber Content: 100 percent hollow-filament nylon Type 6.6.
- D. Fiber Type: Antron Nylon
- E. Pile Characteristic: Textured Patterned loop.
- F. Yarn Ply: Minimum 2
- G. Tufted Yarn Weight: 21 oz./sq. yd.
- H. Density: 9.108.
- I. Pile Thickness: 0.083 inch for finished carpet tile.
- J. Stitches: 9.67 per inch.
- K. Gage: 5/64 per inch (mm).
- L. Dye Method: 100% solution Dyed.
- M. Primary Backing/Backcoating: 100% Non-Woven Synthetic
- N. Secondary Backing: Manufacturer's standard cushion material (Infinity2 ® Modular or equal).
- O. Size: 24 inches by 24 inches (610 by 610 mm).
- P. Installation Method: Horizontal Brick Ashlar.
- Q. Applied Soil-Resistance Treatment: Manufacturer's standard material.
- R. Performance Characteristics: As follows:
 - 1. Appearance Retention Rating: Heavy traffic, 3.0 minimum according to ASTM D 7330.
 - 2. Electrostatic Propensity: Less than 3.0 kV, according to AATCC 134.
 - 3. Critical Radiant Flux Classification: Class 1, not less than 0.45 W/sq. cm according to ASTM E 648.
 - 4. Dry Breaking Strength: Not less than 100 lbf (445 N) according to ASTM D 2646.
 - 5. Tuft Bind: Not less than 10 lbf (45 N) according to ASTM D 1335.
 - 6. Delamination: Not less than 4 lbf/in. (18 N/mm) according to ASTM D 3936.
 - 7. Dimensional Tolerance: Within 1/32 inch (0.8 mm) of specified size dimensions, as determined by physical measurement.
 - 8. Dimensional Stability: 0.2 percent or less according to ISO 2551 (Aachen Test).
 - 9. Resistance to Insects: Comply with AATCC 24.
 - 10. Noise Reduction Coefficient (NRC): according to ASTM C 423.

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11. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.
12. Colorfastness to Light: Not less than 4 after 40 AFU (AATCC fading units) according to AATCC 16, Option E.
13. 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.
14. Electrostatic Propensity: Less than 3.0 kV according to AATCC 134.
15. 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."
- C. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

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

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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.

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- E. Install modular carpet tiles that have a pattern in monolithic method, as opposed to ashlar or checkerboard, unless otherwise directed by Owner's Representative or Architect.
- F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- G. 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.
- H. 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

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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. This Section includes surface preparation and the application of paint systems on the following exterior substrates:
 - 1. Steel handrails and fittings.
 - 2. Miscellaneous exterior surfaces including brick lintels.
 - 3. Exterior Soffits and Plaster Wall Surfaces (except for pre-finished EIFS)
- B. Related Sections include the following:
 - 1. Division 09 Section 099123 "Interior Painting" for surface preparation and the application of paint systems on interior substrates.
 - 2. Division 09 Section 099300 "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on interior wood substrates.
 - 3. Division 09 Section 099600 "High-Performance Coatings" for surface preparation and the application of special paint products on specific surfaces.

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

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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 in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

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. Behr Paint.
3. Benjamin Moore & Co.
4. Bennette Paint Mfg. Co., Inc.
5. Rust-Oleum.
6. Pratt & Lambert.
7. PPG Architectural Finishes, Inc.

2.2 PAINT, GENERAL

A. Material Compatibility:

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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.

- B. Colors: As selected by Architect from manufacturer's full range.

2.3 PRIMER SEALERS

- A. Alkali-Resistant Primer: MPI #3.
- B. Latex Primer MPI #4.
- C. Bonding Primer (Solvent Based): MPI #69.

2.4 METAL PRIMERS

- A. Cementitious Galvanized-Metal Primer: MPI #26.

2.5 EXTERIOR ALKYD PAINTS

- A. Exterior Alkyd Enamel (Flat): MPI #8 (Gloss Level 1).
- B. Exterior Alkyd Enamel (Semigloss): MPI #94 (Gloss Level 5).

2.6 EXTERIOR LATEX PAINTS

- A. Exterior Latex MPI #10 (Gloss Level 1).
- B. Exterior Latex MPI #15 (Gloss Level 3 – 4).

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. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- C. 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.

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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 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 reprime substrate with compatible primers as required to produce paint systems indicated.
- D. Galvanized Steel Substrates: Remove rust and loose mill scale. Clean using MPI #25, etching chemical cleaner. Clean and dry as recommended prior to application of primer.
- 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.
 - 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.
- 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.

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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 of paint materials 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 EXTERIOR PAINTING SCHEDULE

- A. Galvanized-Metal Substrates:
 - 1. Alkyd System: **MPI EXT 5.3C**.
 - a. Prime Coat: Cementitious galvanized-metal primer (unless factory primed).
 - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - c. Topcoat: Exterior alkyd enamel (semi-gloss).
- B. Ferrous Metal Substrates:

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1. Alkyd System: **MPI EXT 5.1Q:**
 - a. Prime Coat: Bonding primer (solvent based).
 - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - c. Topcoat: Exterior alkyd enamel (semi-gloss).

- C. Exterior Gypsum Board and Plaster Substrates (Soffits):
 1. Latex System **MPI EXT 9.2A:**
 - a. Prime Coat: Primer, alkali-resistant, water-based), MPI #3.
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), MPI #10.

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 on the following interior substrates:
 - 1. Gypsum board at walls and ceiling soffits (excluding pre-finished gypsum board)
 - 2. Concrete masonry unit (CMU surfaces).
 - 3. Structural and non-structural steel surfaces, including steel beams, columns, channels, angles, straps and exposed structural members, ferrous metal doors and frames, ferrous metal stair surfaces, railings and guards, miscellaneous steel lintels and supports.
 - 4. Exposed finished woodwork not otherwise factory-finished or scheduled to receive plastic laminate covering.
- B. Related Sections include the following:
 - 1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.
 - 2. Division 09 Section 099113 "Exterior Painting" for surface preparation and the application of coating and painted finishes on exterior substrates.
 - 3. Division 09 Section 099300 "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on interior wood substrates.
 - 4. Division 09 Section 099600 "High-Performance Coatings" for surface preparation and the application of special paint products on specific surfaces.

1.3 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.

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- B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
- C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
- D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.
- E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.
- F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.
- G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

1.4 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.

1.5 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.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

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1.7 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.
- C. Prepare all existing wall surfaces to be painted in accordance with the "Block Wall Repair, Paint & Preparation Notes" found on the Drawings.

1.8 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.
 - 2. Behr Paint.
 - 3. Benjamin Moore & Co.
 - 4. Pratt & Lambert.
 - 5. 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.

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- B. Colors: As selected by Architect from manufacturer's full range.

2.3 PRIMERS/SEALERS

- A. Interior Latex Primer/Sealer: MPI #50.
- B. Concrete Masonry Block Filler, Latex: MPI #4.

2.4 METAL PRIMERS

- A. Quick-Drying Alkyd Metal Primer: MPI #76.
- B. Cementitious Galvanized-Metal Primer: MPI #26 or MPI #134.

2.5 WOOD PRIMERS

- A. Interior Latex-Based Wood Primer: MPI #39.

2.6 ALKYD PAINTS

- A. Interior Alkyd Primer: MPI #45 (over flat paints). MPI #69 (over semi-gloss or gloss surfaces).
- B. Interior Alkyd (Flat): MPI #49 (Gloss Level 1).
- C. Interior Alkyd (Semi-gloss): MPI #47 (Gloss Level 5).

2.7 LATEX PAINTS

- A. Interior Latex Primer (New surfaces): MPI #50.
- B. Interior Latex (Flat): MPI #53 (Gloss Level 1)
- C. Interior Latex (Eggshell): MPI #145 (Gloss Level 3)
- D. Interior Latex (Semi-Gloss): MPI #54 (Gloss Level 5)

PART 3 - EXECUTION

3.1 EXAMINATION

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- 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. Prepare all existing wall surfaces to be painted in accordance with the "Block Wall Repair, Paint & Preparation Notes" found on the Drawings. Bring any conditions in question to the attention of the Owner's Representative or Architect prior to proceeding.
- B. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
- C. 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.
- D. 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.

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- E. 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.
- F. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.
- G. Galvanized Steel Substrates: Remove rust and loose mill scale. Clean using MPI #25, etching chemical cleaner. Clean and dry as recommended prior to application of primer.
- H. 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.
- E. Do not paint existing or new prefinished (vinyl-faced) gypsum board surfaces or related trim.

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:

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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. Steel Substrates:
 1. Alkyd System: **MPI INT 5.1E.**
 - a. Prime Coat: Alkyd anti-corrosive metal primer (unless materials is supplied with a factory applied primer).
 - b. Intermediate Coat: Interior alkyd matching topcoat.
 - c. Topcoat: Interior alkyd (semi-gloss).
 2. Latex System (over alkyd primer): **MPI INT 5.1Q.**
 - a. Prime Coat: Alkyd anti-corrosive metal primer (unless materials is supplied with a factory applied primer).
 - b. Intermediate Coat: Interior latex matching topcoat.
 - c. Topcoat: Interior latex (semi-gloss).
- B. Galvanized-Metal Substrates:

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1. Alkyd System: **MPI INT 5.3C.**
 - a. Prime Coat: Cementitious galvanized-metal primer (MPI #26).
 - b. Intermediate Coat: Interior alkyd matching topcoat.
 - c. Topcoat: Interior alkyd (semi-gloss).

 2. Latex System (over alkyd primer): **MPI INT 5.3.**
 - a. Prime Coat: Water-Based Primer (MPI #134, unless materials is supplied with a factory applied primer).
 - b. Intermediate Coat: Interior latex matching topcoat.
 - c. Topcoat: Interior latex (semi-gloss).
- C. 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).
- D. Gypsum Board Substrates (New Surfaces, Previously Not Painted) :
1. Latex over Latex Sealer System: **MPI INT 9.2A.**
 - a. Prime Coat: Interior latex primer/sealer.
 - b. Intermediate Coat: Interior latex matching topcoat.
 - c. Topcoat: Interior acrylic latex (eggshell).

END OF SECTION 099123

SECTION 099300 - STAINING AND TRANSPARENT FINISHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes surface preparation and application of wood stains and transparent finishes on the following substrates:
 - 1. Interior Substrates:
 - a. Dressed lumber (finish carpentry or woodwork).
- B. Related Requirements:
 - 1. Section 064023 "Interior Architectural Woodwork" for interior woodwork requirements.
 - 2. Section 099123 "Interior Painting" for stains and transparent finishes on concrete floors.

1.3 DEFINITIONS

- A. MPI Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.
- B. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.
- C. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.
- D. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.
- E. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.

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1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 2. Indicate VOC content.
- B. Samples for Initial Selection: For each type of product.
- C. Samples for Verification: For each type of finish system and in each color and gloss of finish required.
1. Submit Samples on representative samples of actual wood substrates, 8 inches (200 mm) long.
 2. Apply coats on Samples in steps to show each coat required for system.
 3. Label each coat of each Sample.
 4. Label each Sample for location and application area.
- D. Product List: Cross-reference to finish system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Stains and Transparent Finishes: Not less than 1/2 gal. (1.7 L) of each material and color applied.

1.6 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each finish system indicated and each color selected to verify preliminary selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
1. Architect will select one surface to represent surfaces and conditions for application of each type of finish system and substrate.
 - 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 stain color selections will be based on mockups.
 - a. If preliminary stain color selections are not approved, apply additional mockups of additional stain colors selected by Architect at no added cost to Owner.

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1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

- A. Apply finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply finishes when relative humidity exceeds 85 percent, at temperatures less than 5 deg F (3 deg C) above the dew point, or to damp or wet surfaces.
- C. Do not apply exterior finishes in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products listed in wood finish systems schedules for the product category indicated.

2.2 MATERIALS, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products List."
- B. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, products shall be recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. Stain Colors: Color interior woodwork finish shall **closely** match the color and sheen of the selected finish from among manufacturer's samples listed in the Color Schedule on the Drawings.

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2.3 SOURCE QUALITY CONTROL

- A. Testing of Materials: Owner reserves the right to invoke the following procedure:
1. Owner may engage the services of a qualified testing agency to sample wood finishing materials. Contractor will be notified in advance and may be present when samples are taken. If materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 2. Testing agency, if employed, will perform tests for compliance with product requirements.
 3. Owner may direct Contractor to stop applying wood finishes if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying materials from Project site, pay for testing, and refinish surfaces finished with rejected materials. Contractor will be required to remove rejected materials from previously finished surfaces before refinishing with complying materials if the two finishes are incompatible or produce results that, in the opinion of the Architect, are aesthetically unacceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Interior Wood Substrates: **10** percent, when measured with an electronic moisture meter.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
1. Field verify color match by preparing samples in the field so as to closely match existing interior woodwork. Test stain multiple samples of wood in various shades, apply clear varnish and allow to cure for Owner's Representative and Architect to examine and approve for color match. Repeat until satisfactory match is obtained. Retain approved sample as control sample for remainder of project.
 2. Existing woodwork has a light honey appearance. This finish may be attained by light application of stain, or perhaps no stain at all, just varnish. Contractor shall not be entitled to additional compensation if stain is required to achieve proper color match.

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- D. Proceed with finish application only after unsatisfactory conditions have been corrected.
 - 1. Beginning finish application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.
 - 1. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each substrate condition and as specified.
 - 1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
 - 2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.
- D. Interior Wood Substrates:
 - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - 2. Apply wood filler paste to open-grain woods, as defined in "MPI Architectural Painting Specification Manual," to produce smooth, glasslike finish.
 - 3. Sand surfaces exposed to view and dust off.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dry.

3.3 APPLICATION

- A. Apply finishes according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
 - 1. Use applicators and techniques suited for finish and substrate indicated.
 - 2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.
 - 3. Do not apply finishes over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

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- B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.

3.5 INTERIOR WOOD -FINISH-SYSTEM SCHEDULE

- A. Wood Substrates: Wood trim and architectural woodwork.

1. Water-Based Varnish over Stain System **MPI INT 6.3W:**

- a. Stain Coat: Stain, semitransparent, for interior wood, **VOC Grade E3 <251 grams/liter, MPI #90.**
 - 1) PPG Architectural DEFT Deft Int Alkyd ft 400.
 - 2) Sherwin-Williams Minwax Interior Oil Stain-250
 - 3) Columbia Paint Minwax Interior Oil Stain-250
- b. First Intermediate Coat: Water-based varnish matching topcoat.
- c. Second Intermediate Coat: Water-based varnish matching topcoat.
- d. Topcoat: Varnish, water based, clear, satin (MPI Gloss Level 4), **MPI #129.**
 - 1) PPG Architectural Deft Interior/Exterior Polyurethane Water-Based Semi-Gloss.
 - 2) Benjamin Moore Lenmar Aqua Plastic Waterborne Urethane Clear Semi-Gloss.
 - 3) Sherwin-Williams Minwax Water Based Polyurethane Clear Semi-Gloss

END OF SECTION 099300

SECTION 101100 - VISUAL DISPLAY SURFACES

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. Markerboards.
 - 2. Display Boards (Tackboards).
 - 3. Display Rails.
 - 4. Accessories for visual display surfaces.

1.3 DEFINITIONS

- A. Markerboard: Framed porcelain-enameled surface used for writing with dry-erase markers, with integral display rail and marker trough (chalktray). Markerboard surface shall also have a specular, glare reducing finish suitable for display of electronically-projected visual images.
- B. Display Board: Framed or unframed, tackable, visual display board assembly.
- C. Tackable Surface, Tackboard: Framed, self-healing, synthetic or natural surface that permits mounting of paper displays, notices or documents using thumbtacks, staples or similar means.
- D. Visual Display Board Assembly: Visual display surface that is factory fabricated into composite panel form, either with or without a perimeter frame; includes markerboards and tackboards.
- E. Visual Display Surface: Surfaces that are used to convey information visually, including surfaces of chalkboards, markerboards, tackboards, and surfacing materials that are not fabricated into composite panel form but are applied directly to walls.

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1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for visual display surfaces.
- B. Shop Drawings: For visual display surfaces. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Include sections of typical trim members.
 - 2. Include an Installation Schedule for all visual display assemblies based on requirements shown on the drawings. Refer to the paragraph entitled "Installation Schedule" at the end of this Section.
- C. Samples for Initial Selection: For each type of visual display surface indicated, for units with factory-applied color finishes, and as follows:
 - 1. Actual sections of markerboard and tackboard assemblies.
 - 2. Include accessory Samples to verify color selected.
- D. Samples for Verification: For each type of visual display surface indicated.
 - 1. Visual Display Surface: Not less than 8-1/2 by 11 inches (215 by 280 mm), mounted on substrate indicated for final Work. Include one panel for each type, color, and texture required.
 - 2. Trim: 6-inch- (152-mm-) long sections of each trim profile.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Warranties: Sample of special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For visual display surfaces to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Source Limitations: Obtain visual display surfaces from single source from single manufacturer.
- B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.

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2. Smoke-Developed Index: 50 or less.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver factory-built visual display surfaces, including factory-applied trim where indicated, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, pre-fit components at the factory, disassemble for delivery, and make final joints at the site.
- B. Store visual display surfaces vertically with packing materials between each unit.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install visual display surfaces until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Verify actual dimensions of construction contiguous with visual display surfaces by field measurements before fabrication.
 1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

1.10 WARRANTY

- A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.
 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Porcelain-Enamel Face Sheet: Manufacturer's standard steel sheet with porcelain-enamel coating fused to steel; uncoated thickness indicated, complying with ASTM A 424 or ASTM A 463/A 463M, Type 1.
 1. Manufacturers/Products: Subject to compliance with requirements, provide products indicated by one of the following:

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- a. Claridge Products and Equipment, Inc.; Vitracite Markerboard
 - b. PolyVision Corporation; a Steelcase company; P³ ceramicsteel Chalkboard.
2. Matte Finish: Low reflective; chalk wipes clean with dry cloth or standard eraser.
 3. Gloss Finish: Gloss as indicated; dry-erase markers wipe clean with dry cloth or standard eraser.
- B. Melamine: Thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
- C. High-Pressure Plastic Laminate: NEMA LD 3.
- D. Plastic-Impregnated Cork Sheet: Seamless, homogeneous, self-sealing sheet consisting of granulated cork, linseed oil, resin binders, and dry pigments that are mixed and calendared onto fabric backing; with washable vinyl finish and integral color throughout.
- E. Hardboard: ANSI A135.4, tempered.
- F. Particleboard: ANSI A208.1, Grade M-1, made with binder containing no urea formaldehyde.
- G. Fiberboard: ASTM C 208.
- H. Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063.
- I. Adhesives: Low- or No-Volatile Organic Compound (VOC) content only.

2.2 MARKERBOARD ASSEMBLIES (MB)

- A. Porcelain-Enamel Markerboards: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction consisting of backing sheet, core material, and 0.021-inch- (0.53-mm-) thick, porcelain-enamel face sheet with low-gloss finish.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Claridge Products and Equipment, Inc.
 - b. PolyVision Corporation; a Steelcase company.
 2. Hardboard Core: 1/4-inch (6 mm) thick; with 0.015-inch- (0.38-mm-) thick, aluminum sheet or 0.013-inch- (0.35-mm-) thick, galvanized-steel sheet backing.

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3. Particleboard Core: 1/2-inch (13 mm) thick; with 0.015-inch- (0.38-mm-) thick, aluminum sheet or 0.013-inch- (0.35-mm-) thick, galvanized-steel sheet backing.
4. Fiberboard Core: 3/8-inch (9.5 mm); with 0.015-inch- (0.38-mm-) thick, aluminum sheet or 0.013-inch- (0.35-mm-) thick, galvanized-steel sheet backing.
5. Manufacturer's Standard Core: Minimum 1/4-inch (6 mm) thick, with manufacturer's standard moisture-barrier backing.
6. Laminating Adhesive: Manufacturer's standard, moisture-resistant thermoplastic type.
7. Accessories: Provide chalktray, display rail (DR) and flag holder as specified herein for each Markerboard Assembly.

2.3 DISPLAY BOARD (TACKBOARD) ASSEMBLIES (DB)

- 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. AARCO Products, Inc.
 2. Best-Rite Manufacturing.
 3. Claridge Products and Equipment, Inc.
 4. Marsh Industries, Inc.; Visual Products Group.
 5. PolyVision Corporation; a Steelcase company.
- B. Plastic-Impregnated Cork Tackboard: 1/4-inch- (6-mm-) thick, plastic-impregnated cork sheet factory laminated to 1/4-inch- (6-mm-) thick hardboard or particleboard backing.

2.4 MODULAR SUPPORT SYSTEM FOR VISUAL DISPLAY BOARDS

- 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. AARCO Products, Inc.
 2. Best-Rite Manufacturing.
 3. Claridge Products and Equipment, Inc.
 4. Platinum Visual Systems; a division of ABC School Equipment, Inc.
 5. PolyVision Corporation; a Steelcase company.
- B. Standards: 72-inch- (1829-mm-) long, extruded-aluminum slotted standards designed for supporting visual display boards on panel clips. Standards shall be punched at not less than 4 inches (100 mm) o.c.
 1. Finish: Clear anodic.

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- C. Panel Clips: Extruded aluminum or steel with finish to match standards.

2.5 RAIL SUPPORT SYSTEM FOR VISUAL DISPLAY BOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Best-Rite Manufacturing.
 - 2. Egan Visual Inc.
 - 3. KOH Design, Inc.
 - 4. Peter Pepper Products, Inc.
 - 5. PolyVision Corporation; a Steelcase company.
- B. Support Rails: Horizontal, wall-mounted, extruded-aluminum rails designed to receive hanger clip and to support visual display boards; capable of gripping and suspending paper directly from rail.
 - 1. Finish: Clear anodic.
- C. Hanger Clips: Extruded aluminum with finish to match rails; designed to support independent visual display boards by engaging support rail and top trim of board.
- D. Visual Display Panels: Fabricated from not less than 3/8-inch- (9.5-mm-) thick, kraft-paper honeycomb core; designed to be rigid and to resist warpage, and with aluminum trim designed to engage hanger clips.

2.6 DISPLAY RAILS (DR)

- A. Aluminum Display Rail: Manufacturer's standard, extruded-aluminum display rail with plastic-impregnated-cork tackable insert, designed to hold accessories.
- B. Tackable Insert Color: Standard Gray.
- C. Size: 2 inches (50 mm) high by length indicated on Drawings.
- D. End Stops: Aluminum.

2.7 MARKERBOARD AND TACKBOARD ACCESSORIES

- A. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- (1.57-mm) thick, extruded aluminum; standard size and shape.
 - 1. Field-Applied Trim: Manufacturer's standard, snap-on trim with no visible screws or exposed joints.
 - 2. Factory-Applied Trim: Manufacturer's standard.

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3. Provide continuous Display Rail (DR) along entire length at top of each Marker Board (MB) assembly (not required above Display Board (DB) assemblies.
 4. Provide continuous marker board tray of extruded aluminum at full length of bottom of markerboards.
- B. Marker tray: Manufacturer's standard, continuous.
1. Solid Type: Extruded aluminum with ribbed section and smoothly curved exposed ends.

2.8 FABRICATION

- A. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.
- B. Visual Display Boards: Factory assemble visual display boards unless otherwise indicated.
1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display boards at manufacturer's factory before shipment.
- C. Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.
1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, [balanced around center of board, as acceptable to Architect.
- D. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to a neat, hairline closure.
1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display units at manufacturer's factory before shipment.

2.9 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are

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acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.10 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

2.11 VISUAL DISPLAY SURFACE SCHEDULE

- A. Markerboards and Tackboards, Factory assembled.
 - 1. Markerboard Surface: Porcelain enamel markerboard for use with dry erase markers, low-sheen/low-glare surface suitable for video projection. Provide marker tray full length of the markerboard.
 - 2. Tackable Surface: Natural-cork tackboard assembly.
 - 3. Corners: Square.
 - 4. Width: As indicated in "Installation Schedule" under Part 3 herein.
 - 5. Height: 4'-0" height, with top of display surface frame.
 - 6. Mounting: Wall.
 - 7. Mounting Height: Mount all 7'-2" above floor or as otherwise required to align with top of adjacent hollow metal door frames.
 - 8. Edges: Concealed by trim.
 - a. Factory Applied Aluminum Trim: Manufacturer's standard style, with clear anodic finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.
- B. Examine walls and partitions for proper preparation and backing for visual display surfaces.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.

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- B. Clean substrates of substances that could impair the performance of and affect the smooth, finished surfaces of visual display boards, including dirt, mold, and mildew.
- C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display surfaces and wall surfaces.
 - 1. Prime wall surfaces indicated to receive direct-applied, visual display tack wall panels and as recommended in writing by primer/sealer manufacturer and wall covering manufacturer.
 - 2. Prepare substrates indicated to receive visual display wall covering as required by manufacturer's written instructions to achieve a smooth, dry, clean, structurally sound surface that is uniform in color.
 - a. Moisture Content: Maximum of 4 percent when tested with an electronic moisture meter.
 - b. Painted Surfaces: Treat areas susceptible to pigment bleeding.

3.3 INSTALLATION, GENERAL

- A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.
- B. Visual Display Boards: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display boards with fasteners at not more than 16 inches (400 mm) o.c. Secure both top and bottom of boards to walls.
 - 1. Field-Applied Aluminum Trim: Attach trim over edges of visual display boards and conceal grounds and clips. Attach trim to boards with fasteners at not more than 24 inches (610 mm) o.c.

3.4 INSTALLATION OF VISUAL DISPLAY WALL PANELS

- A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

3.5 INSTALLATION OF FIELD-FABRICATED VISUAL DISPLAY BOARDS AND ASSEMBLIES

- A. Field-Assembled Visual Display Units: Coordinate field-assembled units with grounds, trim, and accessories indicated. Join parts with a neat, precision fit.

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1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, as indicated on approved Shop Drawings.
2. Provide manufacturer's standard vertical-joint H-trim system between abutting sections of markerboards.
3. Provide manufacturer's standard mullion trim at joints between markerboards and tackboards of combination units.
4. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.

3.6 INSTALLATION OF FACTORY-FABRICATED VISUAL DISPLAY BOARDS AND ASSEMBLIES

- A. Visual Display Boards: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display boards with fasteners at not more than 16 inches (400 mm) o.c. Secure both top and bottom of boards to walls.
1. Field-Applied Aluminum Trim: Attach trim over edges of visual display boards and conceal grounds and clips. Attach trim to boards with fasteners at not more than 24 inches (610 mm) o.c.
 - a. Attach marker trays to boards with fasteners at not more than 12 inches (300 mm) o.c.

3.7 INSTALLATION SCHEDULE

- A. Installation: Provide visual display surfaces in the rooms and spaces of lengths as scheduled below; heights of all markerboards and display boards shall be nominally 4'-0".
1. Locations: Locate visual display boards where specified below, indicated on floor plans, or where otherwise directed by the Owner's Representative.
 2. Installation Schedule: the Contractor's supplier of visual display surfaces shall prepare and submit an Installation Schedule based on all locations indicated throughout the construction documents where marker board (MB), Display Board (DB) and Display Rail (DR) are shown to be provided. Each items shall be tagged with The installation Schedule shall provide the following information to reach item:
 - a) An identifier indicating type (MB, DB or DR) of item, plus a numbered identifier indexed to the room number and individual item number, which allows distinct identification of each item where more than one item of a type occurs within a single room or space.

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- b) The size of the item, height by width, in nominal feet.
 - c) The substrate partition type of the item, indicating what type of attachment method is to be employed.
3. Room Installation Schedule:
- a) Assistant Principal's Office 103: Provide one (1) markerboard, six (6) feet long.
 - b) Principal's Office 106: Provide one (1) markerboard, six (6) feet long.
 - c) Work Room 117: Provide one (1) markerboard, six (6) feet long, and one (1) tackable surface, six (6) feet long.
 - d) Lounge 118: Provide one (1) tackable surface, six (6) feet long.
 - e) Supply 110: Provide one (1) markerboard, six (6) feet long.

END OF SECTION 101100

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SECTION 101419 - DIMENSIONAL LETTER SIGNAGE

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. Cast and fabricated three-dimensional alpha-numeric characters.
 - 2. Die-cut thermoplastic vinyl characters for adhesion to glass

1.3 COORDINATION

- A. Furnish templates for placement of electrical service embedded in permanent construction by other installers.
- B. Existing interior panel signs shall remain, and any new interior panel signs other than those specified herein, shall be provided by the Owner.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For dimensional letter signs.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
 - 3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.
- C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.
 - 1. Include representative Samples of available typestyles and graphic symbols.

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- D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
 - 1. Dimensional Characters: Half-size Sample of each type of dimensional character.
- E. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

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

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 FIELD CONDITIONS

- A. Field Measurements: Verify locations of electrical service embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Separation or delamination of sheet materials and components.
 - 2. Warranty Period: Five years from date of Substantial Completion.

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PART 2 - PRODUCTS

2.1 DIMENSIONAL CHARACTERS

- A. Cast Characters: Characters with uniform faces, sharp corners, and precisely formed lines and profiles, and as follows:
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. ASI Sign Systems, Inc.
 - b. Gemini Incorporated.
 - c. Metal Arts.
 - d. Metallic Arts.
 2. Character Material: Cast aluminum.
 3. Character Height: As indicated.
 4. Thickness: Manufacturer's standard for size of character.
 5. Finishes:
 - a. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard, in color as selected by Architect from manufacturer's full range.
 6. Mounting: Concealed studs.
 7. Typeface: Helvetica.

2.2 FABRICATED LETTERS

- A. Fabricated Characters: Characters with uniform faces, sharp corners, and precisely formed lines and profiles, and as follows:
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. ASI Sign Systems, Inc.
 - b. Gemini Incorporated.
 - c. Metal Arts.
 - d. Metallic Arts.
 - e. Steel Art Architectural Signage.
 2. Character Material: Cut from aluminum plate, 5052 alloy; thickness to suit letter dimensions, according to manufacturer's standard practice, but in no case less than 1/8-inch thick for welded letters and 1/4-inch thickness for flat-cut letters.
 3. Character Height: As indicated.
 4. Thickness: Manufacturer's standard for size of character.

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5. Finishes:
 - a. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard, in color as selected by Architect from manufacturer's full range.
6. Mounting: Concealed studs, 1/2-inch raised above mounting surface.
7. Typeface: Helvetica.

B. Fabrication:

1. Comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.
2. Design, fabricate, and install sign assemblies to prevent buckling, opening up of joints, and over-stressing of welds and fasteners.
3. Flat Cut: Laser or waterjet cut (based on Metal, Gauge and Product), using computer-guided equipment.
4. Grind all welds smooth and mill joints to a tight, hairline fit. Form joints exposed to the weather to exclude water penetration.
5. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.
6. Create signage to required sizes and layout. Comply with requirements indicated for design, dimensions, finish, color, and details of construction.

2.3 ACCESSORIES

- A. Fasteners and Anchors:** Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:
1. Use concealed fasteners and anchors unless indicated to be exposed.
 2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
 3. Sign Mounting Fasteners:
 - a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated. Provide non-corroding metal or heavy plastic spacer sleeves as needed.

2.4 FABRICATION

- A. General:** Provide manufacturer's standard sign assemblies according to requirements indicated.
1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and

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handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.

2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Internally brace signs for stability and for securing fasteners.
6. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
7. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

2.5 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.
- D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.6 ALUMINUM FINISHES

- A. 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.

2.7 DIE-CUT ADHERED LETTERS

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- A. Material: Vinyl Film: UV-resistant vinyl film with pressure-sensitive, permanent adhesive; die cut to form characters or images as indicated on Drawings. Color of letters shall be bright white, opaque, for adhesive application at storefront entrance glass at Administrative Office.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Verify that electrical service is correctly sized and located to accommodate signs.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
 - 3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Mounting Methods:
 - 1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.

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- b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

3.4 SCHEDULE OF SIGNAGE

- A. Interior Wall-Mounted Sign at Administrative Office on Upper Wall (or where otherwise directed):
 1. Sign Type: Flat Cut Aluminum
 2. Typeface: Helvetica (all caps)
 3. Letter height: 9 inches
 4. Copy: YATES ELEMENTARY SCHOOL
- B. Interior Glass-Adhered Signage next to entrance of Administrative Office:
 1. Sign Type: Die-cut self-adhered vinyl (White)
 2. Typeface: Helvetica (all caps)
 3. Letter height: 6 inches
 4. Copy: OFFICE

END OF SECTION 101419

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SECTION 101423 - ROOM-IDENTIFICATION PANEL SIGNAGE

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 interior room-identification signs that are directly attached to the building.
- B. Related Requirements:
 - 1. Section 101419 "Dimensional Letter Signage" for one-piece, solid letter signs, without frames that are used for building identification.

1.3 DEFINITIONS

- A. Accessible: In accordance with the accessibility standard.

1.4 COORDINATION

- A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.
- B. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For room-identification signs.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
 - 3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

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- C. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
 - 1. Room-Identification Signs: Full-size Sample.
 - 2. Full-size Samples, if approved, will be returned to Contractor for use in Project.
- D. Product Schedule: For room-identification signs. Use same designations indicated on Drawings or specified.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

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

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.9 FIELD CONDITIONS

- A. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image.
 - c. Separation or delamination of sheet materials and components.
 - 2. Warranty Period: **Five** years from date of Substantial Completion.

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PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design and ICC A117.1.

2.2 ROOM-IDENTIFICATION SIGNS

- A. Room-Identification Sign: Frameless sign system with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
 - 1. Laminated-Sheet Sign: Photopolymer face sheet with raised graphics laminated over subsurface graphics to acrylic or phenolic backing sheet to produce composite sheet.
 - a. Composite-Sheet Thickness: 0.25 inch (6.35 mm).
 - b. Subsurface Graphics: Reverse applied or etch image.
 - c. Color(s): Match Architect's sample.
 - 2. Sign-Panel Perimeter: Finish edges smooth.
 - a. Edge Condition: 1/8-inch Beveled.
 - b. Corner Condition in Elevation: Square.
 - 3. Mounting: Surface mounted to wall with two-face tape.
 - 4. Text and Typeface: Braille and raised typeface matching Architect's design. Typeface as selected by Architect. Finish raised characters to contrast with background color, and finish Braille to match background color.

2.3 SIGN MATERIALS

- A. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).
- B. Vinyl Film: UV-resistant vinyl film with pressure-sensitive, permanent adhesive; die cut to form characters or images as indicated on Drawings.
- C. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

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2.4 ACCESSORIES

- A. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch (1.14 mm) thick, with adhesive on both sides.
- B. Hook-and-Loop Tape: Manufacturer's standard two-part tape consisting of

2.5 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
 - 1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
 - 2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
 - 3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
 - 4. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
- B. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.
- C. Subsurface-Etched Graphics: Reverse etch back face of clear face-sheet material. Fill resulting copy with manufacturer's standard enamel. Apply opaque manufacturer's standard background color coating over enamel-filled copy.

2.6 GENERAL FINISH REQUIREMENTS

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

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PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Install signs so they do not protrude or obstruct according to the accessibility standard.
 - 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
- B. Accessibility: Install signs in locations on walls as indicated on Drawings and according to the accessibility standard.
- C. Mounting Methods:
 - 1. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.

3.2 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

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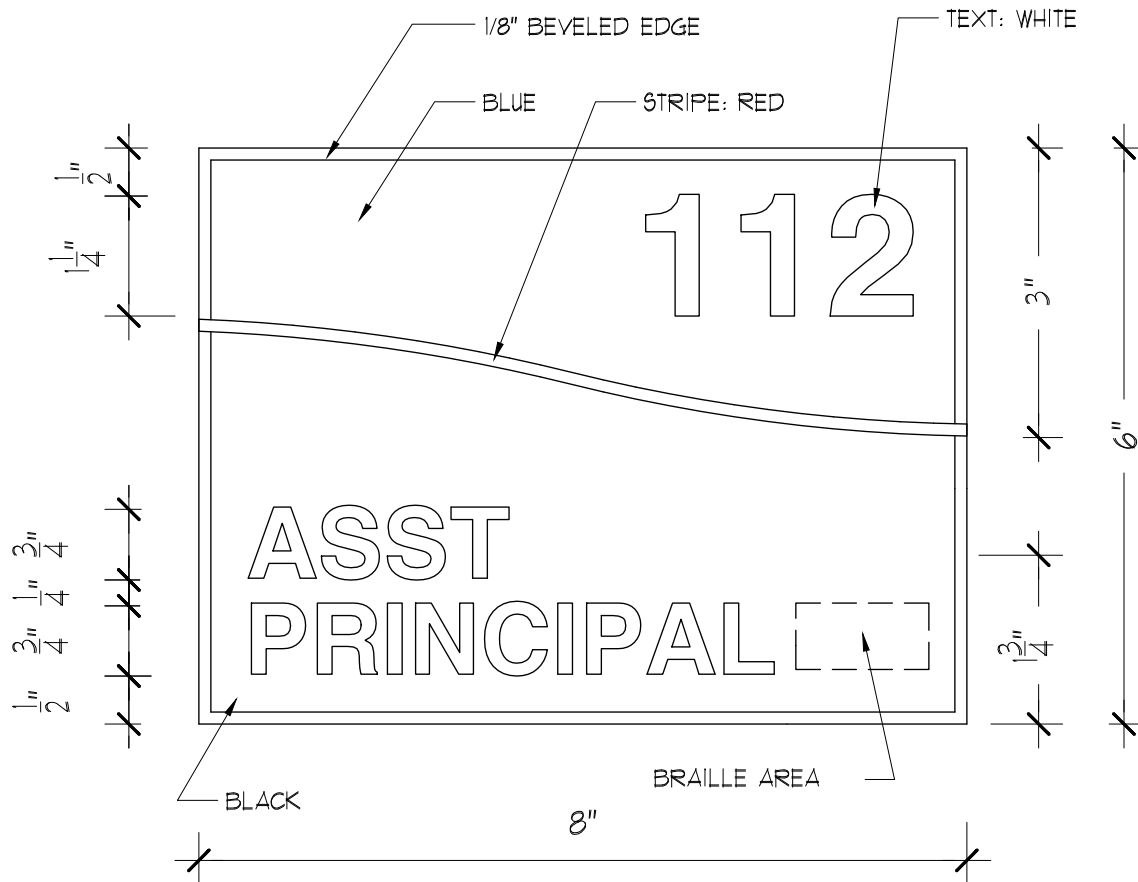
3.3 SCHEDULE OF SIGNS

- A. Provide signs with the following typeface graphics indicated below and according to the template shown on the following page. Note that room numbers are subject to change based on Owner's preferred room numbering system.
- B. Locate each sign on wall at strike side of door entering each space, offset by three (3) inches from the frame, or as directed by the Owner's Representative or Architect. Where the door entering a room is part of a storefront window system, the sign shall be mounted at hinge-side of the door onto the adjacent wall or as otherwise directed by the Owner's Representative or Architect. Height of signs shall not exceed 4'-0" above finish floor, when measured to top of the sign, unless otherwise directed.

<u>Room Number</u>	<u>Room Name</u>	<u>QTY.</u>	<u>LOCATION</u>
102	Main Office	1	Next to Door 102
103	Asst Principal	1	Next to Door 103
104	Reception	1	Next to Door 104B
105	Restroom	1	Next to Door 105
106	Principal	1	Next to Door 106
109	Counselor	1	Next to door entering Counselor's Office
----	Restroom	5	Next to doors entering small restrooms
----	I.T. Room	1	Next to corridor door entering Room 110
111	Office	1	Next to Door 111
112	Mechanical	1	Next to Door 112
113	Clinic	1	Next to Door entering the Clinic
115	Closet	1	Next to Door 115
116	Conference Room	1	Next to Door 116
117	Workroom	1	Next to Opening between Rooms 117 and 118
118	Teachers Lounge	1	Next to Door 118
----	Fire Alarm Within	1	Next to Door 118, opposite jamb
----	Auditorium	1	Next to doors that enter Auditorium
----	Cafeteria	1	Next to doors that enter Cafeteria
----	Library	1	Next to door that enters the Library

END OF SECTION 101423

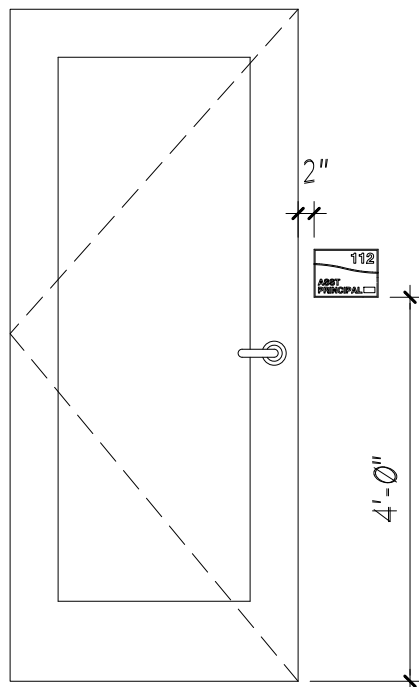
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TYPICAL ROOM IDENTIFICATION SIGN

SCALE: 6"=1'-0"

NOTE: FONT FOR TYPEFACE GRAPHICS SHALL BE HELVETICA REGULAR



SIGNAGE MOUNTING

SCALE: 1/2"=1'-0"

BLUE:
 MATCH SHERWIN WILLIAMS SW-6966
 BLUE BLOOD
 (RGB: 1/80/134, HEX #015086)

RED:
 MATCH SHERWIN WILLIAMS SW-6868
 REAL RED
 (RGB: 191/45/50, HEX #BF2D32)

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SECTION 102800 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes toilet accessory items as scheduled on the drawings.
- B. Work includes Contractor installation of some Owner-furnished toilet accessories as scheduled on the Drawings. Those accessories not furnished by the Owner are to be provided (furnished and installed) by the Contractor.

1.3 SUBMITTALS

- A. General: Submit the following according to Conditions of Contract and Division 1 Specifications Sections.
- B. Product data for each toilet accessory item specified, including construction details relative to materials, dimensions, gages, profiles, mounting method, specified options, and finishes.
- C. Schedule indicating types, quantities, sizes, and installation locations (by room) for each toilet accessory item to be provided for project.
- D. Setting drawings where cutouts are required in other work, including templates, substrate preparation instructions, and directions for preparing cutouts and installing anchorage devices.
- E. Maintenance instructions including replaceable parts and service recommendations.

1.4 QUALITY ASSURANCE

- A. Inserts and Anchorages: Furnish accessory manufacturers' standard inserts and anchoring devices that must be set in concrete or built into masonry. Coordinate delivery with other work to avoid delay.
- B. Single-Source Responsibility: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise acceptable to Owner.

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1.5 PROJECT CONDITIONS

- A. Coordination: Coordinate accessory locations, installation, and sequencing with other work to avoid interference with and ensure proper installation, operation, adjustment, cleaning, and servicing of toilet accessory items.

1.6 WARRANTY

- A. Warranty: Submit a written warranty executed by mirror manufacturer, agreeing to replace any mirrors that develop visible silver spoilage defects within warranty period.
- B. Warranty Period: 10 years from date of Substantial Completion.
- C. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide toilet accessories by one of the following:
 - 1. A & J Washroom Accessories.
 - 2. American Specialties, Inc. (ASI)
 - 3. Bobrick Washroom Equipment, Inc.
 - 4. Bradley Corporation.
 - 5. General Accessory Manufacturing Co.
 - 6. McKinney/Parker.
 - 7. Truebro/IPS Corporation

2.2 MATERIALS, GENERAL

- A. Stainless Steel: AISI Type 302/304, with polished No. 4 finish, 0.034-inch (22-gage) minimum thickness.
- B. Brass: Leaded and unleaded, flat products, ASTM B 19; rods, shapes, forgings, and flat products with finished edges, ASTM B 16; Castings, ASTM B 30.
- C. Sheet Steel: Cold-rolled, commercial quality ASTM A 366, 0.04-inch (20-gage) minimum. Surface preparation and metal pretreatment as required for applied finish.

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- D. Galvanized Steel Sheet: ASTM A 527, G60.
- E. Chromium Plating: Nickel and chromium electro-deposited on base metal, ASTM B 456, Type SC 2.
- F. Baked Enamel Finish: Factory-applied, gloss white, baked acrylic enamel coating.
- G. Mirror Glass: Nominal 6.0-mm (0.23-inch) thick, conforming to ASTM C 1036, Type I, Class 1, Quality q2, and with silvering, electro-plated copper coating, and protective organic coating.
- H. Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.
- I. Fasteners: Screws, bolts, and other devices of same material as accessory unit, or of galvanized steel where concealed.

2.3 TOILET TISSUE DISPENSERS

- A. Toilet Tissue Dispenser: Surface-mounted twin jumbo roll type, equal to Bobrick Model No. B-2892.
 - 1. Mounting: Surface mounted on wall, concealed anchorage.

2.4 GRAB BARS

- A. Stainless Steel Type: Provide grab bars with wall thickness not less than 0.05 inch (18 gage) and as follows:
 - 1. Mounting: Concealed, manufacturer's standard flanges and anchorages.
 - 2. Clearance: 1-1/2-inch clearance between wall surface and inside face of bar.
 - 3. Gripping Surfaces: Manufacturer's standard nonslip texture.
 - 4. Heavy-Duty Size: Outside diameter of 1-1/2 inches.
- B. Provide Bobrick Series B-6160 in the sizes and shapes shown on the drawings, or equal as approved by the Owner.

2.5 SOAP DISPENSERS

- A. Liquid Soap Dispenser, Wall-Mounted: Stainless steel, surface-mounted with concealed fasteners. Provide unit with 40 oz. fluid capacity for liquid soap to be provided by Owner. Basis of Design: Bobrick Model B-2112.

2.6 MIRROR UNITS

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- A. Standard Stainless Steel Framed Mirror Units: Fabricate frame with channel shapes not less than 0.04 inch (20 gage), with square corners carefully mitered to hairline joints and mechanically interlocked. Provide in Type 430 bright polished finish. Provide concealed, surface-mounted attachment to walls. Provide mirror sizes as scheduled on the drawings. Basis of Design: Bobrick Series 165 with channel frame.

2.7 SANITARY NAPKIN DISPOSAL

- A. Stainless steel, surface-mounted with concealed fasteners. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Model No. B-270.

2.8 COMBINATION PAPER TOWEL DISPENSER / WASTE RECEPTACLE

- A. Paper Towel Dispenser, Wall-Mounted: Stainless steel, semi-recessed mounting with concealed fasteners. Unit shall be convertible without replacing existing cabinet in the wall. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Model No. B-3942.

2.9 UNDER-LAVATORY GUARDS

- A. Basis of Design Product: Subject to compliance with requirements, provide product indicated on drawings or comparable product by one of the following:
 - 1. Plumberex Specialty Products, Inc.
 - 2. Truebro by IPS Corporation
- B. Under-Lavatory Guard:
 - 1. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.
 - 2. Material and Finish: Antimicrobial, molded plastic, white.
 - 3. Basis of Design: Truebro "Lav Guard 2" Undersink Piping Covers.

2.10 FABRICATION

- A. General: Only a maximum 1-1/2-inch-diameter, unobtrusive stamped manufacturer logo, as approved by Owner, is permitted on exposed face of toilet or bath accessory units. On either interior surface not exposed to view or back surface, provide additional identification by either a printed, waterproof label or a stamped nameplate, indicating manufacturer's name and product model number.
- B. Surface-Mounted Toilet Accessories, General: Except where otherwise indicated, fabricate units with tight seams and joints, exposed edges rolled.

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Hang doors or access panels with continuous stainless steel piano hinge. Provide concealed anchorage wherever possible.

- C. Framed Mirror Units, General: Fabricate frames for glass mirror units to accommodate wood, felt, plastic, or other glass edge protection material. Provide mirror backing and support system that will permit rigid, tamperproof glass installation and prevent moisture accumulation, as follows:
 - 1. Provide galvanized-steel backing sheet, not less than 0.034 inch (22 gage) and full mirror size, with non-absorptive filler material. Corrugated cardboard is not an acceptable filler material.
- D. Mirror Unit Hangers: Provide system for mounting mirror units that will permit rigid, tamperproof, and theft proof installation.
- E. Keys: Provide universal keys for access to toilet accessory units requiring internal access for servicing, resupply, etc. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install toilet accessory units according to manufacturers' instructions, using fasteners appropriate to substrate as recommended by unit manufacturer. Install units plumb and level, firmly anchored in locations and at heights indicated.
- B. Secure mirrors to walls in concealed, tamperproof manner with special hangers, toggle bolts, or screws. Set units plumb, level, and square at locations indicated, according to manufacturer's instructions for type of substrate involved.
- C. Install grab bars to withstand a downward load of at least 250 lb., complying with ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust toilet accessories for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items.
- B. Clean and polish all exposed surfaces strictly according to manufacturer's recommendations after removing temporary labels and protective coatings.

END OF SECTION 102800

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SECTION 104413 - FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Fire protection cabinets for the following:
 - a. Portable fire extinguishers, specified separately under Section 104416 "Fire Extinguishers."

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 fire protection cabinets.
 - 1. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
- B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples for Initial Selection: For each type of fire protection cabinet indicated.
- D. Product Schedule: For fire protection cabinets. Coordinate final fire protection cabinet schedule with fire extinguisher schedule to ensure proper fit and function.
- E. Maintenance Data: For fire protection cabinets to include in maintenance manuals.

1.4 QUALITY ASSURANCE

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- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.5 COORDINATION

- A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cold-rolled galvanized sheet, ASTM A1008/A1008M, Commercial Steel (CS), Type B.
- B. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.2 FIRE PROTECTION CABINET

- A. Cabinet Type: Suitable for Type A, B or C 5-pound fire extinguisher, with minimum interior tub dimension of 9-1/2 inches wide, by 24 inches high by 5 inches deep.
 - 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. J. L. Industries, Inc., a division of Activar Construction Products Group; "Ambassador" Steel Model No. 1816.
 - b. Larsen's Manufacturing Company; "Architectural Series" Model No. FS 2409-5R.
- B. Cabinet Construction: Non-Fire-Rated, square-edged trim, semi-recessed, with full-glass, framed door panel.
- C. Cabinet Material: Cold-rolled galvanized sheet.
- D. Semi-recessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of

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insufficient depth for recessed cabinets but are of sufficient depth to accommodate semi-recessed cabinet installation.

1. Square-Edge Trim: 1 1/2-inch width; not to exceed 1-1/2 inch projection from finished face of wall.
 - E. Cabinet Trim Material: Enamel-coated galvanized sheet.
 - F. Door Material: Enamel-coated galvanized sheet.
 - G. Door Style: Vertical duo panel with frame; door to mount flush within frame, not overlay.
 - H. Door Glazing: Tempered float glass (clear).
 - I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 1. Provide projecting door pull and friction latch manufacturer's standard.
 2. Provide semi-concealed, continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.
 - J. Accessories:
 1. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.
 - a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet glazing.
 - 2) Application Process: Silk-screened.
 - 3) Lettering Color: Red.
 - 4) Orientation: Vertical.
 - K. Finishes:
 1. White baked enamel, factory-applied, of one the following: TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.
- 2.3 FABRICATION
- A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 1. Weld joints and grind smooth.
 2. Provide factory-drilled mounting holes.

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3. Prepare doors and frames to receive locks.
 4. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
 2. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
1. Run grain of directional finishes with long dimension of each piece.
 2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 3. Satin Finish: No. 4.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where semi-recessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

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3.2 PREPARATION

- A. Prepare recesses for semi-recessed fire protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- 1. General: Install fire protection cabinets in locations and at mounting heights indicated.
- B. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.
- E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

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SECTION 104416 - FIRE EXTINGUISHERS

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 portable extinguishers.
- B. Related Requirements:
 - 1. Section 104413 "Fire Protection Cabinets."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher.
- B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.6 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

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1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet indicated.
 - 1. Source Limitations: Obtain fire extinguishers from single source from single manufacturer.
 - 2. Valves: Nickel-plated, polished-brass body.
 - 3. Handles and Levers: Manufacturer's standard.
 - 4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.
- B. Multipurpose Dry-Chemical Type: UL-rated 3-A:40-B:C, 6-lb (2.7-kg) nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.
- C. Multipurpose Dry-Chemical Type in Steel Container 3-A:40-B:C, 6-lb (2.7-kg) nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

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2.3 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to extinguisher cabinet housing, unless integral with products specified and provided under Section 104413 Fire Extinguisher Cabinets, of sizes required for types and capacities of fire extinguishers indicated, with plated or red or black baked-enamel finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers where indicated at new fire extinguisher cabinets in locations indicated and in compliance with requirements of authorities having jurisdiction.

END OF SECTION 104416

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SECTION 105613 – METAL STORAGE SHELVING

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. Prefabricated, modular open-end metal storage shelving.
 - 2. Lockable storage cabinet.

1.3 SUBMITTALS

- A. Product Data: For each type of shelving indicated. Include construction details, material descriptions, list of accessories, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation details for modular shelving units. Depict shelf construction and support, bracing details, and attachment details to adjacent partitions.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Pack, handle, and ship metal shelving systems properly labeled in heavy-duty packaging to prevent damage.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify required openings for each type of shelving units by field measurements before final assembly and installation.

1.6 QUALITY ASSURANCE

- A. Industry Standards: All shelving shall comply with standards of the Storage Equipment Manufacturers' Association (SMA), and shall be constructed and installed according to ANSI MH 28.1 and ANSI MH 28.2.

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- B. Manufacturer Qualifications: A manufacturer capable of fabricating storage shelving that meets or exceeds performance requirements indicated and of documenting this performance by test reports, and calculations.

1.7 COORDINATION

- A. Coordinate layout and installation of modular shelving units with interior partitions. Where units are to be installed adjacent to new metal stud partitions, provide embedded, horizontal wood blacking between studs inside the partition at approximately 72 inches above the floor in order to anchor the shelf units to the wall and prevent from tipping over.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

- A. Provide all metal shelving products from a single manufacturer among the following, or equal approved by the Architect:
 - 1. Global Equipment Company Inc.
 - 2. L.K. Goodwin Company
 - 3. Uline Company
 - 4. Cisco-Eagle
 - 5. Penco Products

2.2 MATERIALS

- A. Steel: Baked-Enamel or Powder-Coat Finish: Manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to achieve a minimum dry film thickness of 2 mils (0.05 mm). Provide in manufacturer's standard gray color.

2.3 OPEN-END METAL STORAGE SHELVING

- A. Steel Four-Post Shelving: Shelving consisting of four angle-iron uprights per section, with adjustable shelves resting on shelf supports hung on uprights.
- B. Open Shelving Units:
 - 1. Type: Self-supporting unit.
 - 2. Configuration: Open.
 - 3. Width: Varies; as specified herein; 36 inches (914 mm), 42 inches (1067 mm) or 48 inches (1219 mm) as scheduled.
 - 4. Height: 88 inches (2235 mm).

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5. Shelf Depth: Varies; as specified herein; 12 inches, 15 inches, 18 inches and 24 inches, as scheduled
 6. Shelf Gauge: 18 gauge.
 7. Shelf Styles: Provide the following styles and numbers of adjustable shelves:
 - a. Flat; six shelves.
 - b. Shelf construction shall be Class 2 with rolled front and rear edges, ends, with reinforcing steel bars across long sides of front and rear.
- C. Uprights: Double-wall steel posts, 2 inches (51 mm) wide, 0.048 inch (1.22 mm) thick, in manufacturer's standard T-shape for common-post use or L-shape at range ends, with keyhole perforations on the inner wall at 1-1/2 inches (38 mm) o.c.
- D. Steel Spacers: Provide 0.048-inch- (1.22-mm-) thick steel spacers, 3 inches (76 mm) high, welded to posts at bottom, center, and top of open units to prevent deflection.
- E. Accessories: Provide manufacturer's standard bracing to be installed at back of shelf unit. Bracing shall not interfere with adjustability of shelves.

2.4 LOCKABLE STORAGE CABINET

- A. Heavy-duty steel storage cabinet with 16 gauge body and doors. Shelves adjust on 3-inch centers, designed to support up to 1,050 lbs. uniformly distributed. Three-point steel locking system is operated by a 3/16- inch thick steel turn lever handle. Full door height piano hinges for strength and security. Durable gray powder coat finish.
- B. Dimensions: 42 inches wide, by 24 inches deep by 84 inches high with fixed bottom shelf and four adjustable interior shelves, pair of full-height doors.
- C. Manufacturer/Model: Provide Global Industrial Model No. 316054 or similar and equal model by another manufacturer subject to review and approval by the Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of framing, blocking and other conditions affecting performance of installed shelving systems.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

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- A. Install shelves in shelving units at locations indicated on Drawings and according to manufacturer's written instructions.
- B. Shelving Enclosure Panels: Install end panels and canopy tops with concealed fasteners.

3.3 CLEANING AND PROTECTING

- A. Repair or remove and replace defective work as directed on completion of installation.
- B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.
- C. Protect installed products from damage during remainder of the construction period.

3.4 INSTALLATION SCHEDULE

- A. Supply Room 110: Provide one (1) closed-end unit, 36 inches wide by 18 inches deep.
- B. Office Room 111: Provide two (2) open-end units, 36 inches wide by 12 inches deep.
- C. Closet Room 115: Provide two (2) open-end units, 36 inches wide by 18 inches deep.
- D. Clinic Closet 114: Provide one (1) lockable cabinet (or in another location where directed by Owner).

END OF SECTION 105613

SECTION 111500 - BULLET-RESISTANT TRANSACTION DRAWER

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Bullet-resistant Sliding Transaction drawer.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. American Welding Society (AWS) D1.3/D1.3M - Structural Welding Code - Sheet Steel.
- B. ASTM International (ASTM) A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
- C. Underwriters Laboratories (UL) 752 - Bullet Resisting Equipment.

1.3 SYSTEM DESCRIPTION

- A. Design Requirements: Provide drawer with "non-ricochet type" intended to permit capture and retention of attacking projectile, lessening potential of random injury or lateral penetration for UL 752 Level 3.

1.4 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings: Include profiles and sizes, reinforcement size and locations, details of joints and connections.
 - 2. Product Data: Include product description for drawer including bullet-resistant ratings.

1.5 QUALITY ASSURANCE

- A. Transaction Drawers: Ballistic Level 3 to UL 752.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Store drawers in protected, dry area, off ground or floor.

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- B. Do not cover with non vented coverings that create excessive humidity.
- C. Remove wet coverings immediately.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on Model 6003 by ARMORTEX, 5926 Corridor Parkway, Schertz, Texas, 800-880-8306, www.armortex.com.
- B. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

- A. Steel Sheet:
 - 1. ASTM A1008/1008M, cold rolled, free from scale, pitting, coil breaks, and other surface defects.
- B. Bullet-Resistant Composite: UL Listed Bullet Resistant Composite by ARMORTEX, of UL Ballistic Level equal to specified frame ballistic protection level.
- C. Ballistic Steel: Hi-Hard Ballistic Steel, of UL Ballistic Level equal to specified ballistic protection level.

2.3 FABRICATION

:

- A. Drawers
 - 1. Fabricate Case from 16 gage steel
 - 2. Face 16ga #3 Brushed Stainless Steel
 - 3. Stainless Steel mounting flange.
 - 4. Heavy duty drawer slides
- B. Welding: In accordance with AWS D1.3/D1.3M. Grind exposed welds flush and smooth.
- C. Finish work neat and free from defects.

2.4 FINISHES

- A. Stainless Steel: No. 3 brushed finish.

PART 3 EXECUTION

3.1 INSTALLATION

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- A. Install drawer in accordance with manufacturer's instructions and approved Shop Drawings.
- B. Set with flanges on top of counter
- C. Secure to adjacent using fastener type best suited to application.

END OF SECTION 111500

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SECTION 122413 - ROLLER WINDOW SHADES

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. Manually operated roller shades with single rollers to be provided at ALL exterior windows throughout the Administrative Office and Reception area.
2. Provide manually operated roller shades with single rollers at the following interior window locations: Throughout the Principal's Office, Workroom and Lounge along the main corridors. Provide also at the interior windows of the Reception Area that look into Vestibule and Lobby.
3. Shades are **not** required at exterior or interior windows of the Secure Vestibule or Lobby. Shades are **not** required at exterior windows of the Corridor(s). Shades are **not** required at lites set into doors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

- B. Shop Drawings:

1. Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.
2. Installation Schedule: Prepare and submit a schedule of all locations where window shades are to be installed indexed by room number and unit sub-number. Schedule shall indicate sizes (height by width) and include remarks for mounting method

- C. Samples: For each exposed product and for each color and texture specified, 10 inches (250 mm) long.

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- D. Samples for Initial Selection: For each type and color of shadeband material.
 - 1. Include Samples of accessories involving color selection.
- E. Samples for Verification: For each type of roller shade.
 - 1. Shadeband Material: Not less than 10 inches (250 mm). Mark inside face of material if applicable.
 - 2. Roller Shade: Full-size operating unit, not less than 16 inches (400 mm) wide by 36 inches (900 mm) long for each type of roller shade indicated.
 - 3. Installation Accessories: Full-size unit, not less than 10 inches (250 mm) long.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of shadeband material, signed by product manufacturer.
- C. Product Test Reports: For each type of shadeband material, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roller shades to include in maintenance manuals.

1.6 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. Roller Shades: Full-size units equal to two (2) full-size shades.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

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1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide products by one of the following:
 - 1. Draper Inc.
 - 2. Hunter Douglas Contract.
 - 3. MechoShade Systems, Inc.
 - 4. Nysan Solar Control Inc.; Hunter Douglas Company.
 - 5. OEM Shades Inc.
 - 6. Shade Techniques, LLC.
 - 7. Silent Gliss USA, Inc.
 - 8. SM Automatic, Inc.
- C. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

- A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

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1. Bead Chains: Nickel-plated metal or Stainless steel.
 - a. Loop Length: Full length of roller shade.
 - b. Limit Stops: Provide upper and lower ball stops.
 - c. Chain-Retainer Type: Chain tensioner, sill mounted.
2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller-shade weight and lifting heavy roller shades.
 - a. Provide for shadebands that weigh more than 10 lb (4.5 kg) or for shades as recommended by manufacturer, whichever criteria are more stringent.
- B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
 1. Roller Drive-End Location: Right side of inside face of shade.
 2. Direction of Shadeband Roll: Standard, from front of roller.
 3. Shadeband-to-Roller Attachment: Removable spline fitting integral channel in tube, permitting replacement of the shade fabric.
 4. Provide the smallest diameter roller assembly possible. Provide valence housing to conceal roller and gathered shade.
- C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- D. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.
- E. Shadebands:
 1. Shadeband Bottom (Hem) Bar: Extruded aluminum.
 - a. Type: Pocketed, with no plastic across bottom of shade.
 - b. Color and Finish: As specified below in section entitled "Shadeband Materials."
- F. Installation Accessories:
 1. Front Fascia (Valence): Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
 - a. Shape: L-shaped.
 - b. Height: Manufacturer's standard height required to conceal roller and shadeband when shade is fully open, but not less than 3 inches (76 mm).

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2. Endcap Covers: To cover exposed endcaps.
3. Installation Accessories Color and Finish: Brushed aluminum. Provide manufacturer's standard mounting clips and fascia support. Units to be secured to lintels above windows. Provide for concealed or flushed/countersunk mounting of all items to the greatest practical extent.

2.3 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.
 1. Source: Roller-shade manufacturer.
 2. Type: PVC-coated polyester.
 3. Weave: Mesh.
 4. Thickness: 0.037-inch.
 5. Weight: 20.7 oz./sq. yd. (g/sq. m)>.
 6. Roll Width: To suit end mullion to end mullion dimensions of windows at jambs, full opening width, with 1/2-inch gap at ends of masonry openings, approximately as follows (Contractor to field verify all opening dimensions):
 - a. Administrative Offices and Training Room: Masonry opening width of 4'-0" with a height of 4'-8" – but must be field-verified prior to shade fabrication.
 7. Orientation on Shadeband: Up the bolt.
 8. Openness Factor:
 - a. **3 percent at exterior window locations.**
 - b. **7 percent at interior window locations.**
 9. Color: Hunter Douglas Contract, SheerWeave 4400, Color: "Eco-Granite." Products of similar design and performance specified herein by other manufacturers may be provided subject to submittal for review and approval by Architect and Owner.

2.4 ROLLER-SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):

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1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch (6 mm) per side or 1/2-inch (13-mm) total, plus or minus 1/8 inch (3.1 mm). Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch (6 mm), plus or minus 1/8 inch (3.1 mm).
 2. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
- C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:
1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
 2. Skylight Shades: Provide battens and seams at uniform spacings along shadeband as required to ensure shadeband tracking and alignment through its full range of movement without distortion or sag of material.
 3. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER-SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions. Mount shades to interior side of aluminum window frames with close alignment of edges to walls at ends and centerline of mullions at multiple window bays.

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3.3 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

- A. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

3.6 INSTALLATION SCHEDULE

- A. Shades at Exterior Windows: Install at all exterior windows located in the following spaces:
 - 1. SRO Room 101
 - 2. Admin. Office Room 102
 - 3. Asst. Principal Office 103
 - 4. Principal's Office 106
 - 5. Work Room 117
 - 6. Staff Lounge 118
- B. Shades at Interior Windows: Install at all interior windows located in the following spaces:
 - 1. Reception 104 (adjoining Corridor, Lobby & SRO's space)
 - 2. Office 111 (adjoining Corridor)
 - 3. Conference Room 116 (Adjoining Corridor)

END OF SECTION 122413

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SECTION 220500 - PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections, Section 230100 "Mechanical General Provisions", and Section 230700 "Mechanical Insulation" apply to this Section.

1.2 SERVICE CONNECTIONS

- A. Contractor shall make all connections of building sewer and domestic water piping to existing within the building where indicated. Storm drain shall connect to existing at a point 5'-0" outside of building unless otherwise noted on drawings.

1.3 PERMITS

- A. Contractor shall give all required notices and secure all necessary permits. Inspection certificates from local authorities having jurisdiction shall be delivered to the Architect prior to final payment.

1.4 GENERAL REQUIREMENTS

- A. Follow Plumbing Code for minimum requirements; where drawings or specifications are at variance with Code, follow whichever provides for maximum size or condition.
- B. Verify all grades, elevations and utility connections before commencing work.
- C. Comply with requirements of the Uniform Federal Accessibility Standards (UFAS).
- D. All pipe, fittings and fixtures that are connected to potable water systems must meet the current Water Drinking Act and where applicable, meet NSF Standard 61 and be so labeled and be so certified. All plumbing valves, devices, fixtures and fittings shall be lead free.

1.5 SUBMITTALS AND SHOP DRAWINGS

- A. Submit manufacturer's data on the following:

- Plumbing Fixtures
- Plumbing Fixture Supports
- Faucets
- Flush Valves
- Balancing Valves
- Supplies and Traps
- Roof Drains
- Cleanouts

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Valves
Wall Hydrants
Hot Water Recirculating System
ADA Pipe Covers

- B. Submit a schedule of all pipe materials to be used for each type of service.

1.6 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.
- B. During the guarantee period, the Contractor shall repair or replace defective material and workmanship and place same in working order to the satisfaction of the Architect at no additional expense to the Owner.
- C. Contractor shall service the systems for 12 months from date of Substantial Completion. Such service shall include all emergency services and adjustments, except cleaning of filters and screens.

PART 2 - PRODUCTS

2.1 SOIL, WASTE, DRAIN AND VENT PIPING

- A. Underground soil, waste, drain, rain leader piping within the building and to a point 5'-0" outside of building foundation shall be centrifugally cast, coated Service Weight hub-and-spigot (ASTM A74), hubless cast-iron (ASTM A888), or DWV Schedule 40 PVC pipe (ASTM D2665) and fittings, unless otherwise noted.
- B. Above ground soil, waste, drain, rain leader and vent piping shall be hubless cast-iron pipe (ASTM A888), DWV copper pipe (ASTM B306) or DWV Schedule 40 PVC pipe (ASTM D2665) and fittings, except that PVC pipe shall not be used where piping penetrates fire partitions, or where rain leaders are exposed from floor to at least 10 feet above floor, or any location not allowed by the Building Code. PVC piping for any service shall not be installed in return air plenums. Cast iron shall be used in plenum spaces above ceilings and return air plenums.
- C. Foam Core PVC piping is not acceptable for any application.
- D. Hub-and-spigot piping shall be assembled using plain-end spigot and positive double-seal elastomeric compression-type gasket joints above ground. Hubless pipe and fittings shall be assembled using Neoprene gasket and stainless-steel retaining sleeve. Underground hubless pipe and fittings shall be assembled per paragraph below. PVC pipe and fittings shall be assembled in strict accordance with manufacturer's instructions. Solvent cement shall conform to ASTM D2564.

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- E. Hubless Cast-iron Pipe and Fittings - Below Grade: Joints shall be heavy duty, Factory Mutual approved, to FM 1680 Class 1, type 304 stainless-steel couplings with a shield thickness of .024 (24 gauge) with 125 in/lb. worm drive clamps with Neoprene gaskets conforming to ASTM C564. Couplings 1-1/2" to 4" in diameter shall be 3" wide and have two clamps. Couplings 5" to 10" in diameter shall be 4" wide and have four clamps. Couplings 12" and 15" wide shall be 5-5/8" wide and have six clamps. Model HI-TORQ 125 as manufactured by CLAMP-ALL PRODUCTS, IDEAL CLAMP PRODUCTS, or approved equal.

2.2 CLEANING PLUGS AND TEST TEES

- A. Provide cleanouts as indicated and/or required by the Plumbing Code.
- B. Cleanouts shall be the same size as pipe, up to 4". Cleanouts for pipes larger than 4" shall be sized in accordance with the Plumbing Code. Cleanouts installed in connection with cast-iron, hub-and-spigot pipe shall consist of longsweep 1/4 bends or one or two 1/8 bends extended to easily accessible, approved location or where indicated. Extra-heavy cast-brass ferrule with cast-brass cleanout plug shall be caulked into hub of fittings and shall be flush with floor. Cleanouts in connection with threaded pipe shall be cast-iron drainage T-pattern 90-degree branch fittings with extra-heavy brass screw plugs of the same size as pipes, up to and including 4". Install test tees with cast-iron cleanout plugs at foot of drain stacks and on each building drain outside building. Where cleanouts occur on pipe concealed in partitions and walls, provide with chromium-plated cast-brass plate secured to brass plugs. Verify cleanout locations before pipe installation. Extend cleanout plugs to within 1" of finished wall.
- C. See paragraph FIXTURES AND EQUIPMENT for cleanout access covers.
- D. Cleanouts indicated outside of building shall be flush with grade and have concrete pad as specified in Section 230100.

2.3 TRAPS

- A. Provide a trap for each fixture and piece of equipment requiring connections to drainage system. Supply traps with fixtures. Place each trap as near fixture as possible and no fixture shall be double trapped. Traps installed on threaded pipe shall be recess drainage pattern. Trap on all floor drains shall be deep-seal type.
- B. Exposed traps and drain piping shall be chromium plated.

2.4 WATER PIPING

- A. Water piping shall be copper tubing, Type L, hard-tempered above ground. Piping shall be assembled with wrought-copper fittings using 95-5 solder above ground and silver solder underground.

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B. Press Connector Fittings:

1. Copper and copper alloy press fittings shall conform to material requirements of ASME B16.18 or ASME B16.22 and NSF/ANSI Standard (NSF 61). Sealing elements for press fittings shall be factory installed EPDM.
2. Press-connected fittings 1/2" – 2" press end shall have a leak-before-press feature, which assures leakage from inside the system past the sealing element of an unpressed connection. Fittings 2-1/2" – 4" press end shall have a factory installed means for visual inspection of completed press. Copper press fitting joints shall be made in accordance with the manufacturer's installation instructions. The tubing shall be fully inserted into the fitting and the tuning marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark in the tubing to ensure the tubing is fully inserted in the fitting. The joints shall be pressed using the pressing tool and jaws or jaw set, approved by the fitting manufacturer. Fitting installer shall be trained by the fitting manufacturer's factory representative.
3. Press connected fittings shall be by ELKHART PRODUCTS CORP., NIBCO, VIEGA or approved equal.

- C. Exposed water piping located in finished areas shall be chromium plated or stainless steel where materials are available. For larger pipe sizes, pipe may be painted.

2.5 VALVES

- A. Provide valves on piping as indicated and as required to isolate fixtures and equipment and to give complete control of water in risers and branch lines. Valves shall be ball, unless otherwise indicated. All valves shall be lead-free.
- B. No cast-iron valves shall be used on domestic hot water piping. Valves shall be bronze or brass body valves only.
- C. Valves on copper water piping, up to and including 2", shall be bronze or brass. Gate Valves 2-1/2" and larger shall be cast-iron body, bronze-mounted with companion flanges. Valves on cold or chilled piping shall have extended shafts to match the pipe insulation thickness to prevent condensation. Catalog numbers indicated are NIBCO. Valves with equivalent characteristics by APOLLO or MILWAUKEE are acceptable.

<u>Type</u>	<u>Size</u>	<u>Catalog Number</u>
Ball	2-1/2" - 3"	S-FP-600A-LF
Ball	2" and smaller	S-585-80-LF
Check	2" and smaller	S-413-Y-LF

2.6 THERMAL BALANCING VALVES

- A. Provide thermal balancing valve where indicated, CALEFFI Series 1164A for pipe sizes 1/2" to 3/4".

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- B. Thermal balancing valve shall be constructed of DZR low-lead brass, and shall be rated for 230 psi at 195°F inlet temperature. Reduced port valves are not acceptable.
- C. Adjustment temperature range shall be from 105-150°F. Adjustment temperature knob shall be lockable.
- D. Valves shall be sized as indicated or as recommended by valve manufacturer for intended flow capacity.

2.7 FIXTURES AND EQUIPMENT

- A. Provide complete fixtures and equipment indicated and scheduled on contract documents. Fixtures and equipment shall be as manufactured by the listed manufacturers below or approved equal. The plumbing fixtures listed below are selected to establish examples of design intent and to set a standard of quality. Equivalent fixtures and fittings from other manufactures may be submitted for approval.
 - 1. Vitreous china fixtures shall be as manufactured by KOHLER, AMERICAN STANDARD, or SLOAN.
 - 2. Stainless steel sinks shall be as manufactured by JUST, ELKAY, or ADVANCED TABCO.
 - 3. Manual faucets shall be as manufactured by CHICAGO, T&S BRASS, or MOEN.
 - 4. Manual flush valves shall be as manufactured by SLOAN, ZURN, or DELANY.
- B. All material shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
- C. Provide supply stops as required for all fixtures. Refer to plumbing drawings for additional fixture information.
- D. Provide floor-mounted supports with concealed arms for wall-hung lavatories. Carriers shall be as manufactured by J. R. SMITH CO., or approved equal. Contractor to select proper model to suit wall construction.
- E. Wall hydrants shall be freezeless type, Model 65 satin-chrome finish, with loose key handle, vacuum breaker and backflow preventer. WOODFORD MFG. CO. Contractor to select proper model to suit wall construction.
- F. Roof drains shall be type indicated, coated cast-iron body with extension as required, roof sump receiver and under-deck clamp; drain shall have combination membrane flashing clamp/gravel guard and low-silhouette aluminum dome.
- G. Provide nickel-bronze cleanout access. Where waterproof membranes occur, provide clamping collar. SMITH numbers indicated. ZURN or JOSAM may be used.

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Resilient tile floor	4020-U
Painted masonry walls	4402
Ceramic tile floor	4020-U
Carpeted floors	4020-Y
Terrazzo floors	4020-U
Concrete floors	4020-U

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

- A. Grade horizontal soil, waste and drain pipes as follows, except as approved and as indicated on drawings:

2"	1/4" per foot, minimum
3" and larger	1/8" per foot, minimum

- B. Install vertical soil and waste piping with provision for expansion and extend full size to and above roof lines as vents, except as otherwise indicated. Where practicable, connect two or more vent pipes together and extend as one pipe through roof at approved locations. Run concealed vent pipes in overhead spaces with horizontal waste or soil piping pitched down to stacks without forming traps in pipes, using required fittings. Where an end or circuit vent pipe from fixture or line of fixture is connected to vent line serving other fixtures, make the connection at least 4'-0" above the floor on which fixtures are located. Vent lines shall not be used as waste, except as approved. Extend cast-iron hub-and-spigot pipe inside of building 6" above the floor.
- C. Make changes in pipe sizes on soil, waste and drain lines with reducing fittings or recessed reducers. Make changes in direction by appropriate use of 45-degree wyes, longsweep 1/6, 1/8, or 1/16 bends, except sanitary tees may be used where permitted by code in soil and waste lines where change in direction of flow is from horizontal to vertical and on discharge from water closets. Short-radius fittings shall not be permitted, except in approved location.
- D. Slip joints are permitted only in trap seals or on inlet side of traps. Use hub fittings for making union connections wherever practicable, in connection with dry vents.
- E. PVC piping shall not be installed in return-air plenums, through fire walls, or any location not allowed by the Building Code.
- F. All flow measuring and balancing valves shall be balanced for flow indicated by Plumbing Contractor.

3.2 CONNECTIONS TO EQUIPMENT

- A. Make plumbing connections to all equipment requiring connections, including equipment in Contract and equipment furnished by others. Make all connections according to manufacturer's recommendations.

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3.3 FIXTURE SETTING HEIGHTS

- A. Plumbing fixtures shall be at heights indicated and/or directed. Heights of hand-capped plumbing fixtures shall be as governed by the Building Code, ANSI A117.1 and the requirements of the Uniform Federal Accessibility Standards (UFAS).

3.4 INSPECTION AND TESTS

- A. The new plumbing system shall be tested by the Contractor in the presence of the Architect. Governing authorities having jurisdiction shall be notified of test required by them and Final Acceptance of work shall be contingent upon their approval. At least 48 hours' notice shall be given prior to test. All costs of conducting test and furnishing necessary equipment for test shall be borne by the Contractor.
- B. The new soil, waste, drain and vent system shall be tested and proved tight prior to connection of fixtures, by closing all openings, except highest at roof and filling with water to point of overflow. Allow water to stand at least 2 hours before starting inspection. Where piping must be tested in sections to facilitate construction, include at least the upper 10 feet of the preceding section so that no pipe or joint in building will have been subjected to less than 10 feet head of water. Piping laid in trenches shall not be backfilled until test has been made and joints proved tight. Owner shall be provided 24 hours' notice prior to tests and provided written results of tests.
- C. Upon completion of roughing-in and before setting fixtures, test new hot and cold water piping system at hydrostatic pressure of 100 psig and prove watertight at this pressure. Test water piping system to be concealed separately in same manner as prescribed for entire system.
- D. Thoroughly clean and flush piping and apply chlorine solution to new system at least 3 hours to destroy nonspore-forming bacteria. Following chlorination, flush agent from system until water is both bacteriologically and chemically satisfactory to Public Health Officer.
- E. If inspection or tests show defect, replace such defective work or materials and repeat inspection tests. Make repairs to piping with new materials. No caulking of screwed joints or holes shall be acceptable.
- F. Clean equipment, pipe, valves and fittings of grease, metal cuttings and sludge accumulated by operations of system for testing. Stoppage or discoloration or other damage to parts of building, its finish or furnishings due to Contractor's failure to properly clean piping system shall be repaired without cost to the Owner.
- G. All domestic hot water flow measuring and balancing valves shall be balanced for flow indicated in the contract documents by the Plumbing Contractor. Balanced flow shall be reported in the final TAB Report.

END OF SECTION 220500

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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) 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:

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
IEEE	Institute of Electrical and Electronics Engineers
NAFM	National Association of Fan Manufacturers
NEC 2020	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, 2021 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

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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 "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 Architect.
- 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.

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- 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 their use.
- G. Contractor shall submit automatic temperature controls package specified in 230900 prior to equipment packages specified in 230500.

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 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".

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1.13 OWNER'S TRAINING

- A. Upon completion of work and at a time designated by the Architect, 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 one 8-hour session. All training shall be video recorded by the Contractor and provided in electronic format.

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 Substantial Completion.
- 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 Substantial Completion.

PART 2 - PRODUCTS

2.1 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 walls and at all fire-rated assemblies. Pipe sleeves, 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 walls, floors (including first floor slab on grade), partitions, and slab on grade 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

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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, Use trapeze hangers on pipes running parallel and close together. 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. All support block hardware shall be hot dipped galvanized. For roof mounted piping, provide approved pipe supports every four feet for Polyvinyl Chloride (PVC), and every six feet for Copper piping.
1. For flat roof installations, roof mounted pipe supports shall be installed on 12" x 12" slip sheets matching the roofing material, either white TPO or EPDM. Base of pipe supports shall be adhered to

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slipsheet using M-1 structural adhesive. Slipsheet shall be adhered to roof surface using adhesive compliant with roof warranty.

- 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. 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.
- I. Support and fasten fixtures and equipment in an approved manner.
- J. 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".

2.2 DUCT AND 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.
- B. Fit ductwork passing through floors, walls, or ceilings with 22-gauge galvanized sheet-metal sleeves. Sleeves shall be large enough to completely close hole around duct and shall be at least 1/2" larger than outside dimensions of duct and insulation. Provide flanges on both sides of penetrations to cover the wall edge. For uncovered ducts, sleeves shall be of same material as duct. Secure sleeves and flanges in an approved manner.

2.3 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.

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2.4 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.

2.5 ELECTRICAL WORK FOR EQUIPMENT UNDER MECHANICAL SYSTEMS

- A. 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.
- B. 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.
- C. 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.
- D. 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.
- E. Auxiliary 120-Volt contacts shall be provided to give control and interlocking as required or as indicated.
- F. Where control voltages are different from motor voltages, a control-voltage transformer shall be provided as a part of the starter.
- G. 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.

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- H. 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.
- I. Short-Circuit Current Rating (SCCR) on HVAC equipment nameplates:
 - 1. The nameplate for all HVAC equipment shall be provided with SCCR in accordance with the National Electric Code (NEC) Article 440.4(B). The SCCR shall meet or exceed the SCCR indicated on the contract documents.
- J. The Mechanical Contractor shall coordinate the following electrical requirements with the Electrical Contractor prior to ordering any equipment:
 - 1. Number of electrical connections
 - 2. Number and size of feeder conductors
 - 3. Number and size of feeders' terminal lugs
 - 4. Maximum overcurrent protection
 - 5. Size and type of fuses

2.6 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.

2.7 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.

2.8 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.

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- 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.
- D. Pipe outlets of drip pans, condensate drains, backflow preventers and other drain points to floor drain unless otherwise indicated.
- 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. 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.
- G. 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.

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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.

- H. Make copper tubing sweat joints with noncorrosive flux and lead-free solder recommended for service encountered or as indicated.
- I. 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.
- J. All copper pipe joints shall be made with fittings. Formed bell & spigot couplings and mechanical "T" formed joints are not acceptable.

3.2 TRENCH EXCAVATION AND BACKFILL

- A. Excavate trenches to line and grades required. Excavate trenches with 8" clearance on each side of pipe as a minimum or as required by the piping manufacturer. Do not carry excavation below bottom of pipe and, before pipe is laid, fill space between bottom of pipe with gravel. Excavation below required level shall be backfilled at Contractor's expense and thoroughly tamped as directed. Tamp bottom of trenches hard and grade to secure required fall. Remove unstable soil to depth determined by the Engineer and replace with gravel or crushed stone. Erect, maintain and safeguard temporary bridges, walks, barricades, or crossings where necessary to maintain traffic flow.
- B. Perform necessary pumping and bailing as required to keep trench in satisfactory condition for pipe laying.
- C. Backfill after pipelines have been tested, inspected, approved and forms removed. Backfill shall be material from excavation, borrow of sand, gravel, or other approved material free from large clods and undesirable matter.
- D. Place evenly and carefully in horizontal layers around and over pipe in 6" maximum layers. Compact and tamp each layer by hand or with suitable equipment to density that will prevent excessive settlement or shrinkage and until pipe has 18" cover. Continue backfill in 12" layers, tamp in approved manner. Dispose of surplus material.

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 Architect.

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3.4 EQUIPMENT SUPPORTS

- 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. Fasten wall-mounted or ceiling-hung equipment to building structures or inserts as approved.
- C. Provide adequate supports for roof-mounted mechanical equipment. Supports shall keep equipment clear of roof and transmit weight to roof structure as approved by Architect.
- D. The Contractor shall submit for review physical data for each unit supported from the building structure, either suspended from or attached to the building structure. The physical data shall include the equipment operating weight, corner weights, and center of gravity.

3.5 NOISE AND VIBRATION

- A. Mechanical and electrical equipment shall operate without objectionable noise or vibration as determined by the Architect.
- 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 FLASHING

- A. Provide cap flashing for roof-mounted fans, goosenecks, air intakes, vents and the like.

3.7 PROTECTION OF EQUIPMENT AND MATERIALS

- A. Responsibility for care and protection of mechanical equipment rests with Contractor until Substantial Completion of the work.

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- 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 (MERV13) 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 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 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., 4-way cassettes, shut-off terminal boxes, air handling unit, 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.
- 3.8 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

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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. Air handling units
 - 2. Split system air conditioning units
- 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.

3.9 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. Provide adequate access to all points of measurement and adjustment and ensure that all dampers operate freely.
- E. 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.
- F. 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.
- G. Carefully review the drawings and Specifications for the various systems noting all facilities incorporated in the design for purposes of adjusting and balancing.

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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.

3.10 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. 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:

<u>Insulated and Un-Insulated Pipe Size</u>	<u>Label Heights</u>
Up to 1"	1"
1-1/4" to 2"	2"
2-1/2" to 4"	3"
4" and above	4"

- D. 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".
- E. 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.

3.11 EQUIPMENT MARKING

- A. Label all mechanical equipment, including starters, control panels, boilers, chillers, fans, VAV boxes, pumps, air-handling units, and thermostats.

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- 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.
- E. Thermostat labels shall be a self-adhesive type. Labels shall identify the equipment served by the thermostat.

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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.

B. 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. All ductwork and connections of duct to air terminals have been checked and no visible or audible leakage exists.
4. 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.
5. 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: _____.

END OF SECTION 230100

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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 the 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, Sprinkler 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 to air handling unit, 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.

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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 to be operational to protect the building and personnel.

PART 2 - PRODUCTS

2.1 HEAT GENERATION (NOT USED)

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. Cabinet Exhaust Fans: Fans shall be constructed of galvanized steel, with forward curved direct-drive centrifugal fans. Provide factory-wired plug-type disconnect and gravity back-draft damper. Provide aluminum ceiling grille for all ceiling mounted fans.
3. 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

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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.

4. Provide solid-state speed controls for all direct drive fans except for EC motors.
5. All fans shall be statically and dynamically balanced.
6. Install as required for quiet operation.

2.4 UNITARY EQUIPMENT

A. Split System Air Handling Unit (AHU-1)

1. General
 - a. This section includes the design, controls, and installation requirements for indoor air handling units.
2. Quality Assurance
 - a. Unit shall be certified in accordance with UL Standard 1995/CSA C22.2 No. 236, Safety Standard for Heating and Cooling Equipment.
 - b. Unit shall be safety certified by ETL and be ETL US and ETL Canada listed. Unit nameplate shall include the ETL label.
3. 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 provided. Run test report shall be supplied with the unit in the control compartment's literature packet, and also available electronically after the unit ships.
 - b. Shop Drawings: Unit drawings shall be provided that indicate assembly, unit dimensions, clearances, and connection details. Computer generated fan curves for each fan shall be submitted with specific design operation point noted. Wiring diagram shall be provided with detail for power and control systems and differentiate between factory installed and field installed wiring.
4. Delivery, Storage, and Handling

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- a. Unit shall be on a wooden pallet with skeleton crating 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.
5. Warranty
- a. Refer to Specification Section 23 01 00 for warranty requirements.
6. Manufacturer
- a. Products shall be provided by the following manufacturers:
 - 1) Basis of design is AAON "V3" model. Units may also be provided by DAIKIN "RCS", or TRANE "Odyssey".
 - b. Alternate equipment by the manufacturers listed above may be considered for approval that includes at a minimum:
 - 1) VFD driven direct drive backward curved plenum supply fans
 - 2) Double wall cabinet construction
 - 3) Insulation with a minimum R-value of 6.25
 - 4) Hinged access doors with lockable handles
 - 5) LED service lights in the control panel
 - 6) Designed, engineered, and manufactured in the USA
 - 7) All other provisions of this specification must be satisfactorily addressed
7. General Description
- a. Indoor air handling units shall include filters, supply fans, and unit controls.
 - b. Unit shall have a draw-through supply fan configuration and discharge air vertically.
 - c. Unit shall be factory assembled and tested including leak testing of the coils and run testing of the supply fans and factory wired system. Run test report shall be supplied with the unit in the control compartment's literature packet, and also available electronically after the unit ships.
 - d. Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel.
 - e. Unit components shall be labeled, including electrical and controls components.
 - f. Installation, Operation and Maintenance manual shall be supplied within the unit.

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- g. Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment's hinged access door.
 - h. Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment's hinged access door.
- 8. Construction
 - a. All cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam injected panels.
 - b. Unit insulation shall have a minimum thermal resistance R-value of 6.25. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D1929-11 for a minimum flash ignition temperature of 610°F.
 - c. Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture accumulation on the insulation, provides a cleanable interior, reduces heat transfer through the panel and prevents exterior condensation on the panel.
 - d. Unit shall be designed to reduce air leakage and infiltration through the cabinet. Sealing shall be included between panels and between access doors and openings to reduce air leakage. Piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.
 - e. Access doors shall be flush mounted to cabinetry.
 - f. Units shall include double-sloped 304 stainless steel drain pan. Drain pan connection shall be on the right hand side of unit with a 1" MPT fitting.
 - g. Unit shall include a high condensate level switch that shuts down the unit when a high-water level is detected in the drain pan.
 - h. Unit shall include factory wired control panel compartment LED service lights.
- 9. Electrical
 - a. Unit shall be provided with an external control panel with separated low voltage control wiring. Access to control panel shall be through service access door with removable pin hinges and lockable quarter turn handle.
 - b. Unit shall be provided with standard power block for connecting power to the unit.
 - c. Unit shall include a factory installed 24V control circuit transformer.
 - d. Unit shall have a 65KAIC SCCR.
- 10. Supply Fans
 - a. Unit shall include direct drive, unhooded, backward curved, plenum supply fans.
 - b. Blower and motor assembly shall be dynamically balanced.

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- c. Motor shall be IE5 efficiency permanent magnet totally enclosed motor. Variable frequency drive shall be factory wired and mounted in the unit.
- d. Blower and motor assembly shall utilize neoprene gasket.
- e. Access to supply fan shall be through removable bolted access panels on the top and bottom of the unit or through service access door with piano hinges and lockable quarter turn handles located on the opposite access side of the unit.

11. Refrigeration System

- a. Coil shall two circuits and interlaced circuitry.
- b. Air handling unit and matching condensing unit shall be capable of operation as an R-454B split system air conditioner.
- c. Modulating hot gas reheat shall be provided on the lead refrigeration circuit. Air handling unit shall be provided with hot gas reheat coil, a check valve on the liquid line, and a check valve on the hot gas reheat line. The matching condensing unit must include modulating 3-way reheat valve, liquid line receiver, electronic controller, supply air temperature sensor and a dehumidification control signal terminal. This allows the system to have a dehumidification mode of operation and includes supply air temperature control to prevent supply air temperature swings and overcooling of the space. Reheat line connections shall be labeled, extend beyond the unit casing and be located near the suction and liquid line connections for ease of field connection. Connections shall be factory sealed on both the interior and exterior of the unit casing to minimize air leakage.
- d. Unit shall be configured as heat pump. Refrigeration circuit shall be equipped with a thermal expansion with an external check valve on the indoor coil.
- e. Reversing valve, outdoor coil thermal expansion valve, bi-flow filter drier, and liquid line receiver shall be factory installed in the matching condensing unit.

12. Electric Heating

- a. Unit shall include an electric heater consisting of electric heating coils, fuses, contactors, and a high temperature limit switch, with capacities as shown on the plans.
- b. Electric heating access shall be through bolted service access panel with handle.
- c. Electric heating coils shall be located in the reheat position downstream of the supply fan.
- d. Electric heater shall have full modulation capacity controlled by an SCR (Silicon Controlled Rectifier). Controller shall provide the heating control signal to control the amount of heating.

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- e. Auxiliary electric heating capacity shall be sized to meet heating leaving air temperature setpoint when heat pump heating is in operation. Dual fuel auxiliary heating capacity shall be available for operation when heat pump heating is in operation.
 - f. Emergency electric heating capacity shall be sized to meet heating leaving air temperature setpoint when heat pump heating is not in operation. Auxiliary electric heating capacity shall be sized to meet heating leaving air temperature setpoint when heat pump heating is in operation. Unit shall include 1 stage of auxiliary electric heating capacity.
13. Filters
- a. Unit filter access shall be through service access door with piano hinges and draw latches.
 - b. Unit shall include 2 inch thick, pleated panel filters with MERV rating of 13, upstream of the cooling coil.
 - c. Unit shall include a clogged filter switch that senses that pressure drop across the unit filter bank and cooling coil.
14. Controls
- a. Unit shall be provided with a proof of airflow switch. When airflow is not detected, other electrical components cannot power on.
 - b. Unit shall be provided with an external control panel with separated low and high voltage control wiring.
 - c. Access to external control panel shall be through an access door with removable pin hinges and lockable quarter turn handles.
 - d. Unit controller shall be capable of controlling all features and options of the unit. Controller shall be factory installed in the unit controls compartment and factory tested.
 - e. Controller shall be capable of standalone operation with unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling available without dependence on a building management system.
 - f. Controller shall have an onboard clock and calendar functions that allow for occupancy scheduling.
 - g. Controller shall include non-volatile memory to retain all programmed values without the use of a battery, in the event of a power failure.
 - h. Unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling shall be accomplished with connection to interface module with LCD screen and input keypad, interface module with touch screen, or with connection to PC with free configuration software. Controller shall be capable of connection with other factory installed and factory provided unit controllers with individual unit configuration, setpoint adjustment, sensor status viewing, and occupancy scheduling available from a single unit. Connection between unit controllers shall be with a

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modular cable. Controller shall be capable of communicating and integrating with a LonWorks or BACnet network.

15. Installation, Operation, and Maintenance
 - a. Installation, Operation and Maintenance manual shall be supplied with the unit.
 - b. Installing contractor shall install unit, including field installed components, in accordance with Installation, Operation and Maintenance manual instructions.
 - c. Start up and maintenance requirements shall be complied with to ensure safe and correct operation of the unit.
- B. Split System Condensing Unit (CU-1)
 1. General
 - a. This section includes the design, controls and installation requirements for air-cooled condensing units.
 2. Quality Assurance
 - a. Unit shall be certified in accordance with UL Standard 1995/CSA C22.2 No. 236, Safety Standard for Heating and Cooling Equipment.
 - b. Unit and refrigeration system shall comply with ASHRAE 15, Safety Standard for Mechanical Refrigeration.
 - c. Energy Efficiency Ratio (EER) shall be equal to or greater than 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 ETL label.
 3. Submittals
 - a. Product Data: Literature shall be provided that indicates dimensions, operating and shipping weights, capacities, ratings, factory supplied accessories, electrical characteristics, and connection requirements. Installation, Operation and Maintenance manual with startup requirements shall be provided.
 - b. Shop Drawings: Unit drawings shall be provided that indicate assembly, unit dimensions, 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.
 4. Delivery, Storage, and Handling
 - a. Unit shall be shipped on a wooden pallet with skeleton crating prior to shipment with doors bolted shut 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.

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- c. Unit shall be stored in a clean, dry place protected from construction traffic in accordance with the Installation, Operation and Maintenance manual.
- 5. Warranty
 - a. Manufacturer shall provide startup and full-service warranty in accordance with Specification Section 23 01 00.
- 6. Manufacturer
 - a. Products shall be provided by the following manufacturers:
 - 1) Basis of design is AAON "CFA" model. Units may also be provided by DAIKIN or TRANE.
 - b. Alternate equipment by the manufacturers listed above may be considered for approval that includes at a minimum:
 - 1) R-454B refrigerant
 - 2) Hinged access doors with lockable handles
 - 3) 2,500 hour salt spray exterior corrosion protection
 - 4) Designed, engineered, and manufactured in the USA
 - 5) All other provisions of the specifications must be satisfactorily addressed.
- 7. General Description
 - a. Air-Source heat pump condensing unit shall include compressors, air-cooled condenser coils, condenser fans, suction and liquid connection valves, accumulator, receiver, reversing valve, filter driers with check valves, and thermal expansion valves.
 - b. Unit shall be factory assembled and tested including leak testing of the coil and run testing of the completed unit. Run test report shall be supplied with the unit in the control compartment.
 - c. Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel.
 - d. Unit components shall be labeled, including pipe stub outs, refrigeration system components and electrical and controls components.
 - e. Installation, Operation and Maintenance manual shall be supplied within the unit.
 - f. Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment's access door.
 - g. Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment's access door.
- 8. Construction
 - a. Unit shall be completely factory assembled, piped, and wired and shipped in one section.

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- b. All cabinet walls, access doors, and roof shall be fabricated of G90 galvanized steel panels.
 - c. Unit shall be specifically designed for outdoor application.
 - d. Access to compressors and control components shall be through hinged access doors with quarter turn, lockable handles.
 - e. Access to condenser coils and fans is through removable access panels.
 - f. Exterior paint finish shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.
 - g. Unit shall include lifting lugs.
 - h. Unit shall include forklift slots.
 - i. Unit shall be provided with hail guards to protect condenser coils.
9. Electrical
- a. Unit shall be provided with standard power block for connecting power to the unit.
 - b. Control circuit transformer and wiring shall provide 24 VAC control voltage from the line voltage provided to the unit.
 - c. Unit shall have a 5kAIC SCCR.
 - d. Air-source heat pump shall include an optimized start defrost cycle to prevent frost accumulation on the outdoor coil during heat pump heating operation and to minimize defrost cycle energy usage. If the temperature of the outdoor heat exchanger and/or the suction line is less than a predetermined value, a deferred defrost cycle is initiated wherein the defrost cycle starts after a variable, continuously optimizing, time interval has elapsed. The defrost cycle is terminated when the relative temperatures of the outdoor heat exchanger and/or the suction line indicate that sufficient frost is melted from the heat exchanger to ensure adequate time between successive defrost cycles for optimizing the efficiency and reliability of the system, or after a predetermined time interval has elapsed, whichever condition occurs first. During defrost cycle all compressors shall energize, reversing valves shall energize, and auxiliary heat shall energize.
 - e. Unit shall be provided with factory installed and factory wired, non-fused disconnect switch.
 - f. Unit shall be provided with phase and brown out protection which shuts down all motors in the unit if the electrical phases are more than 10% out of balance on voltage, the voltage is more than 10% under design voltage, or on phase reversal.
10. Refrigeration System
- a. Each compressor shall be variable speed and furnished with a crankcase heater.

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- b. Compressors shall be mounted in an isolated service compartment which can be accessed without affecting unit operation. Lockable hinged access doors shall provide access to the compressors.
 - c. Compressors shall be isolated from the base pan with the compressor manufacturer's recommended rubber vibration isolators and mounted on an elevated compressor deck, to reduce any transmission of noise from the compressors into the building area.
 - d. Each refrigeration circuit shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant safety controls, Schrader type service fittings on both the high pressure and low pressure sides, and service valves for liquid and suction connections. Liquid line filter driers shall be factory provided and installed. Field installed refrigerant circuits shall include the low side cooling components, refrigerant, thermal expansion valve, liquid line and insulated suction line.
 - e. Unit shall include a factory holding charge of R-454B refrigerant and oil. Adjusting the charge of the system will be required during installation.
 - f. Unit shall be configured as an air-source heat pump. Each refrigeration circuit shall be equipped with a bi-flow liquid line filter drier, reversing valve, suction line accumulator, liquid line receiver, and a bypass loop with check valve around a thermal expansion valve. Reversing valve shall de-energize during the heat pump heating mode of operation. The matching indoor air handler must include a bypass loop with check valve around the thermal expansion valve.
 - g. The factory installed controls shall include a 3 minute off delay timer to prevent compressor short cycling. The controls shall also include an adjustable, 20 second delay timer for each additional capacity stage to prevent multiple capacity stages from starting simultaneously and adjustable compressor lock out.
 - h. Units shall be provided with a suction pressure transducer on each refrigeration circuit.
11. Fans
- a. Condensing unit shall be provided with an electrically commutated motor (ECM) condenser fan, condenser head pressure controller, and discharge pressure transducers for modulating head pressure control to allow cooling operation down to 35°F. Fan motor shall be weather protected, single phase, direct drive, and totally enclosed air over (TEAO) with electronic protection.
12. Installation, Operating, and Maintenance
- a. Installation, Operation and Maintenance manual shall be supplied with the unit.

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- b. Installing contractor shall install unit, including field installed components, in accordance with Installation, Operation and Maintenance manual instructions.
 - c. Start up and maintenance requirements shall be complied with to ensure safe and correct operation of the unit.
- C. 4-Way Ceiling Cassette Unit (2'x2') (IU-9/OU-9):
- 1. General
 - a. Indoor Unit
 - 1) Unit shall be manufactured by LG. Acceptable alternate manufacturers include Mitsubishi and Daikin.
 - 2) Unit shall be designed for indoor application.
 - 3) Unit shall be designed to mount recessed in the ceiling and have a surface mounted panel on the bottom of the unit.
 - 4) The unit shall be available in a 2' x 2' chassis.
 - b. Casing/Panel
 - 1) Unit case shall be manufactured using galvanized steel plate.
 - 2) The unit panel and grille shall be made of a white Acrylonitrile Butadiene Styrene (ABS) polymeric resin.
 - 3) The panel shall have a tapered trim edge, and a hinged, spring clip (screw-less) return air filter-grille door.
 - 4) Unit shall be provided with metal ears designed to support the unit weight on four corners.
 - 5) Ears shall have pre-punched holes designed to accept field supplied all thread rod hangers.
 - 6) Unit shall be supplied with snap off access panels to facilitate leveling of unit without removing the panel.
 - c. Cabinet Assembly
 - 1) Unit shall have four supply air outlets and one return air inlet.
 - 2) The supply air outlet shall be through four directional slot diffusers each equipped with independent oscillating motorized guide vanes designed to change the airflow direction.
 - 3) The panel vanes shall have a discharge range of motion of 40° in an up/down direction with capabilities of locking the vanes.
 - 4) The unit shall have a guide vane algorithm designed to sequentially change the predominant discharge airflow direction in a counterclockwise pattern.
 - 5) Guide vanes shall provide airflow in all directions.

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- 6) Unit shall be equipped with factory installed temperature thermistors for:
 - a) Return air
 - b) Refrigerant entering coil
 - c) Refrigerant leaving coil
- 7) Unit shall have a factory assembled, piped and wired electronic expansion valve (EEV) for refrigerant control.
- 8) Unit shall have a built-in control panel to communicate with other indoor units and to the outdoor unit.
- 9) The unit shall have factory designated branch duct knockouts on the unit case.
- 10) The unit shall have provision of fresh air ventilation through a knock-out on the cabinet.
- 11) The branch duct knockouts shall have the ability to duct up to 1/2 the unit airflow capacity.
- 12) The branch duct cannot be ducted to another room.
- 13) Unit shall have the following functions as standard:
 - a) Self-diagnostic function
 - b) Auto restart function
 - c) Auto operation function
 - d) Forced operation
 - e) Dehumidifying function
 - f) Sleep mode
 - g) Hot Start

d. Fan Assembly

- 1) The unit shall have a single, direct-drive turbo fan made of high strength ABS HT-700 polymeric resin.
- 2) The fan impeller shall be statically and dynamically balanced.
- 3) The fan motor is Brushless Digitally commutated (BLDC) with permanently lubricated and sealed ball bearings.
- 4) The fan motor shall include thermal, overcurrent and low RPM protection.
- 5) The fan/motor assembly shall be mounted on vibration attenuating rubber grommets.
- 6) The fan speed shall be controlled using microprocessor based direct digitally controlled algorithm that provides a minimum of four pre-programmed fan speeds in the heating mode and fan only mode and five speeds in the cooling mode. The fan speed algorithm provides a field selectable fixed speed.
- 7) A field setting shall be provided to vary air throw pattern to compensate for high ceiling installations.

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- 8) In cooling mode, the indoor fan shall have the following settings: Low, Med, High, Super high, Power Cool, and Auto.
 - 9) In heating mode, the indoor fan shall have the following settings: Low, Med, High, Super high and Auto.
 - 10) Unit shall have factory installed motorized louvers to provide flow of air in an up and down direction for uniform airflow.
- e. Filter Assembly
- 1) The return air inlet shall have a factory supplied removable, washable filter.
 - 2) The filter access shall be from the bottom of the unit without the need for tools.
- f. Coil Assembly
- 1) Unit shall have a factory-built coil comprised of aluminum fins mechanically bonded on copper tubing.
 - 2) Unit shall have a minimum of 2 rows of coils.
 - 3) Unit shall have a factory supplied condensate drain pan below the coil constructed of EPS (expandable polystyrene resin).
 - 4) Unit shall include an installed and wired condensate drain lift pump capable of providing minimum 27.5-inch lift from bottom surface of the unit.
 - 5) The drain pump shall have a safety switch to shut off the unit if condensate rises too high in the drain pan.
 - 6) Unit shall have provision of 45° flare refrigerant pipe connections.
 - 7) The coil shall be factory pressure tested at a minimum of 551 psig.
 - 8) All refrigerant piping from outdoor unit to indoor unit shall be field insulated. Each pipe should be insulated separately. Thickness and heat transfer characteristics shall be determined by the design engineer and shall meet all code requirements.
- g. Microprocessor Control
- 1) The unit shall have a factory installed microprocessor controller capable of performing functions necessary to operate the system.
 - 2) The unit shall be able to communicate with other indoor units and the outdoor unit using a field supplied minimum of 18 AWG, two core, stranded, twisted and shielded communication cable.

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- 3) The unit controls shall operate the indoor unit using one of the five operating modes:
 - a) Auto operation
 - b) Heating
 - c) Cooling
 - d) Dry
 - e) Fan only
- 4) The unit shall be able to operate in either cooling or heating mode for testing and/or commissioning.
- 5) The unit shall be able to operate with the fan turned off during system cooling thermal off.
- 6) The unit shall have adjustable, multi-step cooling and heating mode thermal on/off temperature range settings.
- 7) The system shall include a product check function to access and display indoor unit type and capacity from a wired programmable thermostat controller.
- 8) Unit shall have a field settable method to choose auto fan speed change operation based on mode of operation, on/off fan operation based on mode of operation, or continuous minimum set fan speed operation.

h. Electrical

- 1) The unit electrical power shall be 120/1/60 (V/Ph/Hz).
- 2) The unit shall be capable of operating within voltage limits of +/- 10% of the rated voltage.

i. Controls

- 1) Unit shall use controls provided by the manufacturer to perform all functions necessary to operate the system effectively and efficiently and communicate with the outdoor unit over an RS-485 daisy chain.

j. Warranty

- 1) Refer to Specification Section 230100 for all warranty requirements.

2.5 TERMINAL EQUIPMENT (NOT USED)

2.6 HVAC PIPING AND SPECIALTIES

A. PIPING

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1. 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. 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
 - c. Below ground: refer to Specification Section 220500 Plumbing
3. Refrigerant piping:
 - a. Above ground
 - 1) Copper Type ACR
4. Type L copper pipe shall conform to ASTM B42, and be assembled with wrought-copper soldering fittings using 95-5 solder or with press on fittings as specified herein.
5. Schedule 40 PVC pipe shall be assembled in strict accordance with manufacturer's instructions. Solvent cement shall conform to ASTM D2564.
6. ACR tubing shall be nitrogen-filled assembled with wrought-copper soldering fittings using silver solder.
7. 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.
8. All concealed condensate drain piping shall be labeled at its termination point to indicate whether the drain piping is connected to a primary or secondary (auxiliary) mechanical unit drain.

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.

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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 ductwork from variable air volume air handlers to the inlet of VAV terminal boxes shall be 3" w.g. pressure class construction and shall be double-wall round or double wall flat oval. 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.
5. Round duct and fittings shall be manufactured by a company for whom the manufacture of spiral duct and welded fittings has been a principal business for at least 15 years. Contractor fabricated round spiral duct and fittings will not be acceptable.
6. 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.
7. Duct shall be provided in continuous, un-joined lengths wherever possible. Except when interrupted by fittings, round spiral duct sections shall not be less than 12 feet long.
8. Round fittings may be spot welded and bonded.
9. Insulation shall have the following UL rating:

Flame Spread	10-20
Fuel Contributed	10-15
Smoke Developed	0-20
10. Round fittings shall be UNITED MCGILL CORPORATION, or equal by VORTEX METAL MANUFACTURING, HAMLIN SHEET METAL, SEMCO MANUFACTURING, LINDAB, INC or EASTERN SHEET METAL.
11. Round ductwork shall not be delivered to the job site until just prior to erection. Ductwork with dents or other damages shall not be accepted.
12. 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/ft²), unless otherwise shown on the contract documents. Sheets shall be free of pits, blisters, slivers, and un-galvanized spots.
13. 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

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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 $\frac{1}{2}$ 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.

14. Provide flexible connections of fiberglass between ducts and air-handling unit connections, 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.

15. 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, square elbows shall be provided with double wall turning vanes. 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.
16. 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.
17. Connect ductwork to intake and discharge louvers, dampers, and other work installed in various trades requiring sheet-metal connections.

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18. Make sheet-metal connections to masonry work airtight and watertight in approved manner.
19. 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.
20. Provide square to round transition fittings with balancing damper at all round-duct take-offs to supply diffusers and registers.
21. Provide access doors in building walls and ceilings where damper quadrants are concealed in shafts or above non-accessible ceilings.
22. Duct sizes are inside free area. Increase duct sizes as required.
23. Ductwork and accessories shall not be delivered to the job site until just prior to erection and must be stored in an approved manner.
24. All ductwork shall be internally cleaned by vacuuming prior to installation.
25. All ductwork open ends shall be sealed with polyethylene and duct tape during construction after hanging.

B. Back-Draft Dampers:

1. Duct-mounted back-draft dampers shall be RUSKIN Model BD6, or approved equal.

C. 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.

D. Gravity Exhaust Hoods

1. Provide gravity relief ventilators in quantity and in sizes indicated on drawing. Unit shall be GREENHECK "FGR/FGI," COOK "GR/GI," or TWIN CITY FANS "MGR/MGI."
2. General Description
 - a. Ventilator shall be low silhouette for relief applications with natural gravity or negative pressure system.

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- b. Each unit shall bear a permanently affixed manufacturer's nameplate containing the model number and individual serial number.
 3. Hood shall be constructed of precision formed, arched aluminum panels with interlocking seams. Vertical end panels shall be fully locked into hood end panels. Base height shall be standard of 5". Curb cap shall be 6" larger than throat size and shall include pre-punched mounting holes for installation.
 4. Birdscreen shall be constructed of 1/2" aluminum mesh and mounted horizontally across the intake area of the hood.
 5. Hood support shall be constructed of galvanized steel and fastened so that hood can either be removed completely from the base or hinged open.
 6. For flat roof applications, unit shall be provided with welded, straight sided curb with 2 inches of flashing flange and wood nailer. Curb shall be galvanized steel with 1" insulation and 2" flashing flange.
 7. Unit shall be provided with gravity backdraft damper balanced for minimal resistance to flow. Damper shall have galvanized frame with pre-punched mounting holes.
- E. Roof Curbs and Equipment Rails:
1. Provide 18-gauge galvanized roof curbs for all roof-mounted equipment where curbs are not otherwise specified. Curbs shall be insulated with wood nailers and be 14" in height. Curbs shall be constructed to match the slope of the roof where installed.
 2. Provide 18-gauge galvanized equipment rail with unitized construction with integral base plate, continuous welded corner seams, pressure treated wood nailer, and counterflashing with stainless steel screws. Rail shall be internally reinforced to conform with the manufacturer's load bearing factors. Curb shall be 14" in height. Rails shall be RPS "ER-4A," PATE "ES-5," or KEES "RC."
- F. Shut-Off Electric Heat Variable Air Volume Terminals
1. General: Provide variable air volume terminals complete with casing, primary air valve and discharge plenum, where indicated. Units shall be manufactured by GREENHECK., PRICE, TRANE CO. or approved equal. Acoustical data shall be certified in accordance with ARI 880. Acoustical data shall consider effect of discharge plenum and outlet combination.
 2. Casing: Provide 22-gauge, acoustically lined, galvanized-steel casing. The interior surface of the unit casing shall be acoustically and thermally lined with 1-inch, 1.5 lb/ft³ density glass fiber with foil facing. The insulation shall be UL listed and meets NFPA-90A and UL 181 standards as well as bacteriological standard ASTM C 665. There shall be no exposed edges of insulation (complete metal encapsulation).

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3. Primary Air Valve: The primary air inlet connection shall be an 18-gage galvanized steel cylinder sized to fit standard round duct. A multiple-point, averaging flow sensing ring shall be provided with balancing taps for measuring +/-5% of unit cataloged airflow. An airflow-versus-pressure differential calibration chart shall be provided. The damper blade shall be constructed of a closed-cell foam seal that is mechanically locked between two 22-gage galvanized steel disks. The damper blade assembly shall be connected to a cast zinc shaft supported by self-lubricating bearings. The shaft shall be cast with a damper position indicator. The valve assembly shall include a mechanical stop to prevent over-stroking. At 4.0 in. wg, air valve leakage shall not exceed 1% of cataloged airflow.
4. Electric Heating Coil: Provide factory-mounted electric heater, UL recognized resistance open-type heater with airflow switch. Heater shall also contain a disc-type automatic pilot duty thermal primary cutout, and manual reset load carrying thermal secondary device. Heater element material shall be nickel-chromium. The heater terminal box shall be provided with 7/8" knockouts for field power supply. Terminal connections shall be plated steel with ceramic insulators.
 - a. Provide an air pressure device designed to disable the heater when the system fan is off.
 - b. Provide mercury electric heater 24V contactor for use with direct digital controls.
 - c. Line Fuse: A safety fuse located in the electric heater's line of power to prevent power surge damage to the electric heater. A line fuse shall be provided for the fan motor to prevent power surge damage to the motor.
 - d. Disconnect Switch: A factory provided disconnect switch with an interlocking door on the heater control panel.
5. Provide factory mount controller and damper operator.
6. Units shall have removable access panel or access door for service access.
7. Units shall be installed with strict attention paid to manufacturer's recommended length of straight inlet duct.
8. Automatic Controls: Provide factory-installed automatic (direct digital) controls provided by the control vendor. The control vendor shall furnish and variable volume terminal unit manufacturer shall install Direct Digital Controller.
9. Controller shall provide the sequence of operation specified. Controller shall provide the required signals to achieve pressure independent operation throughout the specified volume range of the unit.
10. Variable volume terminal unit manufacturer shall examine terminal unit locations indicated on drawings and shall locate controllers on most accessible side of unit. All costs associated with factory mounting of vendor's controls shall be included in this Section.

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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 indoor ceiling cassette 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. 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-Ibar, AMERICAN ION, ACTIVE AIR SOLUTIONS, PHENOMENAL AIRE, 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

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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 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

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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 on the plans. The contractor shall follow all manufacturer IOM instructions during installation.

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 m³/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.

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 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.

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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.

PART 3 - EXECUTION

3.1 TESTS

- A. Refer to Section 230593 "Testing, Adjusting and Balancing" for related requirements.
- B. At their 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. 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.

END OF SECTION 230500

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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 220500 "Plumbing" and 230100 "Mechanical General Provisions" and 230593 "Testing, Adjusting and Balancing" 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

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- A. Provide all necessary instrumentation required to measure and adjust the HVAC air systems and domestic hot water recirculating 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 systems and domestic hot water recirculating 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, Plumbing 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 duct and equipment, including valves, controls, dampers, etc., to properly perform to $\pm 10\%$ 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.
 - 1. Electric Shut Off VAV boxes shall be balanced in a manner that assures the design primary airflow is delivered to the VAV box at maximum and minimum air flow. The manufacturer provided flow measurement device may or may not be accurate due to upstream duct conditions. (see 3.2.H.7 for reporting requirements)

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- E. The Test and Balance Agency shall perform the following:
1. Adjust fan RPM, 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. Adjust each air handler to obtain designed airflow.
 5. Adjust dampers to provide design outside air quantities.
 6. Adjust airflow exhausted from and supplied to hoods.
 7. 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.
 8. 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. This shall include the domestic hot water recirculating system balancing valve.
- 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.

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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. Temperatures for each air handling unit at maximum capacity including the following measurements:
 - a. Entering and Leaving air temperature at each coil.
 10. Air Handling unit is defined as any equipment that consists of a fan and coil, including Air Handling Units, etc.
 11. Nameplate data of each piece of HVAC equipment installed.
 12. Final percent setting after adjustment of each balancing valve where applicable.
- I. All domestic hot water flow measuring and balancing valves shall be balanced for flow indicated in the contract documents by the Plumbing Contractor. Balanced flow shall be reported in the final TAB Report.
 - J. 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.
 - K. 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 $\pm 5\%$ 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

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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.

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- 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 °F.
- B. Blanket Type in unconditioned space: 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 °F.
- C. Board Type in unconditioned 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 °F.

2.4 ACOUSTIC DUCT LINER

- A. Fiberglass duct liner shall not be used.

2.5 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.

2.6 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

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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.

2.7 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:

Condensate Drain Above Floor:	1/2" thickness
Storm Drains Above Floor that Receive Condensate:	1/2" thickness
Refrigerant Liquid Piping	3/4" thickness flexible unicellular
Refrigerant Gas (Suction) Piping	3/4" thickness flexible unicellular for pipe sizes up to 1" and 1" thickness flexible unicellular for pipe sizes over 1"
Cold Water:	1/2" thickness for pipe sizes up to 1-1/4" and 1" thickness for pipe sizes over 1-1/4".

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Domestic Hot and Hot Water
Recirculating: 1" thickness for pipe sizes up to 1-1/4"
and 1-1/2" thickness for pipe sizes
over 1-1/4".

Rain Leaders and Overflow Rain
Leaders, including Roof Drain and
Overflow Roof Drain Bodies: 1" thickness, except insulation not
required where piping is concealed
in walls.

- B. Fittings and valves on insulated piping shall be insulated with fiberglass blanket to thickness equal to adjoining pipe insulation unless otherwise noted. On all fittings and valves, insulation shall be finished with a preformed PVC jacket.
- C. All valves and piping accessories above ceilings handling cold water shall be completely insulated to prevent condensation.
- D. Fittings and valves on refrigerant piping shall be insulated with cut sections of flexible unicellular insulation of thickness equal to adjoining pipe insulation.
- E. All flexible unicellular and glass fiber piping insulation exposed to the weather shall be provided with PVC jacketing.
- F. No piping shall be insulated until it has been tested and thoroughly cleaned.
- G. 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
- H. Hangers and supports for cold water piping shall not injure or pierce insulation.

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

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Exposed Supply, Return,
Relief and Outside Air Ductwork
Externally Insulated:
(mechanical mezzanines) 2" thickness rigid board

Plenums: 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.

END OF SECTION 230700

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SECTION 230800 - COMMISSIONING

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:

All HVAC and related systems

- 1. Air Handling Unit (AHU's)
- 2. Condensing Units (CU's)
- 3. Shut-off Terminal Units
- 4. Exhaust Fans
- 5. Split System Heat Pump Unit

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.

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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. DALI report
 - iv. TABs report
 - v. Prefunctional Checklists completed by the installing Foreman.
 - vi. Functional Checklists completed by the Mechanical Contractor.
 - 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 90.1-2016, 6.7.2.4
- 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

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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 independent functional performance testing after receiving functional performance checklists from the Commissioning Agent.
 7. Contractor's functional performance testing with the Commissioning Agent.
 8. Contractor's completion of operating and maintenance manuals and submittal to the Commissioning Agent.
 9. Contractor's operation and maintenance personnel instruction.
 10. Commissioning Agent's preparation of the Final Commissioning Report and submission to Owner.
 11. 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

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change orders. Verification of the basic installation testing of systems shall be performed by the Contractor and shall include:

- a. 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. At the request of the Owner, Contractor shall provide trend data demonstrating equipment has been started and is operating within design parameters.
4. Contractor's Independent Functional Performance Testing: Prior to the functional performance testing with the Commissioning Agent onsite, the Commissioning Agent shall send all Functional Performance Checklists to the Contractor. The Contractor shall be responsible for performing all tests and verifications included in the Functional Performance Checklists. Upon completion of checklists for each piece of equipment, Contractor shall sign and return checklists to the Commissioning Agent.
5. Notification: The Commissioning Agent shall notify the Owner and Contractor when the startup verification has been completed, Contractor's independent functional performance testing has been completed, and the HVAC functional performance testing with the Commissioning Agent 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:

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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. Testing and balancing report is submitted to and approved by the Engineer.
 4. Direct digital control graphic screen shots of all equipment are submitted for approval by Engineer and Commissioning Agent, showing each unit operating within design parameters and Owner-designated operating schedules. Screen shots must be visible to Owner on Owner's front-end workstation when submitted.
 5. Demonstrate through trend data successful operation of the HVAC systems for a period of not less than 2 weeks. Any alarms during this 14-day period will restart the 14-day run time, unless otherwise advised by Engineer or Commissioning Agent.
 6. 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.

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2. The functional performance testing of systems by the Contractor shall begin after equipment and subsystems have been tested and documented 14-day alarm free operation. 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.

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- 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.
- J. Upon completion of the Function Performance testing process as listed in the above items, Contractor shall submit electronic copies of project Operation & Maintenance manuals to Engineer and Commissioning Agent for review and approval.

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:

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- 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.

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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-Tape: 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 always be available for inspection. At the time of final acceptance of the project, the Commissioning Agent shall furnish one hard copy and one electronic copy (located on a USB thumb drive) of the commissioning documentation to the Owner.
- 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

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COMMISSIONING PLAN

YATES ELEMENTARY SCHOOL SECURITY VESTIBULE & OFFICE ADDITION AND ALTERATIONS



Project No. 23-063

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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 without 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

Owners Representative

[OWNER PM AND TITLE]
[DEPARTMENT AND JURISDICTION]
[ADDRESS 1]
[ADDRESS 2]
[CONTACT #]

Architect

[ARCHITECT PM AND TITLE]
[ARCHITECT FIRM]
[ADDRESS 1]
[ADDRESS 2]
[CONTACT #]

Mechanical Engineer

Kevin Allen, P.E.
Thompson Consulting Engineers
22 Enterprise Parkway, Suite 120
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

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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 Section 230100, "Mechanical General Provisions," and Section 230500 "Heating, Ventilating, Air Conditioning" apply to this section.
- B. Refer to drawings for unit control sequences, control diagrams, and points lists.

1.2 SYSTEM DESCRIPTION

- A. Overview: NNPS has standardized on the Tridium Niagara N4 (or later Tridium version) platform for its user interface and building controllers for all building control systems. The controls contractor shall provide new BACnet compatible controllers for all new and existing HVAC equipment at Yates Elementary School. It is the intent of NNPS to utilize the BACnet interface on packaged equipment. The packaged equipment shall be provided with an expansion module to capture any points required for independent control of the equipment. The user interface shall have setpoint control and mode of operation command available through the BACnet interface. The unit mounted controller shall not rely on a building controller for operational commands. If required, the control contractor may utilize a building controller for status points not available through the BACnet interface or expansion modules. For all new and existing HVAC equipment not controlled through the unit BACnet interface, the controls contractor shall provide new BACnet compatible controllers. Where possible, the controls contractor may re-use existing compatible controllers to interface with the Tridium Niagara N4 platform. All new and existing equipment controllers shall be integrated into the Tridium Niagara N4 system architecture. The open protocol Direct Digital Controls (DDC) controllers provided by the control contractor and/or the HVAC equipment manufacturers shall be connected to the Niagara N4 platform. The controls contractor is responsible for integrating new and existing controls with the Niagara N4 supervising server located at NNPS plant.
- B. Protocols: NNPS standard is to utilize BACnet protocol within the building control system. BACnet factory supplied onboard controllers shall be in their "native" open protocol, avoiding the need for gateways or translators. There may be some instances where a gateway or translator is the only method to integrate a controller, but those shall be submitted to and approved by the consultant engineer on a case-by-case basis.
- C. DDC Controllers: The building control system will consist of DDC controllers that can stand-alone operate each piece of HVAC equipment (existing and new)

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or an HVAC system (existing and new) without the use of more than one (1) controller per equipment or system. The DDC controllers will be a combination of factory supplied controllers and control contractor provided and field installed controllers. The coordination of factory controllers vs. field controllers, sensors and integration will be the responsibility of the controls contractor to coordinate with the HVAC equipment providers. Reuse existing controllers where possible.

- D. **Factory Installed Controllers:** When a factory installed controller is provided with the HVAC equipment, the manufacturer is required to expose all functional and operational points within that controller to the open protocol communication port on the controller. This may require the manufacturers to create "shadow points" that mirror internal points within the onboard controller. The intent is not to display every point on the user interface graphics, but to ensure that all points are accessible to the building control system. The controls contractor shall coordinate with the equipment supplier to ensure the handshake between the building control system and the factory supplied controller is 100% accurate and reliable information. The controls contractor shall be responsible for all field installation of sensors and control wiring for factory supplied controls.
- E. **Building Controllers:** The controls contractor shall furnish and install Building Controllers to incorporate all the existing and new DDC controllers and factory controllers into one seamless harmonic building control system. The Building Controllers shall be based on the Niagara 4 Framework and "open licensed" so that any Niagara approved and qualified contractor can fully access and support the building control system. The controls contractor shall provide the number of DDC controllers needed to fully implement the sequence of operation, regardless of license pricing limitation thresholds.
- F. **Network Communication:** NNPS will provide a network communication port in a local data closet. The controls contractor shall furnish & install a CAT5 communication cable from each Building Controller to the designated port on the IT switch. Additionally, the controls contractor shall provide NNPS with the Building Controller's MAC address and location identifier. The JACE passwords shall be provided by NNPS to the Contractor. There shall be no other passwords or access to the JACE other than as provided by NNPS.
- G. **Server:** NNPS has an established and designated server that is running the Niagara N4 Framework. The server applications to be applied by the controls contractor for this project are as follows:
 - 1. **User Login Credentials:** are synchronized via the NNPS Active Directory where access privileges are assigned by a designated staff person. The controls contractor shall review & incorporate these user privileges in the building control system as to prevent lower-level users from obtaining specific features that are above their level of authority. Note: these access groups & privileges are well defined on the server.

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2. Point Mapping: Every point in the building control system shall be mapped to the server by the controls contractor.
 3. Graphics: The control contractor will be responsible for developing and populating color graphics on the server for Yates Elementary School that are in accordance with NNPS standards.
 4. Schedules: The control contractor will be responsible for linking existing schedules from the server to the appropriate areas of the school.
 5. Trending: The control contractor will be responsible for mapping and archiving all trended points to the server with uploading to the server every 2 hours. NNPS will provide to the controls contractor the trend intervals for all point types.
 6. Alarming: The control contractor will be responsible for developing "smart alarms" which are critical alarms that get transmitted via email and/or text message to designated NNPS staff. Note: the smart alarm schedule and distribution list is currently setup on the server.
- H. User Interface: The controls contractor is not required to provide any user interface products such as computer workstations, laptop computers, notebook computers or panel mounted displays. NNPS will utilize its existing user interface products to access the building control system through the NNPS network.
- I. Software Editing Tools:
1. The control contractor shall provide one (1) licensed copies of the Niagara Engineering Tool software required to program and modify the internal programming for the DDC controllers that are provided by the control contractor. Included shall be a detailed user manual on how to use the software tool.
 2. In addition, each JACE shall have embedded work bench software to permit programing changes without the use of the above Niagara Engineering Tool.
- J. The installation of the control system shall be performed under the direct supervision of the controls contractor including; shop drawings, flow diagrams, bill of materials, component designation or identification number and sequence of operation.
- K. All materials and equipment used shall be standard components, regularly manufactured for this and/or other systems and not custom designed especially for this project.
- L. The controls contractor shall be responsible for all Building Automation Systems (BAS), temperature control, 120 volt and low-voltage control wiring for the mechanical system, including interlock wiring for non DDC controlled equipment, for a complete and operable system. Control wiring shall be done

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in accordance with the specifications, NNPS standard practices, and all local and national codes.

- M. The controls contractor shall purchase three 5-year maintenance support agreements for a total of 15 years of coverage, to begin after the initial 18-month support agreement expires. The agreement ownership shall be transferred to Newport News Public Schools.

1.3 QUALITY ASSURANCE

- A. The DDC system shall be designed and installed, commissioned and serviced by manufacturer / factory trained personnel. The controls contractor shall have an in-place support facility within 100 miles of the project site with technical staff, spare parts inventory and necessary test and diagnostic equipment.
- B. The controls contractor shall provide a dedicated and experienced Tridium Niagara N4 certified project manager for this work, responsible for direct supervision of the installation, start up and commissioning of the building control system.
- C. 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.
- D. All Building Controllers and DDC controllers shall be UL Listed under Standard UL 916.
- E. All programmers working in the N4 platform shall be Niagara 4 certified.
- F. The Controls Contractor shall lead a coordination meeting between Major Equipment Suppliers, Mechanical Contractor, Electrical Contractor, General Contractor, Engineer and Owner to plan the integration of manufacturer provided equipment level controllers into the control system. Every control point and startup responsibilities shall be reviewed for a smooth integration process. Meeting minutes shall be prepared and forwarded to participants by the Controls Contractor.
- G. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference and be so labeled.
- H. The lead programmer shall operate the controls the entire duration of the Commissioning process.

1.4 WORK BY OTHERS

- A. All control and power wiring required for temperature control system and all

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interlocking and accessory control wiring required for equipment installed under Division 23 Sections shall be installed by the Temperature Control Contractor. 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.

- B. Wiring of all power feeds through all disconnect starters to electrical motor.
- C. Wiring of any remote start/stop switches and manual or automatic motor speed control devices not furnished by BAS manufacturer.
- D. Wiring of any electrical sub-metering devices furnished by BAS manufacturer.

1.5 SUBMITTALS

- A. Submit six 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.
 - 10. Backup Niagara logic files for all JACE and Drivers for this project.

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- C. Niagara 4 Technical Certification Program (TCP) certificate for all integrating and on-site programmers.
- D. The input setup data for equipment manufacturer provided programmable controllers shall be included in the O&M manual or controls as-built documents. This may take the form of screen shots for each input screen for each controller.

1.6 WARRANTY

- A. Provide all services, materials and equipment necessary for the successful operation of the DDC system for a period of one year after project acceptance.
- B. The adjustment, required testing, and repair of the system includes all new computer equipment, transmission equipment and sensors and control devices.
- C. The on-line support services shall allow the local Controls Contractor to remote-in over the customer's LAN/WAN via secure connection to monitor and control the facility's DDC 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 Controls Contractor 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 Yates Elementary School. 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.

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- C. No additional control contractors will be considered.

2.2 DDC EQUIPMENT

- A. Operator Work Station: This project will utilize existing workstations owned and maintained by NNPS.
- B. Server: This project will utilize an existing server and software applications owned and maintained by NNPS.
- C. Building Controllers: Provide an adequate number of Building Controllers 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. Building Controllers shall be provided as required to accomplish the sequence of operation regardless of software licensing pricing limitations. Each Building Controller shall be connected to the NNPS network via Ethernet connection to an IT switch port located in a nearby data closet.
 - 1. Building Controllers shall be suitable for the anticipated ambient conditions and 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 Building Controls shall maintain all BIOS and programming information in the event of a power loss by utilizing EEPROM auto-save features.
 - 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 Watts at 3 ft.
 - 6. Automatic staggered restart of HVAC equipment after restoration of power with short cycle protection.
 - 7. The Building Controllers shall provide the interface between the Server and the DDC Controllers and provide global supervisory control functions over the entire building control system. It shall be capable of executing application control programs to provide:
 - a. Calendar functions
 - b. Scheduling
 - c. Trending
 - d. Alarm monitoring and routing

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- e. Time synchronization by means of an Atomic Clock Internet site including automatic synchronization
 - f. Integration of open protocols for BACnet, LON and Modbus
 - g. Central Management functions for all DDC Controllers and integrated controllers.
8. Building Controllers must provide the following hardware features as a minimum:
- a. One Ethernet Port – 10/100 Mbps
 - b. One 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
9. Event Alarm Notification and Actions:
- a. The Building Controller shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.
 - b. The Building Controller shall be able to route any alarm condition to any defined user location via NNPS network.
 - d. Provide for the creation of a minimum of five (5) alarm classes for the purpose of routing types, Critical, Failure, Trouble, Override, and User-Defined.
 - 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:
 - 3) Day of week
 - 4) Time of day
 - 5) Recipient
 - 6) Graphic with flashing alarm object(s)

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- i. The following shall be recorded by the Building Controller for each alarm:
 - 1) Time and date
 - 2) Location (building, floor, zone, office number, etc.)
 - 3) Equipment (air handler #, access way, etc.)
 - 4) Acknowledge time, date, and user who issued acknowledgement.
 - 5) Number of occurrences since last acknowledgement.
 - j. Alarm actions may be initiated by user defined programmable objects created for that purpose.
 - k. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.
 - l. A log of all alarms shall be maintained by the 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.
10. Data Collection and Storage
- a. The Building Controller 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 Building Controller 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.

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- c. 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.
- d. All log data, when accessed from a server, shall be capable of being manipulated using standard SQL statements.
- e. All log data shall be available to the user in the following data formats:
 - 1) HTML
 - 2) XML
 - 3) Plain Text
 - 4) Comma or tab separated values
- f. The Building Controller shall have the ability to archive its log data locally (to itself) and remotely to the server.
 - 1) Archive on time of day
 - 2) Archive on user-defined number of data stores in the log (buffer size)
 - 3) Archive when log has reached its user-defined capacity of data stores
 - 4) Provide ability to clear logs once archived

11. Audit Log:

- a. Provide and maintain an Audit Log that tracks all activities performed in the Building Controller. 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 Building Controller), to another Building Controller 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.

D. DDC Controllers: Modular, comprising processor board with programmable, nonvolatile, RAM/EEPROM memory for custom control applications and standard control applications. DDC Controllers shall be provided for; Packaged Rooftop Units, DOAS Units, Vert-WSHPs, Horz-WSHPs, the central plant pumping system, and other applications as shown on drawings or identified in the points list.

- 1. DDC Controllers shall monitor and/or control each input/output point;

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process information; and provide 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. Capable of stand-alone mode control functions operate regardless of network status.
3. Have a local operator interface port for program download from portable workstation.
4. Shall communicate with the Building Controller using BACnet protocol.

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. Power Supplies: Provide power supplies that have the line-voltage (120V) totally enclosed as to ensure Arch-Flash Compliance. Only low-voltage shall be exposed within any control panel.
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

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- 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. All thermometers shall have a digital read-out.
 - 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.
 - 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 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.

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2.5 CONTROL CABLE

- A. Network communication cable shall be plenum rated CAT5.
- B. BACnet communication cable shall be plenum rated and certified BACnet compatible.
- C. Field device cable shall be plenum rated 18 gauge stranded, twisted-shielded.

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 controls 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 controls 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 control 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 controls 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 controls 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

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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 controls contractor shall assist in working out space conditions to make a satisfactory adjustment.
 4. If the controls 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 controls 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 controls contractor shall furnish a single set of all tools necessary to interface to the control system for test and balance purposes.
 2. The controls 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 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 controls contractor as follows:
1. 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.
 2. The controls 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.
 3. The controls 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 controls contractor is responsible for the interface of control products provided by multiple suppliers regardless of where this interface is described within the Contract Documents.

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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 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. Controls contractor shall have a 6 Sigma certified (or equivalent certification) quality manager on staff to inspect the project execution and to enforce quality standards.
- B. 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.
- C. Controls contractor shall continually monitor the field installation for code compliance and quality of workmanship.
- D. Controls 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.)

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- 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 control wiring in conduit containing line voltage.
- 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.

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- 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 controls 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 controls 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.

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- E. Controls 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 lightning 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 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 YATES ES Newport News Public Schools 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.

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- F. Manufacturers' nameplates and UL or CSA labels are to be visible and legible after equipment is installed.
- G. Identifiers shall match record documents.

3.10 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 Controls Contractor. Refer to "Submittals" in PART 1.
- C. Operator Interface:
 - 1. Standard graphics—Provide graphics for all mechanical systems and floor plans of the building. 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 Dashboard for all equipment on a "graphic" summary table. Provide dynamic information for each point shown.

3.11 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.
- 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.

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- 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 DDC program shall be put on line and commissioned. The controls 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 controls contractor shall

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demonstrate each point. The controls contractor shall also demonstrate 100% of the system functions. The controls contractor shall demonstrate all points and system functions until all devices and functions meet specification.

4. The controls 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.

3.12 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 controls 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 controls 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,

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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 control's 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 controls 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 controls 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 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 controls 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

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the controls 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."

3.13 TRAINING

- A. The controls 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 7:00 a.m. to 3:00 p.m. weekdays.
- B. Provide a minimum combined 16 hours of on-site training / orientation session and classroom or on-line training session for personnel designated by the Owner. Coordinate training sessions with the owner.

3.14 MISCELLANEOUS

- A. Air Purification System Plasma Detector: The DDC System shall connect to the dry-contacts of the manufacturers provided control relay on the duct mounted plasma detection device. The DDC system shall transmit an alarm to the DDC operator's workstation anytime the associated system fan is enabled and the plasma detector fails to detections in the airstream.

END OF SECTION 230900

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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,

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mechanical system drawings, and 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 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.
- C. The contractor shall coordinate the following electrical requirements for all mechanical equipment with the Division 23 Contractor:
 - 1. Number of electrical connections.
 - 2. Number and size of feeders' terminal lugs.
 - 3. Maximum overcurrent protection.
 - 4. Size and type of fuses.

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

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IESNA	Illuminating Engineering Society of North America
LEED	Leadership in Energy and Environmental Design
NEC 2020	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, 2021 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.

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:

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Submittal
Information
Required:

Light FixturesProduct Data
See light fixture schedule on drawings

NOTE: If substitute light fixtures are submitted for review, provide catalog data on the substitution which will provide all the information required to compare it to the specified product. At a minimum, provide dimensional and weight data, coefficients of utilization (CU) information, and photometrics for both the specified and substitute light fixtures.

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:

Conductors (each type)
Conduit (each type)
Emergency Battery Ballast

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Fire Alarm System Components
Fuses (each type)
LED Drivers
Occupancy Sensing Switches (all types)
Coordination Study and Arc Flash Hazard Analysis
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 Architect 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 Architect 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, Engineer 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.

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- C. Run all conduits concealed except where specifically indicated otherwise. Exposed conduit installation other than where indicated shall be approved by the Architect/Engineer and Owner prior to installation.

3.2 CLEANING

- A. Remove all dirt, trash, and oil from all raceways, boxes, fittings, cabinets, and panelboards.
- B. Protect, to the satisfaction of the Architect/Engineer, 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/Engineer.

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. Removal of Existing Electrical Distribution System:
 - a. Removal of existing electrical distribution system equipment shall include equipment's associated wiring including conductors, cables, exposed conduit, surface metal raceways, boxes, fittings, etc., back to equipment's source or as indicated on the electrical drawings.
 - 4. Continuation of Service:

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- 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/Engineer. 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:

Light Fixtures
Power Distribution Equipment (Panelboards and Disconnect Switches)
Short Circuit Coordination Study and Arc Flash Hazard Analysis
Occupancy Sensing Switches (all types)
Surge Protective Devices

END OF SECTION 260100

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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 Architect 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 or in other specifications. 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.

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.

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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 metal conduit (GRS), electrical metallic tubing (EMT), flexible metal conduit, or intermediate metallic conduit (IMC). Flexible metal conduit outdoors shall be liquid tight. Schedule 40 PVC conduit may be used only below grade, under concrete slabs-on-grade and other locations where specifically indicated.

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. The use of Aluminum conductors is not permitted.

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 drawings, and finish conditions and arrange work as required to meet such conditions to the approval of the Architect.
- C. Verify the exact swing of doors and locations of furniture and built-in cabinetry prior to installing outlets for switches and receptacles and make the necessary adjustments in location and mounting height of same to avoid conflicts at no additional cost. Coordinate outlets with change orders, addenda, and job site differences.

2.5 FUSES

- A. All fuses shall be provided by the Electrical Contractor.
- B. Fuses shall be as follows:

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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, and the name of the trademark of the manufacturer.
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. Circuits 601 to 6,000 amperes shall be protected by Type KRP-C HI-CAP current-limiting fuses.
3. 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, 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: The First line of label shall state name of panel as shown on the drawings. The Second line shall state from where the panel is fed. Lettering shall be 3/8" high.

Example:	Panel L-100	Transformer TC-1
	Fed from MDS	Fed From Panel #1
	Circuit # _____	Circuit # _____
	Voltage _____	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 1/4" high letters. First line shall state the name of the equipment as it

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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: Disconnect switches shall be labeled in 1/4" high letters. The First line shall state what the switch/contactors is feeding. The Second line shall state from which circuit and panel the switch/contactors/time clock is fed.

- D. Attach labels with a minimum of two rivets or sheet metal screws. Adhesive-backed labeling will not be accepted.
- E. Workspace indication for all electrical equipment (Panelboards): Provide 3" wide, 5 mil floor marking safety vinyl tape (striped black and yellow) to show working clearances in the direction of access to live parts. Working clearance around equipment shall not be less than those listed in the N.E.C, Article 110.26 for all voltages specified. Do not install in front of flush-mounted or surface-mounted panelboards and similar equipment in finished spaces, unless directed by the owner.

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

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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 AND CONTROLLER DISCONNECTING MEANS

- A. Provide a disconnecting means for each motor, where indicated on the drawings. A circuit breaker in a panelboard, horsepower rated switch, or type specified under Article 430 and 440 of the NEC 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

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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/Engineer.

END OF SECTION 260500

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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.
- 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.

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- G. Wiring sizes #12 and #10 AWG shall be solid. Larger sizes may be stranded.
- H. Neutral conductors shall not be under sized.

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 circuits, feeders, and control wiring or cables of any type shall be color coded to identify the voltage and phase. The color shall be integral with the Insulation 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:

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<u>120/208-Volt System</u>	<u>277/480-Volt System</u>
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

3.2 TEMPORARY WIRING

- A. Temporary wiring is not specified nor governed by this Division of the Specifications.

END OF SECTION 260519

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SECTION 260525 - SURFACE METAL RACEWAYS

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/Engineer 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.

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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 Beige 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

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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.

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- 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 complete 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

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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 conduits, motor frames, metal casings, receptacles, and solid neutral, and as required by NEC Article 250.

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. 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.

END OF SECTION 260526

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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
- Minerallac Straps
- 2-Piece Strutt Straps
- Slotted Channel
- Cable Ties

- 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."

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- 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; 1/4" dia.; approx. 12.2 pounds per 100 feet, 3/8" dia.; approx. 29.3 pounds per 100 feet, 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.
 - 9. 2-Piece strut strap, appropriate size, and type for type of conduit being installed. 1-piece straps are prohibited.
 - 10. Minerallac straps sized appropriately for the conduit installed. Drilling out the attachment hole is prohibited. Use proper size hardware for attachment per the UL listing.
 - 11. 7/8" and 1 3/4" slotted channel shall be sized appropriately per the manufacturer's specifications for weight distribution. All feeder conduit racks shall be 1 3/4" minimum.
 - 12. Cable ties shall be Type 2S and 21S. Install in accordance with Section 330.30(A) of the NEC.

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- 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.
 3. Concrete anchors: Anchors used for attaching 1/4" rod shall be Hangermate one-piece.
Concrete screw with internal threads or equal. Follow manufacturers installation specifications for proper installation.
 4. Concrete Anchors: Anchors used for attaching 3/8" and 1/2" rod shall Lok Bolt Sleeve anchor type Dewalt 05815S-PWR and 05825S-PWR or approved equal. Follow manufacturers technical Data for weight limitations and installation specifications for proper installation.
 5. Drop-in type anchors shall be used only in vertical concrete walls. Hollow wall anchors shall be used in hollow CMU walls. Anchor shall be installed with manufacturer approved set tool.
- 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

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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

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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/Engineer.
- 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. Verify exact swing of doors, prior to installing conduit for switches. Coordinate switches with the Architect's plans, change orders, addenda, and job site differences and make the necessary adjustments to avoid conflicts at no additional cost.
- G. Coordinate the routing of conduit with other trades to avoid conflicts with structural members, piping, ductwork, and other job site conditions.
- H. When PVC conduit is used below grade, it shall be glued together in such a manner so as to make it watertight.

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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 (GRS), electrical metallic tubing (EMT), or intermediate metallic conduit (IMC). Flexible 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 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 or elbow shall be within the concrete slab. All below grade conduit elbows shall be GRS type. 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 conduit shall be galvanized, continuous spiral, single strip type. In areas subject to moisture (such as outside), and where specifically indicated, flexible 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 conduit installed in outdoors shall be plastic covered. The maximum length for flexible conduit is 72" unless as otherwise indicated. Liquid tight flexible metal conduit is prohibited where subject to physical damage and areas where ambient and conductor temperature exceed the approved operating temperature. Cable ties used to support LFMC shall be type 2S or 21S.
- 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 all existing underground utilities.

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- H. Empty or spare conduits stub-ups shall be capped with a threaded cap.

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.
- E. Conduits entering service enclosures (panelboards, disconnect switches, switchboards, motor control centers, etc. used as service entrance equipment) shall be provided with specification grade, insulating, grounding type bushings. Grounding bushing shall be bonded together and bonded to the service grounding bus.

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

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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 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

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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 or Hollow wall anchors; to brick and concrete with expansion Anchors; to metal surfaces with machine screws; and to wood with wood screws. Overhead conduits supported by threaded rod from concrete shall be those listed in the approved hanger specification and conform to the manufactures technical data and installation specifications.
- 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. Do not run conduit in the cavity of exterior walls between brick and CMU.
- Q. Where conduits penetrate through non-fire-rated floors, ceiling, or walls, seal the conduits with a fire-resistant caulk to prevent liquids and insects from passing through.
- R. Where conduits penetrate through fire-rated floors, ceiling, or walls, provide a UL-Listed, water-resistant firestop material with a rating equal to or greater than the rating of the penetrated floors, ceilings, or walls.
- S. Metal conduit installed in earth shall be painted with two coats of bitumastic paint.
- T. All conduit runs entering the building from outdoors shall be sealed against moisture migration and condensation by filling with insulating type foam.

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- U. Single runs of conduit 1/2" to 1-1/2" in diameter shall be supported by 1/4" round galvanized rod. Single runs of conduit 2" and larger shall be supported by 3/8" round galvanized rod. Single tier conduit racks with conduit 1/2" to 1" and no greater than five shall be supported by 1/4" round galvanized rod. Single tier conduits racks 1-1/4" and larger shall be supported with 3/8" round galvanized rod. All conduit racks larger than a single tier shall be 1/2" minimum round galvanize rod. Conduit and conduit racks shall comply with the manufacturer's supporting limitations.

END OF SECTION 260533

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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 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.

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- 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. If an extension ring is used to extend a junction box, one extension ring shall be used per box.
- 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 conduit or cast-iron boxes are required for watertight or vaportight outlets.

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 Architect/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.

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- D. Check the location of all wall outlets prior to roughing-in conduit to verify that the outlet will clear any wall fixtures, shelving, worktables, 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. Do not install boxes back to back in walls. Provide not less than 6" (150 mm) separation. Thru-the-wall boxes may not be used.
- M. Position recessed outlet boxes accurately to allow for surface finish thickness.
- N. Fasten electrical boxes firmly and rigidly to substrates or structural surfaces to which attached or solidly embed electrical boxes in concrete or masonry.
- O. Subsequent to installation of boxes, protect boxes from construction debris and damage.
- P. Upon completion of installation work, properly ground all electrical boxes.
- Q. Do not mount boxes to metal roof decking.

END OF SECTION 260534

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SECTION 260923 - LIGHTING CONTROL 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 SUMMARY

- A. This Section includes the following lighting control devices:
 - 1. Indoor occupancy sensors.
 - 2. Wall Switch Occupancy Sensors – Small Areas
 - 3. Line Voltage Occupancy Sensors
 - 4. Emergency Inverter for Lighting
- B. Related Sections include the following:
 - 1. Division 26 Section "Wiring Devices and Device Plates" for wall-box dimmers and manual light switches.

1.3 DEFINITIONS

- A. LED: Light-emitting diode.
- B. PIR: Passive infrared.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show installation details for occupancy and light level sensors.
 - 1. Provide scaled plan layouts of all occupancy sensor locations based upon the manufacturer's suggested layout for their equipment in full compliance with these specifications.
 - a. Show sensor type being supplied for each sensor location and the area of coverage for each sensor.
 - 2. Interconnection diagrams showing field-installed wiring.
- C. Field quality-control test reports.

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- D. Operation and Maintenance Data: For each type of product to include in Emergency section of the operation and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.

- B. Occupancy Sensing Detection Technology

1. The occupancy sensor system shall sense the presence of human activity within the covered space and fully control the on/off function of the lighting.
2. Sensors shall utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state; thus preventing false on conditions. Ultrasonic or Microwave based sensing technologies will not be accepted.
3. For applications where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions), a sensor with an additional "dual" technology shall be used.
4. Dual technology sensors shall have one of its two technologies not require motion to detect occupancy. Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT) which both looks for occupant motion and listens for sounds indicating occupants. Sensors where both technologies detect motion (PIR/Ultrasonic) will not be acceptable.
5. All sensing technologies shall be acoustically passive meaning they do not transmit sounds waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonics technology. Ultrasonic or Microwave based sensing technologies will not be accepted.

- C. Occupancy Sensor Operation Requirements

1. Sensors shall offer a minimum on timer of at least 15 minutes, in order to prevent cycling of lamps before they have burned in accordance with the lamp manufacturer's minimum recommended time period. This timer shall be in addition to the regular occupancy time delay that keeps lights on after last detected occupancy. User shall be able to disable/enable and change the value of this timer.
2. Sensors shall utilize an occupancy time delay that keeps lights on after last detected occupancy. Factory default setting of the occupancy time delay shall be 10 minutes. Sensors with a longer factory default setting will not be permitted.

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3. Manual adjustment to the occupancy time delay so as to increase it shall be accommodated, but will not be allowed unless approved by the Architect/Engineer/Owner.
4. All sensors shall be factory calibrated for optimum performance for its installed PIR lens, and shall not require initial or subsequent field adjustment of detection sensitivity.
5. All sensor setting adjustments shall be digital and made using a push-button. Dip switches, analog dials, and/or the need for tools of any kind will not be accepted.
6. The contractor is responsible for a complete and functional system in accordance with all applicable local and national codes.

1.6 COORDINATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.
- B. Sensors are shown schematically only. Contractor shall provide an adequate quantity of sensors as needed to completely cover the space being controlled. If the Architect/Engineer deems coverage to be unacceptable, contractor shall provide additional sensors as required to satisfy Architect/Engineer at no additional cost.

1.7 MISCELLANEOUS REQUIREMENTS

- A. All steps in sensor manufacturing process will occur in the USA; including population of all electronic components on circuit boards, soldering, programming, wiring, and housing. Manufacturing facility must be ROHS compliant.
- B. In high humidity or cold environments, the sensors shall be conformably coated and rated for condensing humidity and -40 degree Fahrenheit (and Celsius) operation.
- C. All applicable products must be UL Listed.
- D. Sensors shall carry a full 5-year warranty.

1.8 MANUFACTURER AND SUBSTITUTIONS

- A. The basis of design for the products specified herein is those manufactured by Sensor Switch, Inc.
- B. Substitutions may be submitted for review. All substitutions must clearly identify any and all exceptions to the specifications with a detailed explanation as to

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the exception. If the substitution is approved, the contractor shall bear the responsibility of a fully functional system to the Architect/Engineer/Owner.

PART 2 - PRODUCTS

2.1 INDOOR OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Hubbell Lighting.
 2. Leviton Mfg. Company Inc.
 3. Lithonia Lighting; Acuity Lighting Group, Inc.
 4. TORK.
 5. Watt Stopper (The).
 6. Sensor Switch.
 7. Crestron.
- B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit or line voltage.
1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time-delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes. Shall also be capable of operating as a vacancy sensor.
 2. Sensor Output: Contacts rated to operate the connected relay complying with UL 773A. Sensor shall be powered from the relay unit.
 3. Relay Unit (if required): Dry contacts rated for 20-A ballast load at 120 and 277-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
 4. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
 6. Bypass Switch: Override the on function in case of sensor failure.
 7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lx); keep lighting off when selected lighting level is present.
 8. Provide single or 2-pole switches as required/indicated on drawings.

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- C. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.
 - 1. Sensitivity Adjustment: Separate for each sensing technology.
 - 2. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm), and detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
 - 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.

2.2 WALL SWITCH OCCUPANCY SENSORS – SMALL AREAS

- A. Sensor shall provide wall-to-wall PIR detection such that small hand motions are detected out to 20 ft (6.10 m).
- B. In areas with periodic or permanent obstruction to a sensor's field of view, sensors that utilize dual technology (PIR/Microphonics) detection shall be used.
- C. Sensors shall be capable of switching 120 VAC and 277 VAC. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC.
- D. Sensor shall recess into single gang switch box and fit a standard GFI opening.
- E. Sensor shall meet NEC grounding requirements by providing a dedicated ground connection and intrinsically grounding through its mounting strap.
- F. Sensor shall not require a neutral connection regardless of number of poles and/or detection technology.
- G. Sensor shall not allow any leakage of current to pass to the load when sensor is in the unoccupied (off) condition. Sensor shall not require a minimum load to be connected in order to function.
- H. Sensor shall have optional features available for photocell/daylight override, vandal resistant lens, low temperature/high humidity operation.
- I. All sensor settings, including time delay and photocell settings shall be digital and accessible for adjustment via a push-button without requiring removal of cover plate or tools of any kind.

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- J. Wall Switch sensors shall have field programmable adjustments for selecting operational modes, occupancy time delays, minimum on time, and photocell set-point as applicable.
 - 1. All models shall be capable of both Auto-On and Manual On operation.
 - 2. All models shall be capable of a "Reduced Turn On" operation where the initial PIR turn on level is higher in order to eliminate PIR from reflective surfaces from being detected. PIR shall be returned to normal levels upon initial PIR detection.
 - 3. All models shall have a "Predictive Off" mode where user can manually turn the lights off when leaving the room and still have them come on automatically when they return to space.
- K. All models shall be capable of disabling override switch.
- L. Sensors shall be the following Sensor Switch model numbers or approved equals:
 - 1. WSX PDT SA (PIR/Microphonics, Manual On by default)

2.3 WALL SWITCH DIMMING OCCUPANCY SENSORS – SMALL AREAS

- A. Sensor shall provide wall-to-wall PIR detection such that small hand motions are detected out to 20 ft (6.10 m).
- B. In areas with periodic or permanent obstruction to a sensor's field of view, sensors that utilize dual technology (PIR/Microphonics) detection shall be used.
- C. Sensors shall be capable of switching 120 VAC and 277 VAC. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC.
- D. Sensor shall recess into single gang switch box and fit a standard GFI opening.
- E. Sensor shall meet NEC grounding requirements by providing a dedicated ground connection and intrinsically grounding through its mounting strap.
- F. Sensor shall not require a neutral connection regardless of number of poles and/or detection technology.
- G. Sensor shall not allow any leakage of current to pass to the load when sensor is in the unoccupied (off) condition. Sensor shall not require a minimum load to be connected in order to function.
- H. Sensor shall have optional features available for photocell/daylight override, vandal resistant lens, low temperature/high humidity operation.

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- I. All sensor settings, including time delay and photocell settings shall be digital and accessible for adjustment via a push-button without requiring removal of cover plate or tools of any kind.
- J. Wall Switch sensors shall have field programmable adjustments for selecting operational modes, occupancy time delays, minimum on time, and photocell set-point as applicable.
 - 1. All models shall be capable of both Auto-On and Manual On operation.
 - 2. All models shall be capable of a "Reduced Turn On" operation where the initial PIR turn on level is higher in order to eliminate PIR from reflective surfaces from being detected. PIR shall be returned to normal levels upon initial PIR detection.
 - 3. All models shall have a "Predictive Off" mode where user can manually turn the lights off when leaving the room and still have them come on automatically when they return to space.
- K. All models shall be capable of disabling override switch.
- L. Compatible with 0-10V dimming luminaries
- M. Sensors shall be the following Sensor Switch model numbers or approved equals:
 - 1. WSX PDT D SA (PIR/Microphonics, Manual On by default)

2.4 LINE VOLTAGE OCCUPANCY SENSORS

- A. Sensors shall be self-contained and accept Class 1 wiring directly without the use of a power pack.
- B. The installing contractor shall install one or more sensors with PIR coverage areas that cover the entire space and all entrance points. Exact placement and quantity required shall be per manufacturer's best practice recommendations.
- C. In areas with periodic or permanent obstruction to a sensor's field of view, sensors that utilize dual technology (PIR/Microphonics) detection shall be used (as specified in above section 1.1, *Occupancy Sensor Technology Requirements*).
- D. Sensors shall utilize a digital PIR detector (dual element pyro-electric detector) component, so as to provide a high degree of RF immunity.
- E. Line and load wire connections shall be interchangeable, such that installer cannot make an improper connection to a line/load in a manner that will cause malfunction or damage to the sensor.

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- F. Multiple sensors controlling the same load shall be wired in parallel.
- G. For applications requiring independent control of two loads, a sensor with two dual relays shall be required. Each relay shall have independent programmable occupancy time delays.
- H. Dual relay sensors shall have an optional operational mode called "Alternating On" where when during unoccupied periods, one relay is always left closed (thus one load is always on). The particular relay that is left closed alternates each cycle so that the aging of the connected lamps is even.
- I. Sensors shall be capable of switching both 120 VAC and 277 VAC and run off of 50/60 Hz power. A version capable of switching 347 VAC shall also be available. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, 1500 W @ 347 VAC, and ¼ HP motor load.
- J. Specific sensors capable of switching 5 Amps of two phase power (208/240 or 480 VAC) shall be available. These sensors shall always simultaneously switch both phases as per NEC guidelines.
- K. Wall mounted sensors must be installed at 7 to 8 feet above the floor. Single and two circuit units shall be available.
- L. High bay sensors controlling HID Bi-Level must incorporate a "Start to High" timer on initial power up to provide full light output for up to 20 minutes to prevent shortened lamp life.
- M. Sensors shall have test mode that temporarily shortens/disable all time delays (e.g., minimum on, occupancy, photocell transition, dimming rates) such that an installer can quickly test operation of sensor. Test mode shall time out and return sensor to normal operation should the installer forget to disable test mode after installation.
- N. Sensors shall have optional features for on/off photocell control, automatic dimming control photocell, high/low occupancy based dimming, and usage in low temperature/high humidity environments.
- O. Sensors shall be the following Sensor Switch models or approved equal:
 - 1. CMR PDT 10 / CMR PDT 10 2P (Extended Range 360°, PIR/Microphonics Dual Technology, Ceiling Mount – Single / Two-Pole)
 - 2. WVR 16 / WVR 16 2P (Wide View, PIR, Wall Mount – Single / Two-Pole)
 - 3. WVR PDT 16 / WVR PDT 2P (Wide View, PIR/Microphonics Dual Technology, Wall Mount – Single / Two-Pole)
 - 4. CMR 6 / CMR 6 2P (High Bay 360°, PIR, Ceiling Mount – Single / Two-Pole)

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2.5 EMERGENCY INVERTER FOR LIGHTING

- A. The Emergency Lighting Inverter (ELI) shall function in conjunction with a fluorescent, incandescent or LED fixture to create an emergency lighting system.
 - 1. The ELI unit shall permit the connected fixture(s) to be on, off, switched or dimmed without affecting emergency operation.
 - 2. Each ELI unit shall consist of a sealed lead calcium battery, charger and electronic circuitry in one steel case.
 - 3. The ELI unit shall provide power to the input side of the fixture, including the ballast, and shall have the capability to be used with indoor or outdoor emergency fixture applications.
 - 4. Provide ELI unit(s) as shown on the drawings.

- B. ELI Operation.
 - 1. Upon failure of normal power, the ELI shall instantly (less than 1 second) begin providing emergency power to the connected lighting load for a minimum of 90 minutes.
 - 2. The ELI shall support lumen output at 91% of the lamp's rating throughout the 90-minute duration.
 - 3. A solid-state low voltage disconnect circuit shall protect the inverter battery from severe damage by deep discharge during prolonged power failures.
 - 4. Whenever normal power is restored, the automatic, temperature-compensated, variable rate float charger shall begin to recharge the battery.
 - 5. The battery capacity shall be fully restored in 24 hours.
 - 6. A brownout sensing circuit shall be provided to ensure proper operation during low voltage conditions.
 - 7. The ELI shall contain self-diagnostic circuitry. The circuitry shall verify the different operating parameters during initial start-up, normal standby and diagnostic stages. If a fault is detected, the fault indicator shall flash to alert maintenance personnel.
 - 8. The ELI unit shall automatically initiate a 15-minute diagnostic cycle every 25 to 30 days to test emergency operation. The self-diagnostic circuitry shall not utilize the lighting load (i.e., the emergency lamps) to cycle and test the unit battery. A built-in resistive load shall be used for the battery test.

- C. Warranties, components and functions shall be provided for each ELI unit.
 - 1. The ELI unit shall be warranted for 3-years, full coverage.
 - 2. The ELI battery shall be warranted for 3-years, full coverage and warranted for an additional 7-years prorated.

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3. The ELI unit shall be rated for full operation in 680F to 860F ambient temperature.
4. A test switch shall be provided.
5. An LED battery charging light shall be provided.
6. The ELI unit shall be tested by Underwriters Laboratory in accordance with the standards set forth in UL 924, "Emergency Lighting and Power Equipment," and shall be UL Listed for field installation.
7. The total operation and function of the ELI unit shall exceed the National Electrical Code (NEC) and Life Safety Code (NFPA-LSC) requirements for emergency illumination.

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
- B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.
- C. Provide no less quantity of sensors as shown on plans but add additional sensors when required to fulfill coverage requirement for the specific model of the sensor provided.
- D. Provide occupancy sensor operation that requires movement to activate luminaires controlled and turns luminaires off after a set time of inactivity.
- E. Provide vacancy sensor operation that requires manual control to activate luminaires and turns luminaires off after a set time of inactivity.

3.2 WIRING INSTALLATION

- A. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and non-power limited conductors according to conductor manufacturer's written instructions.
- B. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
- C. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

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3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate lighting control devices and perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections
 - 1. Operational Test: After installing sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Lighting control devices will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.4 ADJUSTING

- A. For occupancy sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.

3.5 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION 260923

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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.

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- 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. Circuit breakers serving surge protective devices "SPD" shall be located close to the equipment main circuit breaker or main lugs whether indicated or not. Provide HACR rated circuit breakers for all heating and air conditioning equipment. Circuit breakers serving heat trace and ice melting equipment shall be capable of being locked in the open (off) position.

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

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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.

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- 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.

END OF SECTION 262416

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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 Heavy Duty type.

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- 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.

2.2 MOTOR RATED SWITCHES

- A. Motor rated switches shall be rated for the voltage of the equipment being served with number of poles and current rating as indicated.
- B. Motor rated switches shall be UL listed, suitable as motor disconnect, and industrial grade.
- C. Motor-rated switches shall be horsepower rated when used for motor disconnect means.

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 variable frequency drives 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/Engineer 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.

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- 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 torquing tools, including torque screwdriver, beam-type torque wrench, and ratchet wrench with adjustable torque settings. Where manufacturer's torquing requirements are not available, tighten connectors and terminals to comply with torquing values contained in UL 486A.
- H. Provide flexible metal conduit for motor connections and other electrical equipment connections where subject to movement and vibration.
- I. Provide liquid-tight flexible metal 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
- J. The contractor shall coordinate the following electrical requirements for all mechanical equipment with the Division 23 Contractor:

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1. Number of electrical connections.
2. Number and size of feeders' terminal lugs.
3. Maximum overcurrent protection.
4. Size and type of fuses

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.

END OF SECTION 262420

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
- Wall Plate-type Dimmer Switches
- Plugs and Connectors
- Floor Service Outlets

- 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.

2.2 RECEPTACLES

- A. Duplex: Provide Industrial/Institutional, Specification-Grade, Tamper Resistant TR duplex receptacles, 2-pole, 3-wire, grounding, with green hexagonal equipment

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ground screw, single-piece brass mounting yoke with integral ground terminals, 20 amperes, 125 Volts, with metal plaster ears; designed for side and back wiring, with NEMA configuration 5-20R, unless otherwise indicated. LEVITON 5362, Tamper Resistant TR Series, or approved equal.

- B. Ground-fault Circuit Interrupters: Provide Industrial/Institutional, Specification-Grade, Tamper Resistant TR, "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, Tamper Resistant TR Series, or approved equal.
- C. Ground-fault Weather Resistant Circuit Interrupters; Provide Industrial/Institutional, Specification-Grade, Tamper Resistant TR, "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, Tamper Resistant TR 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.
- B. Three Way: Provide Specification-Grade, flush, 3-way switches, 20 amperes, 120/277 Volts AC, with mounting yoke insulated from mechanism, equipped with plaster ears, switch handle, equipment grounding screw, side-wired screw terminals, with break-off tab features, which allow wiring with separate or common feed. LEVITON 1223-2 Series or approved equal. Provide for key operation where indicated on drawings.
- C. Four Way: Provide Specification-Grade, flush, 4-way quiet switches, 20 amperes, 120/277 Volts AC, with mounting yoke insulated from mechanism, equipped with plaster ears, switch handle, equipment grounding screw, side-wired screw terminals, with break-off tab features, which allow wiring with separate or common feed. LEVITON 1224-2 Series or approved equal. Provide for key operation where indicated on drawings.
- D. LED Dimmers: Provide 120/277 volts AC, 60Hz, Single pole and 3-Way, 0-10VDC, LED power Supply Dimmer controls for LED light fixtures; wattage as indicated, with continuously adjustable slide dimmer, ON/OFF button, and equipped with electromagnetic filters to eliminate noise, RF and TV interference.

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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.
- B. Floor Service Outlets: Provide floor service receptacle outlets and fittings of types and ratings indicated.
- C. Provide "metal 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 torqueing 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.

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- I. Install grounded conductors at the location of switches per the requirements of NEC Article 404.
- J. Switches that are combined in the same enclosure that exceed 300 volts are prohibited.
- K. Receptacle that are used during construction after permanent power is energized shall be replaced at the final completion of the project.

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. The proper outlet testing equipment shall be used to test receptacles.

END OF SECTION 262726

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SECTION 264313 - SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SCOPE

- A. The Contractor shall furnish and install the Surge Protective Device (SPD) equipment having the electrical characteristics, ratings, and modifications as specified herein and as shown on the contract drawings.

1.2 RELATED SECTIONS

- A. Section 262416 – Panelboards

1.3 REFERENCES

- A. SPD units and all components shall be designed, manufactured, and tested in accordance with the latest applicable UL standard (ANSI/UL 1449 latest addition).

1.4 SUBMITTALS – FOR REVIEW/APPROVAL

- A. The following information shall be submitted to the Engineer:
 - 1. Provide verification that the SPD complies with the required ANSI/UL 1449 Latest Edition listing by Underwriters Laboratories (UL) or other Nationally Recognized Testing Laboratory (NRTL). Compliance may be in the form of a file number that can be verified on UL's website or on any other NRTL's website, as long as the website contains the following information at a minimum: model number, SPD Type, system voltage, phases, modes of protection, Voltage Protection Rating (VPR), and Nominal Discharge Current (I_n).
 - 2. Electrical/mechanical drawings showing unit dimensions, weights, installation instruction details, and wiring configuration.
- B. Where applicable the following additional information shall be submitted to the engineer:
 - 1. Descriptive bulletins
 - 2. Product sheets

1.5 QUALIFICATIONS

- A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.
- B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

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- C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
- D. The SPD shall be compliant with the Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of manufacturer's instructions shall be included with the equipment at time of shipment.

1.7 OPERATION AND MAINTENANCE MANUALS

- A. Operation and maintenance manuals shall be provided with each SPD shipped.

PART 2 - PRODUCTS

2.1 VOLTAGE SURGE SUPPRESSION – GENERAL

- A. Electrical Requirements:
 1. Unit Operating Voltage – Refer to drawings for operating voltage and unit configuration.
 2. Maximum Continuous Operating Voltage (MCOV) – The MCOV shall not be less than 115% of the nominal system operating voltage.
 3. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.
 4. Protection Modes – The SPD must protect all modes of the electrical system being utilized. The required protection modes are indicated by bullets in the following table:

Configuration	Protection Modes			
	L-N	L-G	L-L	N-G
Wye	●	●	●	●
Delta	N/A	●	●	N/A
Single Split Phase	●	●	●	●
High Leg Delta	●	●	●	●

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5. Nominal Discharge Current (I_n) – All SPDs applied to the distribution system shall have a 20kA I_n rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an I_n less than 20kA shall be rejected.
6. ANSI/UL 1449 Latest Edition Voltage Protection Rating (VPR) – The maximum ANSI/UL 1449 Latest Edition VPR for the device shall not exceed the following:

Modes	208Y/120	480Y/277
L-L	1200	2000
L-N	800	1200
L-G	800	1200
N-G	700	1200

B. SPD Design:

1. Maintenance Free Design – The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
2. Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable SPD modules shall not be accepted.
3. Electrical Noise Filter – Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method. Products unable able to meet this specification shall not be accepted.
4. Internal Connections – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be soldered, hardwired with connections utilizing low impedance conductors.
5. Monitoring Diagnostics – Each SPD shall provide the following integral monitoring options:
 - a. Protection Status Indicators - Each unit shall have a green / red solid-state indicator light that reports the status of the protection on each phase.
 - 1) For wye configured units, the indicator lights must report the status of all protection elements and circuitry in the L-N and

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L-G modes. Wye configured units shall also contain an additional green / red solid-state indicator light that reports the status of the protection elements and circuitry in the N-G mode. SPDs that indicate only the status of the L-N and L-G modes shall not be accepted.

- 2) For delta configured units, the indicator lights must report the status of all protection elements and circuitry in the L-G and L-L modes.
- 3) The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted.

- b. Remote Status Monitor – The SPD must include Form C dry contacts (one NO and one NC) for remote annunciation of its status. Both the NO and NC contacts shall change state under any fault condition.
- c. Audible Alarm and Silence Button – The SPD shall contain an audible alarm that will be activated under any fault condition. There shall also be an audible alarm silence button used to silence the audible alarm after it has been activated.
- d. Surge Counter – The SPD shall be equipped with an LCD display that indicates to the user how many surges have occurred at the location. The surge counter shall trigger each time a surge event with a peak current magnitude of a minimum of $50 \pm 20A$ occurs. A reset pushbutton shall also be standard, allowing the surge counter to be zeroed. The reset button shall contain a mechanism to prevent accidental resetting of the counter via a single, short-duration button press. In order to prevent accidental resetting, the surge counter reset button shall be depressed for a minimum of 2 seconds in order to clear the surge count total.

- 1) The ongoing surge count shall be stored in non-volatile memory. If power to the SPD is completely interrupted, the ongoing count indicated on the surge counter's display prior to the interruption shall be stored in non-volatile memory and displayed after power is restored. The surge counter's memory shall not require a backup battery in order to achieve this functionality.

6. Overcurrent Protection:

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The unit shall contain thermally protected MOVs. These thermally protected MOVs shall have a thermal protection element packaged together with the MOV in order to achieve overcurrent protection of the MOV. The thermal protection element shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition.

7. Fully Integrated Component Design – All of the SPD's components and diagnostics shall be contained within one discrete assembly. SPDs or individual SPD modules that must be ganged together in order to achieve higher surge current ratings or other functionality shall not be accepted.

8. Safety Requirements:

The SPD shall minimize potential arc flash hazards by containing no user serviceable / replaceable parts and shall be maintenance free. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.

- a. SPDs designed to interface with the electrical assembly via conductors shall require no user contact with the inside of the unit. Such units shall have any required conductors be factory installed.
- b. SPDs shall be factory sealed in order to prevent access to the inside of the unit. SPDs shall have factory installed phase, neutral, ground and remote status contact conductors factory installed and shall have a pigtail of conductors protruding outside of the enclosure for field installation.

2.2 SYSTEM APPLICATION

- A. The SPD applications covered under this section include distribution and branch panel locations and switchboard assemblies. All SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C, B, and A environments.
- B. Surge Current Capacity – The minimum surge current capacity the device is capable of withstanding shall be as shown in the following table:

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Minimum Surge Current Capacity Based on ANSI / IEEE C62.41 Location Category			
Category	Application	Per Phase	Per Mode
C	Service Entrance Locations (Switchboards, Main Service Entrance)	250 kA	125 kA
B	High Exposure Roof Top Locations (Distribution Panelboards)	160 kA	80 kA
A	Branch Locations (Panelboards)	120 kA	60 kA

- C. SPD Type – SPDs installed on the load side of the service entrance disconnect shall be Type 1 or Type 2 SPDs.

2.3 LIGHTING AND DISTRIBUTION PANELBOARD REQUIREMENTS

- A. The SPD application covered under this section includes lighting and distribution panelboards. The SPD units shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category B environments.

1. The SPD shall not limit the use of through-feed lugs, sub-feed lugs, and sub-feed breaker options.
2. SPDs shall be installed immediately following the load side of the main breaker. SPDs installed in main lug only panelboards shall be installed immediately following the incoming main lugs.
3. The panelboard shall be capable of re-energizing upon removal of the SPD.
4. The SPD connected to a 30A circuit breaker for disconnecting purposes may be installed using short lengths of conductors as long as the conductors originate integrally to the SPD. The SPD shall be located directly adjacent to the 30A circuit breaker.

- B. Side mount Mounting Applications Installation (SPD mounted external to electrical assembly):

1. Lead length between the breaker and suppressor shall be kept as short as possible to ensure optimum performance. Any excess conductor length shall be trimmed in order to minimize let-through voltage. The installer shall comply with the manufacturer's recommended installation and wiring practices.

2.4 ENCLOSURES

- A. All enclosed equipment shall have NEMA 1 general purpose enclosures, unless otherwise noted. Provide enclosures suitable for locations as indicated on the drawings and as described below:

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1. NEMA 1 – Constructed of steel intended for indoor use to provide a degree of protection to personal access to hazardous parts and provide a degree of protection against the ingress of solid foreign objects.
2. NEMA 4 – Constructed of steel intended for either indoor or outdoor use to provide a degree of protection against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (dirt and windblown dust); to provide a degree of protection with respect to the harmful effects on the equipment due to the ingress of water (rain, sleet, snow, splashing water, and hose directed water); and that will be undamaged by the external formation of ice on the enclosure.
3. NEMA 4X – Constructed of stainless steel providing the same level of protection as the NEMA 4 enclosure with the addition of corrosion protection.

PART 3 - EXECUTION

3.1 FACTORY TESTING

- A. Standard factory tests shall be performed on the equipment under this section. All tests shall be in accordance with the latest version of NEMA and UL standards.

3.2 INSTALLATION

- A. The Contractor shall install all equipment per the manufacturer's recommendations and the contract drawings.

3.3 WARRANTY

- A. The manufacturer shall provide a full ten (10) year warranty from the date of shipment against any SPD part failure when installed in compliance with manufacturer's written instructions and any applicable national or local code.

END OF SECTION 264313

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SECTION 265100 - INTERIOR BUILDING LIGHTING

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 DEFINITIONS

BF:	Driver factor.
CCT:	Correlated color temperature
THD:	Total Harmonic Distortion
CRI:	Color-rendering index.
CU:	Coefficient of utilization.
RCR:	Room cavity ratio.
L70:	Minimum 70% maintained initial-rated lumens at average rated life for LEDs.
IESNA:	Illuminating Engineering Society of North America
LM-80:	IESNA approved method of measuring Lumen Depreciation of LED Light Sources
LED:	Light Emitting Diode
UL:	Underwriter Laboratories

1.3 SCOPE OF WORK

- A. Extent of interior light fixture work is indicated by drawings and schedules.
- B. Light fixtures shown installed on exterior walls or under canopies attached to the building are considered interior building lighting.
- C. Types of interior light fixtures in this Section include the following:
Light-emitting Diode

1.4 QUALITY ASSURANCE

- A. Comply with the requirements of the NEC, as applicable to installation and construction of interior building light fixtures.
- B. Provide interior light fixtures which are UL-Listed and labeled.
- C. Provide LED drivers which comply with NEMA SSL-1, "Electronic Drivers for LED Devices, Arrays, or Systems", and SSL-3, "High Power White LED Binning for General Illumination".

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PART 2 - PRODUCTS

2.1 INTERIOR LIGHT FIXTURES

- A. Provide light fixtures of sizes, types, and ratings indicated; complete with, but not limited to, housings, reflectors, LED module, LED drivers and wiring. Provide fixture trims as required for proper installation into the type ceiling in which installed. Review Architectural reflected ceiling plans for ceiling types and construction and provide all mounting hardware required for proper installation of the fixtures specified for the location.

2.2 LED LIGHT FIXTURES

- A. LED fixtures shall be in compliance with UL.
- B. Interior Area LED Fixtures:
 - 1. Kelvin temperature of interior fixtures as indicated on drawings.
 - 2. Minimum of 75 plus lumens per watt.
 - 3. CRI 80 or greater.
 - 4. 5-year warranty minimum with L70 of 50,000 hours or greater.
 - 5. Modular design for field replacement of parts.
 - 6. Tool less access to driver and LED modules.
 - 7. Cannot have LED pixilation (or commonly called bug eye effect).
 - 8. UL certified up to 90F degrees operating temperature.
- C. Manufactured by one of the following:
 - 1. Nichia Corporation.
 - 2. Cree, Inc.
 - 3. Philips LumiLED.
 - 4. Osram Opto Semiconductors.
 - 5. Cooper Industries.
 - 6. Lusio Lighting.
 - 7. Sony.
 - 8. Citizens Electronics

2.3 RECESS- AND FLUSH-MOUNTED FIXTURES

- A. Provide light fixture types which can be relamped from the bottom. Access to driver shall be from the bottom. Trim for the exposed surface of flush-mounted fixtures shall be as required for the ceiling construction in which it is installed.

2.4 SUSPENDED FIXTURES

- A. Provide hangers capable of supporting twice the weight of the fixture

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supported by the hanger. Provide with swivel hangers to ensure a plumb installation. Hangers shall be cadmium-plated steel with a swivel-ball tapped for the conduit size required. Hangers shall be shock-absorbing type where indicated. Hangers shall allow fixtures to swing within an angle of 20 degrees. Multiple-unit or continuous row fixtures shall have a tubing or stem for wiring at one point and a tubing or rod suspension provided for each unit length of chassis, including one at each end, unless indicated otherwise. Rods shall be a minimum 1/4" diameter.

2.5 EXIT LIGHTS

- A. Exit lights shall be in conformance with UL and NFPA. Exit lights shall be self-powered type where indicated.
- B. Self-Powered LED-Type Exit lights (Battery Backup): Provide with automatic power failure device, test switch, pilot light and fully automatic high/low trickle charger in a self-contained power pack. Battery shall be sealed electrolyte type, shall operate unattended, and require no maintenance, including no additional water, for a period of not less than 5 years. LED exit lights shall have emergency run time of 1.5 hours (90 minutes) minimum.

2.6 EMERGENCY LIGHTING EQUIPMENT

- A. Equipment shall be in conformance with UL and NFPA. Provide lamps in wattage indicated.
- B. LED Emergency Driver: Each unit shall consist of an automatic power failure device, test switch operable from outside of the fixture, pilot light visible from outside the fixture, and fully automatic solid-state charger in a self-contained power pack. Charger shall be either trickle, float, constant-current or constant-potential type, or a combination of these. Battery shall be sealed electrolyte type with capacity as required to supply power to two LED circuit boards for 90 minutes at a minimum of 800 lumens output power. Battery shall operate unattended and require no maintenance for a period of not less than 5 years.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install interior light fixtures at locations and heights as indicated in accordance with fixture manufacturer's published instructions, applicable requirements of the NEC, NECA "Standard of Installation," NEMA standards, and with recognized industry practices to ensure that light fixtures fulfill requirements.
- B. Coordinate with all other work on this Contract as appropriate to properly interface installation of interior light fixtures.

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- C. Fasten fixtures securely to building structural members, and check to ensure that solid pendant fixtures are plumb. Recessed fixtures shall be supported with individual annealed, light zinc-coated finish, 12-gauge wire from all four corners tied to building structural members. Securing safety wires to bridging is not acceptable. The supporting wires shall be distinguishable by color or tagging.
- D. Clean interior light fixtures of dirt and debris (including lenses) upon completion of installation.
- E. Protect installed fixtures from damage during entire construction period.

3.2 FIELD QUALITY CONTROL

- A. Upon completion of installation of interior light fixtures and after building circuitry has been energized, apply electrical energy to 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 proceed with retesting.
- B. At the time of Substantial Completion, replace lamps in interior light fixtures which are observed to be noticeably dimmed after Contractor's use and testing, as judged by the Architect/Engineer.

3.3 GROUNDING

- A. Provide tight equipment grounding connections for each interior light fixture installation.

END OF SECTION 265100

SECTION 311000 - SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Removing surface debris.
2. Removing designated paving, curbs, and sidewalks.
3. Removing designated trees, shrubs, and other plant life.

1.2 QUALITY ASSURANCE

- A. The Contractor shall comply with all applicable standards specified: Section 200, IV. Product Delivery, Storage, and Handling; and Division 3, Section 301, of the Hampton Roads Planning District Commission Regional Construction Standards (HRPDC Regional Construction Standards), Technical Specifications and Standard Details, Fifth Edition. Whenever a specifically named code or standard is referenced, it shall mean the latest revision of said code or standard as amended prior to the date of the Invitation to Bid. Materials that do not conform to these referenced standards or referenced specifications shall not be used unless specifically approved by the Owner.
- B. The Contractor shall comply with all applicable Virginia Department of Transportation (VDOT) specifications references of the VDOT Road and Bridge Specifications, latest edition, unless otherwise noted.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing plant life designated to remain is tagged or identified.

3.2 PREPARATION

- A. Call the Virginia Utility Protection Service (VUPS) at 811 or 1-800-552-7001 not less than two working days before performing Work.
1. Request underground utilities to be located and marked within and surrounding construction areas.

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2. The utility lines shall also be reviewed by Newport News Public Schools Plant personnel prior to proceeding with excavation work.

3.3 PROTECTION

- A. Locate, identify, and protect utilities indicated to remain, from damage.
- B. Protect trees, plant growth, and features designated to remain, as final landscaping.
- C. Protect bench marks, and existing structures from damage or displacement.

3.4 REMOVAL

- A. Partially remove paving, curbs, and, sidewalks as indicated on Drawings. Neatly saw cut edges at right angle to surface.
- B. Remove abandoned utilities. Indicated removal termination point for underground utilities on Record Documents.
- C. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on site.
- D. Do not burn or bury materials on site. Leave site in clean condition.

END OF SECTION 311000

SECTION 312000 - EARTH MOVING

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.
- B. Virginia Department of Transportation (VDOT), Road and Bridge Specifications (RBS), current edition, applies to this section.
- C. Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, Virginia Erosion and Sediment Control Handbook (VSWC VESCH), current edition, applies to this Section.

1.2 SUMMARY

A. Section Includes:

- 1. Excavating and filling for rough grading the Site.
- 2. Preparing subgrades for slabs-on-grade walks, pavements, turf and grasses and plants.
- 3. Preparing subgrades for building slabs.
- 4. Excavating and backfilling for buildings and structures.
- 5. Drainage course for concrete slabs-on-grade.
- 6. Subbase course for concrete pavements.
- 7. Base course for asphalt paving.
- 8. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Requirements:

- 1. Section 033000 "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
- 2. Section 311000 "Site Clearing" for site stripping, grubbing, stripping, and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.

1.3 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
 - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.

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- B. Base Course: Aggregate layer placed between the subgrade and hot-mix asphalt or concrete paving.
- C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
 - 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
 - 2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.
- H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- I. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below base, drainage fill, drainage course, or topsoil materials.
- J. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following manufactured products required:
 - 1. Geotextiles.
 - 2. Warning tapes.
- B. Samples for Verification: For the following products, in sizes indicated below:
 - 1. Geotextile: 12 by 12 inches (300 by 300 mm).

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2. Warning Tape: 12 inches (300 mm) long; of each color.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
 1. Classification according to ASTM D 2487.
 2. Laboratory compaction curve according to ASTM D 698.
- C. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth-moving operations. Submit before earth moving begins.

1.6 QUALITY ASSURANCE

- A. Blasting: Blasting is not allowed.
- B. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

1.7 FIELD CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.
 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. Utility Locator Service: Notify "Miss Utility" for area where Project is located before beginning earth-moving operations.
- C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Engineer and then only after arranging to provide temporary utility services according to requirements indicated.
 1. Notify Owner's Representative not less than two days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Owner's Representative's written permission.
 3. Contact utility-locator service for area where Project is located before excavating.

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- D. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.
- E. Use of Explosives: The use of explosives is not permitted.
- F. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section 015000 "Temporary Facilities and Controls" and Section 311000 "Site Clearing" are in place.
- G. Do not commence earth-moving operations until plant-protection measures specified in Section 311000 "Site Clearing" are in place.
- H. The following practices are prohibited within protection zones:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Parking vehicles or equipment.
 - 3. Foot traffic.
 - 4. Erection of sheds or structures.
 - 5. Impoundment of water.
 - 6. Excavation or other digging unless otherwise indicated.
 - 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- I. Do not direct vehicle or equipment exhaust towards protection zones.
- J. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 2 inches (50 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.
 - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

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- D. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; conform to VDOT RBS, Section 208, Size 21A.
- E. Engineered Fill: Material shall consists of sand or gravel containing less than 25% by weight of fines, ASTM D 2487 Soil Classification Groups GW, GP, SW, SP, and SM, with no more than 25 percent passing the No. 200 sieve, with dimensions not to exceed 2 inches in diameter, having a liquid limit less than 20 and plastic limit less than 6, and should be free of rubble, organics, clay, debris, and other unsuitable material. Engineered fill shall be maintained within 2 percent of optimum moisture content at time of compaction. If fill soil of the required character does not exist at the site, it must be imported.
- F. Bedding Course (Building slabs): Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.
- G. Bedding Course (Pavements): Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; conform to VDOT RBS, Section 203, coarse aggregate grading Size 57.
- H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and zero to 5 percent passing a No. 8 (2.36-mm) sieve.
- I. Sand: ASTM C 33/C 33M; fine aggregate.

2.2 GEOTEXTILES

- A. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 - 1. Survivability: Class 2; AASHTO M 288.
 - 2. Survivability: As follows:
 - a. Grab Tensile Strength: 247 lbf (1100 N); ASTM D 4632.
 - b. Sewn Seam Strength: 222 lbf (990 N); ASTM D 4632.
 - c. Tear Strength: 90 lbf (400 N); ASTM D 4533.
 - d. Puncture Strength: 90 lbf (400 N); ASTM D 4833.
 - 3. Apparent Opening Size: No. 60 (0.250-mm) sieve, maximum; ASTM D 4751.

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4. Permittivity: 0.02 per second, minimum; ASTM D 4491.
5. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.3 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility; colored as follows:
 1. Red: Electric.
 2. Yellow: Gas, oil, steam, and dangerous materials.
 3. Orange: Telephone and other communications.
 4. Blue: Water systems.
 5. Green: Sewer systems.

- B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:
 1. Red: Electric.
 2. Yellow: Gas, oil, steam, and dangerous materials.
 3. Orange: Telephone and other communications.
 4. Blue: Water systems.
 5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

- B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

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- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
- 3.3 EXPLOSIVES
- A. Explosives: Do not use explosives.
- 3.4 EXCAVATION, GENERAL
- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for removal of obstructions.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials, replace with satisfactory soil materials.
- 3.5 EXCAVATION FOR STRUCTURES
- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 - 1. Base bids shall account for subgrade improvements, such as undercut and backfill with structural fill. Depth of undercut for base bid shall be 30 inches below existing grades.
 - 2. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
 - 3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb bottom of excavations intended as bearing surfaces.
 - B. Excavations at Edges of Tree- and Plant-Protection Zones:
 - 1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop

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exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

2. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.
 1. Clearance: As indicated.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
 1. For pipes and conduit less than 6 inches (150 mm) in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
 2. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
 3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
- D. Trench Bottoms: Excavate trenches 4 inches (100 mm) deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.
- E. Trenches in Tree- and Plant-Protection Zones:
 1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
 2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.

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3. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.8 SUBGRADE INSPECTION

- A. Notify Engineer when excavations have reached required subgrade.
- B. If Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Under the presence of the Owner's engaged geotechnical engineering testing agency, proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes) to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph (5 km/h).
 2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed.
- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.9 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi (17.2 MPa), may be used when approved by Engineer.
 1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Engineer.

3.10 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

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3.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
 - 2. Surveying locations of underground utilities for Record Documents.
 - 3. Testing and inspecting underground utilities.
 - 4. Removing concrete formwork.
 - 5. Removing trash and debris.
 - 6. Removing temporary shoring, bracing, and sheeting.
 - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Backfill voids with satisfactory soil while removing shoring and bracing.
- D. Initial Backfill:
 - 1. Soil Backfill: Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch (25 mm) in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.
 - a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- E. Final Backfill:
 - 1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.
- F. Warning Tape: Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

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3.13 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use satisfactory soil material.
 - 3. Under steps and ramps, use engineered fill.
 - 4. Under building slabs, use engineered fill.
 - 5. Under footings and foundations, use engineered fill.
 - 6. Under utility structures use bedding material.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers. Do not compact with vibratory roller within 25 feet of the existing building. Use hand operated compaction equipment. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.
- B. It is recommended that the grading operations be performed during the drier months of the year (historically April through November as indicated by the NCDC Climate Atlas of the United States) to minimize potential problems. If grading is attempted during the winter months, stabilization of wet soils should be anticipated by the contractor and should therefore be included in the base bid price.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

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1. Under structures, building slabs, steps, and pavements, scarify and re-compact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under walkways, scarify and re-compact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 95 percent.
3. Under turf or unpaved areas, scarify and re-compact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 85 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

3.16 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 1. Provide a smooth transition between adjacent existing grades and new grades.
 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:
 1. Turf or Unpaved Areas: Plus or minus 1 inch (25 mm).
 2. Walks: Plus or minus 1 inch (25 mm).
 3. Pavements: Plus or minus 1/2 inch (13 mm).
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

3.17 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, base course under pavements and walks as follows:
 1. Install separation geotextile, where indicated, on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 2. Place base course material over subgrade under hot-mix asphalt pavement.
 3. Shape base course to required crown elevations and cross-slope grades.

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4. Place base course 6 inches (150 mm) or less in compacted thickness in a single layer.
5. Place base course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
6. Compact base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.18 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
 1. Place drainage course 6 inches (150 mm) or less in compacted thickness in a single layer.
 2. Place drainage course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
 3. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.19 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Engineer.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2937, and ASTM D 6938, as applicable. Tests will be performed at the following locations and frequencies:
 1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. (186 sq. m) or less of paved area or building slab but in no case fewer than three tests.

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2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet (30 m) or less of wall length but no fewer than two tests.
 3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet (46 m) or less of trench length but no fewer than two tests.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; re-compact and retest until specified compaction is obtained.
- 3.20 PROTECTION
- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
 - B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 1. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and re-compact.
 - C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.
- 3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS
- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.
 - B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Engineer.
 1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

SECTION 312317 - TRENCHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavating trenches for utilities greater than 5 feet outside building.
2. Compacted fill from top of utility bedding to subgrade elevations.
3. Backfilling and compaction.

B. Related Sections:

1. Section 312000 - Earth Moving.
2. Section 320516 - Aggregates for Exterior Improvements.
3. Refer to Electrical drawings for placement of underground utilities and additional specifications.

1.2 REFERENCES

A. Hampton Roads Planning District Commission Regional Construction Standards (HRPDC Regional Construction Standards), Technical Specifications and Standard Details, latest edition, and any listed references as identified in these documents.

B. Virginia Department of Transportation, Road and Bridge Specifications, latest edition, as amended.

C. American Association of State Highway and Transportation Officials:

1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

D. ASTM International:

1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
2. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
4. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
5. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
6. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

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1.3 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, or cable.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with all applicable sections and divisions of the Hampton Roads Planning District Commission Regional Construction Standards (HRPDC Regional Construction Standards), Technical Specifications and Standard Details, latest edition, (HRPDC Regional Construction Standards), Division 3, Section 303 and 305.

1.6 COORDINATION

A. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

A. Materials shall be in compliance with all applicable sections of Section 200, V. Products, as published in the Hampton Roads Planning District Commission Regional Construction Standards (HRPDC Regional Construction Standards), Technical Specifications and Standard Details, Fifth Edition

PART 3 - EXECUTION

3.1 PROCEDURES

A. Perform Work in accordance with all applicable standards and specifications of Hampton Roads Planning District Commission Regional Construction Standards (HRPDC Regional Construction Standards), Technical Specifications and Standard Details, latest edition, (HRPDC Regional Construction Standards), Division 3, Section 303 and 305, and VDOT Road and Bridge Specifications, latest edition, as amended.

END OF SECTION

SECTION 312319 - DEWATERING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes construction dewatering.
- B. Related Sections:
 - 1. Division 31 Section "Earth Moving" for excavating, backfilling, site grading, and for site utilities.
- C. See geotechnical reports for discussion of subsurface water conditions. A dewatering system is required for this project only if required to maintain groundwater elevations sufficiently below excavations during construction.

1.2 PERFORMANCE REQUIREMENTS

- A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
 - 1. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
 - 2. Prevent surface water from entering excavations by grading, dikes, or other means.
 - 3. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
 - 4. Remove dewatering system when no longer required for construction.

1.3 ACTION SUBMITTALS

- A. None.

1.4 INFORMATIONAL SUBMITTALS

- A. None

1.5 QUALITY ASSURANCE

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

1.6 PROJECT CONDITIONS

- A. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in the report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.
 - 1. Make additional test borings and conduct other exploratory operations necessary for dewatering.
 - 2. The geotechnical report is included elsewhere in the Project Manual.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.
 - 1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.
 - 2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
- B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Provide temporary grading to facilitate dewatering and control of surface water.
- D. Monitor dewatering systems continuously.
- E. Promptly repair damages to adjacent facilities caused by dewatering.

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- F. Protect and maintain temporary erosion and sedimentation controls during dewatering operations.

3.2 INSTALLATION

- A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
 - 1. Space well points or wells at intervals required to provide sufficient dewatering.
 - 2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.
- B. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.
- C. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
 - 1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
- D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
 - 1. Maintain piezometric water level a minimum of 24 inches below surface of excavation.
- E. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.
- F. Provide standby equipment on site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.
 - 1. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.

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- G. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

3.3 FIELD QUALITY CONTROL

- A. Observation Wells: Provide, take measurements, and maintain at least the minimum number of observation wells or piezometers indicated; additional observation wells may be required by authorities having jurisdiction.
 - 1. Observe and record daily elevation of ground water and piezometric water levels in observation wells.
 - 2. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. In areas where observation wells are not functioning properly, suspend construction activities until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.
 - 3. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.
- B. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.

END OF SECTION 312319

SECTION 313116 - TERMITE CONTROL

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. Soil treatment with termiticide.
- 2. Polymer barrier fittings with termiticide for installation around utility penetrations.

- B. Related Sections:

- 1. Section 061000 "Rough Carpentry" for wood preservative treatment by pressure process.

1.3 UNIT PRICES

- A. Work of this Section is affected by unit price for additional polymer barrier fittings with termiticide at utility penetration(s).

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of termite control product.

- 1. Include the EPA-Registered Label for termiticide products.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.

- B. Product Certificates: For termite control products, from manufacturer.

- C. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's records and include the following:

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1. Date and time of application.
 2. Moisture content of soil before application.
 3. Termiticide brand name and manufacturer.
 4. Quantity of undiluted termiticide used.
 5. Dilutions, methods, volumes used, and rates of application.
 6. Areas of application.
 7. Water source for application.
- D. Polymer Barrier Fittings with Termiticide Application Report: After installation of polymer barrier fittings with termiticide is completed, submit report for Owner's records and include the following:
1. Plan drawing showing number and locations of each type of polymer barrier fitting with termiticide.
 2. Termiticide brand name and manufacturer.
 3. Schedule of inspections for one year from date of Substantial Completion.
- E. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located.
- B. Regulatory Requirements: Formulate and apply termiticides and termiticide devices according to the EPA-Registered Label.
- C. Source Limitations: Obtain termite control products from single source.
- D. Preinstallation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.
- B. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.
- C. Install polymer barrier fittings with termiticide around utility penetrations prior to pouring concrete and after installation and inspection of plumbing and electrical pipes and conduits, slab vapor barrier, and concrete slab reinforcement.

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1.8 WARRANTY

- A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

1. Warranty Period: Five years from date of Substantial Completion.

- B. Polymer Barrier Fittings with Termiticide Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work, consisting of installation of polymer barrier fittings with termiticide, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat and repair or replace damage caused by termite infestation.

1. Warranty Period: Five years from date of Substantial Completion.

1.9 MAINTENANCE SERVICE

- A. Continuing Service: Beginning at Substantial Completion, provide 12 months' continuing service including monitoring, inspection, and re-treatment for occurrences of termite activity. Provide a standard continuing service agreement. State services, obligations, conditions, terms for agreement period, and terms for future renewal options.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

- A. Termiticide: Provide an EPA-Registered termiticide, complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. BASF Corporation, Agricultural Products; Termidor.
- b. Bayer Environmental Science; Premise 75.
- c. FMC Corporation, Agricultural Products Group; Prevail.
- d. Syngenta; Probuild TC.

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2. Service Life of Treatment: Soil treatment termiticide that is effective for not less than five years against infestation of subterranean termites.

2.2 WOOD TREATMENT

- A. Products: Subject to compliance with requirements, provide the following:
 1. Syngenta; IMPASSE Termite Blockers.
- B. Pipe/Conduit Fitting: Integral 2-1/2-inch- (65-mm-) long polymer sleeve and 1-inch- (25-mm-) wide circular flange with lambda-cyhalothrin termiticide sealed between two outer polymer layers; with fasteners.
- C. Tub Trap Fitting: Integral polymer boot and 23-by-23-inch (585-by-585-mm) flange with lambda-cyhalothrin termiticide sealed between two outer polymer layers; with fasteners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label requirements, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.
- B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.
- B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.

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1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT

- A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.
 1. Slabs-on-Grade and Basement Slabs: Underground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
 2. Foundations: Adjacent soil, including soil along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
 3. Masonry: Treat voids.
 4. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.
- B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
- C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.
- D. Post warning signs in areas of application.
- E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

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3.5 INSTALLING POLYMER BARRIER FITTINGS

- A. Remove any pipe wrap material so that the polymer barrier fittings can be applied directly to the pipe or conduit. After installing the barrier, reapply pipe wrap material both below and above the blocker to protect the pipe from contact with concrete.
- B. Install polymer barrier fittings around each utility pipe and conduit penetrating concrete slab and foundation walls according to the EPA-Registered Label for the product and manufacturer's written instructions.

END OF SECTION 313116

SECTION 320516 - AGGREGATES FOR EXTERIOR IMPROVEMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Coarse aggregate materials.

B. Related Sections:

1. Section 312317 - Trenching.
2. Refer to Electrical drawings for placement of underground utilities and additional specifications.

1.2 REFERENCES

- A. Hampton Roads Planning District Commission Regional Construction Standards (HRPDC Regional Construction Standards), Technical Specifications and Standard Details, latest edition, and any listed references as identified in these documents.

- B. Virginia Department of Transportation, Road and Bridge Specifications, latest edition, as amended.

C. American Association of State Highway and Transportation Officials:

1. AASHTO M147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses.
2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

D. ASTM International:

1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
2. ASTM D448 - Standard Classification for Sizes of Aggregate for Road and Bridge Construction
3. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
4. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
5. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
6. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

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1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Materials Source: Submit name of imported materials suppliers.
- C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

- A. The Contractor shall comply with all applicable standards specified: Section 200, IV. Product Delivery, Storage, and Handling; and Section 200 of the Hampton Roads Planning District Commission Regional Construction Standards (HRPDC Regional Construction Standards), Technical Specifications and Standard Details, latest edition. Whenever a specifically named code or standard is referenced, it shall mean the latest revision of said code or standard as amended prior to the date of the Invitation to Bid. Materials that do not conform to these referenced standards or referenced specifications shall not be used unless specifically approved by the Owner.
- B. The Contractor shall comply with all applicable Virginia Department of Transportation (VDOT) specifications references of the VDOT Road and Bridge Specifications, latest edition, unless otherwise noted.
- C. Furnish each aggregate material from single source throughout the Work.

PART 2 - PRODUCTS

2.1 COARSE AGGREGATE MATERIALS

- A. Unless specifically stated otherwise, all materials and products shall be new, free from defects, following references:
 - 1. Hampton Roads Planning District Commission (HRPDC) Regional Construction Standards, Fifth Edition, Division 2, Section 200, Subsection V. – Products, paragraph 5.1, as amended,
 - 2. Coarse aggregate, VDOT Type #57 stone, in accordance with Virginia Department of Transportation (VDOT) Road and Bridge Specifications, latest edition.

PART 3 - EXECUTION

3.1 PROCEDURES

- A. Coarse aggregate materials for pipe bedding and backfill shall have a minimum placed and compacted depth of 6 inches.

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3.2 STOCKPILING

- A. Stockpile materials on site at locations designated by Owner.
- B. Stockpile in sufficient quantities to meet Project schedule and requirements.
- C. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.
- D. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

3.3 STOCKPILE CLEANUP

- A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

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SECTION 334100 - STORM UTILITY DRAINAGE PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe and fittings.
2. Nonpressure transition couplings.
3. Cleanouts.
4. Drains.
5. Manholes.
6. Catch basins.

1.2 RELATED SECTIONS:

1. Division 31 Section "Earth Moving" for excavating and backfilling trenches for utilities.

1.3 DEFINITIONS

- A. VDOT: Virginia Department of Transportation Road & Bridge Standards and Road & Bridge Specifications. Sections regarding payment terms do not apply.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle manholes according to manufacturer's written rigging instructions.
- D. Handle structures according to manufacturer's written rigging instructions.

1.7 PROJECT CONDITIONS

- A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
1. Notify Owner no fewer than 14 days in advance of proposed interruption of service.

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PART 2 PRODUCTS

2.1 PIPE AND FITTINGS

A. PVC Type PSM Sewer Piping (6" – 12"):

1. Pipe: ASTM D 3034, SDR 35, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D 3034, PVC with bell ends.
3. Gaskets: ASTM F 477, elastomeric seals.

B. PVC Schedule 40 Piping (4"):

1. Pipe: ASTM D 1785, Schedule 40 PVC, with plain ends for solvent-cemented joints.
2. Fittings: ASTM D 2466, Schedule 40 PVC, socket type.

C. High Density Polyethylene (HDPE) Piping (15" and larger):

1. Pipe: AWWA Standard C906, DR-26
2. Fittings: Molded PE Fittings, ASTM D 3350, butt fusion type

2.2 CONCRETE PIPE (15" AND LARGER)

A. Reinforced-Concrete Sewer Pipe: ASTM C 76

1. Tongue-and-groove ends and gasketed joints with ASTM C 443, rubber gaskets. See drawings for class of pipe. In cases where the class is not provide on the drawings, assume Class III.

2.3 CLEANOUTS

A. Cast-Iron Cleanouts:

1. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
2. Top-Loading Classification(s): Medium Duty.
3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.4 MANHOLES

A. Standard Precast Concrete Manholes:

1. Description: Precast, reinforced concrete, of depth indicated, with provision for sealant joints, meeting the requirements of VDOT MH-2 with eccentric cone top and round lid.

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2. Base unit shall meet requirements of VDOT B-1, B-2 & B-3. Eccentric cone top shall meet requirements of VDOT T-MH-2.
3. Diameter: 48 inches minimum unless otherwise indicated.
4. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.
5. Adjusting Rings: Interlocking HDPE rings, with level or sloped edge in thickness and diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
6. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Manhole Frames and Covers:

1. Description: Manhole frames & covers shall meet requirements of VDOT MH-1. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."

2.5 CONCRETE

- A. General: Concrete shall comply with VDOT requirements for precast structures.
- B. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.

2.6 CATCH BASINS & YARD DRAINS

A. Standard Precast Concrete Catch Basins:

1. Description: Precast, reinforced concrete, of depth indicated, meeting the requirements of the VDOT structure indicated on the drawings.
2. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.

B. Frames shall comply with VDOT MH-1. Grate shall be cast iron rated for H-20 load, 26 inch diameter, flat, and at least 1.1 square feet open area. Coordinate frames and grates.

C. Provide inlet shaping in accordance with VDOT IS-1.

2.7 PVC DRAINAGE BASINS

A. PVC Drainage Basins:

1. Description: Manufactured PVC round drainage basins, of depth indicated, with factory provided inlet and outlet stubs set at the elevations shown on the project drawings.
2. Diameter: as indicated on the project drawings.

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3. Pipe Connectors: factory supplied gaskets provided in stubs.

B. Frames and Grates shall be ductile iron, H-10 load rated.

PART 3 EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow.
2. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.

3.3 PIPING APPLICATIONS

A. Gravity-Flow, Non-pressure Storm Sewer Piping: Use the following pipe materials for each size range:

1. NPS 15 and larger: Concrete pipe, RCP CL III, with gasketed joints.
2. NPS 6 -12: PVC SDR 35 sewer pipe and fittings, with gasketed joints.
3. NPS 4: PVC Schedule 40 pipe and fittings
4. Footer and Underdrain Header Piping: PVC Schedule 40 pipe and fittings.

3.4 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping according to the following:

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1. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasketed joints.
 2. Joint PVC solvent weld pipe according to the solvent adhesive manufacturer's written instructions.
 3. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
 4. Join dissimilar pipe materials with nonpressure-type flexible couplings.
- B. Join gravity-flow, pressure drainage piping according to the following:
1. PE fusion weld joints: fuse pipe according to manufacturer's written instructions.

3.5 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
1. Use Medium-Duty, top-loading classification cleanouts in all areas.
- B. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.6 CONCRETE STRUCTURE INSTALLATION

- A. General: Install structures, complete with appurtenances and accessories indicated.
- B. Install precast concrete structure sections with sealants according to ASTM C 891.
- C. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops flush with finished surface elsewhere unless otherwise indicated.

3.7 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318.

3.8 CHANNEL DRAINAGE SYSTEM INSTALLATION (NOT APPLICABLE)

3.9 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Division 22 Section "Facility Storm Drainage Piping."
- B. Make connections to existing piping and underground manholes.
1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping;

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- and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
2. Make branch connections into existing structures by core drilling into existing unit and creating an opening large enough to allow 3 inches of non-shrink grout to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
 - a. Use non-shrink grout that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
 - b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
 3. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.
- C. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
 - a. Flexible couplings for same or minor difference OD pipes.
 - b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
 - c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

3.10 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

- A. Abandoned Piping: Close open ends of abandoned underground at the structure. Close opening in structure with 3,000 psi concrete at least as thick as structure wall. Use epoxy-bonding compound as interface between new and existing concrete. Remove abandoned piping completely.
- B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:
 1. Remove structure completely.
- C. Backfill to grade according to Division 31 Section "Earth Moving."

3.11 FIELD QUALITY CONTROL

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- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
 - 1. Submit separate reports for each system inspection.
 - 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 - 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 - 4. Reinspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 - 1. Do not enclose, cover, or put into service before inspection and approval.
 - 2. Test completed piping systems according to requirements of authorities having jurisdiction.
 - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
 - 4. Submit separate report for each test.
 - 5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
 - a. Option: Test plastic piping according to ASTM F 1417.
 - b. Option: Test concrete piping according to ASTM C 924.
- C. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.12 CLEANING

- A. Clean interior of piping of dirt and superfluous materials.

END OF SECTION 334100

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